FINAL

ENVIRONMENTAL IMPACT STATEMENT

for

ELECTRONIC INSTALLATIONS IN THE WESTERN PACIFIC

Bureau of Planning

DEPARTMENT OF THE NAVY
NAVAL SPACE COMMAND

June 1990

Bureau of Planning

PREFACE

FINAL ENVIRONMENTAL IMPACT STATEMENT FOR ELECTRONIC INSTALLATIONS IN THE WESTERN PACIFIC

This Final Environmental Impact Statement (FEIS) has been prepared taking into consideration comments and questions received during the public review of the Draft Environmental Impact Statement (DEIS). This document is consistent with the intent of Council on Environmental Quality and Department of the Navy regulations. Appendices A through G in the DEIS have not been reproduced in this FEIS. For complete coverage, the DEIS and FEIS should be read together.

The FEIS includes Sections 4.0 and 8.0 which discuss the cumulative environmental consequences of the ROTHR program for the western Pacific and Sections 4.4 and 8.5 which consolidates the discussion of Means of Mitigating Potentially Adverse Effects in Sections 5.1.22 and 5.2.22 of the DEIS. Section 10.0 of the FEIS provides Response to Comments on the DEIS. Supplemental information to Section 10.0 is in the following appendices:

Appendix H	Public Hearing Information
Appendix I	Bureau of Medicine and Surgery Study
Appendix J	Review/Evaluation of Alternative Sites

Subsequent to publication of the DEIS, the U.S.Department of the Interior Fish and Wildlife Service (USFWS) issued a final biological opinion on the effects of construction and operation of Project P-223 at the northern site on Tinian for the transmitter and the Runway site on Northwest Field in northern Guam for the receiver and a final biological opinion for the engineering field surveys for Project P-225. The opinions are in:

Appendix K	Final Biological Opinion Project P-223
Appendix L	Final Biological Opinion Project P-225 (Surveys)

At the time of publication of the DEIS, field surveys had not been conducted on all alignments to be used as alternate sites for support facilities in northern Tinian and the Harmon Annex site on Guam for Project P-223. These surveys were completed in March 1990. The conclusions of the DEIS have not changed as a result of the surveys which are provided as:

Appendix B-1	Bird and Mammal Survey (Tinian)
Appendix C-1	Botanical Survey (Tinian)
Appendix D-1	Archaeological/Historic Survey (Tinian)
Appendix E-1	Bird and Mammal Survey (Guam)
Appendix F-1	Botanical Survey (Guam)
Appendix G-1	Archaeological/Historic Survey (Guam)

ABSTRACT
FINAL
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FOR
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Lead Agency:
Department of the Navy
Naval Space Command
Dahlgren, Virginia

Cooperating Agency:
Department of the Air Force
Pacific Air Forces

The following person may be contacted for additional information:

Commander P. Hiller, CEC, Head
Facilities Planning Department
Department of the Navy, Pacific Division
Naval Facilities Engineering Command
Pearl Harbor, Hawaii 96860-7300
Telephone: (808) 471-3088

The proposed Relocatable Over-the-Horizon Radar or ROTHR program, has a defense mission that serves the interests of national security. The program is the construction and operation of up to three electronic radar systems in the western Pacific. Each system contains three components: a transmitter potentially located on Tinian, Commonwealth of the Northern Mariana Islands; a receiver potentially located on Guam, Mariana Islands; and an operational control center located near the receiver. Each system is a stand-alone project, would operate independently, and would not require the construction of a second or third system to be operational. By collocation of the transmitters, some support facilities could be shared. All three transmitters would be located on Tinian, within lands leased by the U.S. Government for defense purposes. One of the proposed transmitter sites is located within the North Field National Historic Landmark. The three proposed receiver would be located on Guam at any combination of the following sites: Northwest Field, a property controlled by the U.S. Air Force; South Finegayan/Harmon Annex, property controlled by the U.S. Navy and the U.S. Air Force respectively; a portion on land controlled by the U.S. Navy Public Works Center, Guam; and private property located in the Dandan area of southeastern Guam. Northwest Field is included within the area being considered by the U.S. Fish and Wildlife Services for designation as critical habitat. Northwest Field is also being considered for inclusion on the National Register of Historic Places as a National Historic Landmark. Three bird species listed as endangered by the Federal Government were found on three of the proposed receiver sites and one species was found on the proposed transmitter sites. Consultation required by Section 7 (a)(1) of the Endangered Species Act has been completed between the U.S. Navy and Department of the Interior Fish and Wildlife Service. Memorandums of Agreement with the appropriate Historic Preservation Officers and the Advisory Council on Historic Preservation have been initiated to meet the requirements of Sections 106 and 110 of the National Historic Preservation Act of 1966, as amended.

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SUMMARY OF PROPOSED PROGRAM (PROGRAMMATIC EIS PART I)

( ) Draft EIS (X) Final EIS

Name of Action: Electronic Installations on Tinian, Commonwealth of the Northern Mariana Islands (CNMI) and on Guam, Mariana Islands (MI)

(X) Administrative ( ) Legislative

DESCRIPTION OF THE PROPOSED PROGRAM. The proposed program has a defense mission that serves the interests of national security. The proposed program is the construction and operation of up to three electronic installations on Tinian, Commonwealth of the Northern Mariana Islands (CNMI) and on Guam, Mariana Islands. The installations are collectively designated as the Relocatable Over-the-Horizon Radar (ROTHR) program and include antenna towers and arrays, ground screens and support facilities constructed at three sites on each island. Each ROTHR system includes transmitter antennas, receiver antennas and an operational control center. The proposed installations identified as Military Construction (MILCON) Projects P-223, P-225, and P-002, would be constructed over a period of years, with Project P-223 funded first in FY 89. Construction of Projects P-225 and P-002 depends on Congressional approval and funding. Each ROTHR system is a stand-alone project which operates independently and provides coverage of a specific area of strategic importance. Collocation of the systems is not an operational necessity. However, collocation of the systems would permit sharing of some support facilities and hereby reducing costs and areas to be affected.

TRANSMITTER DESCRIPTION. Each transmitter will consist of 34 vertical antennas towers, including the sounder antenna, and 34 vertical support poles. The low band antenna portion of the transmitter will consist of 16 126-FT high towers and 16 36-FT high support poles sited 35 linear feet (LF) apart. The total length of the low band antenna array is 525 LF. The high band portion of the transmitter will consist of 16 72-FT high towers and 16 17-FT high support poles sited about 17.5 LF apart. The total length of the high band antenna is 262.5 LF. Each transmitter will consist of 11 transmitter shelters each capable of transmitting with power of 5 to 20 kilowatts. One transmitter system can produce up to 200 kilowatts of average power which will be radiated mainly in the direction of its orientation. If fully developed, three transmitters would be constructed.

Each antenna array and ground screen will be fenced with a wire fence on four sides. The fenced area, called the radiation hazard area or

exclusion fence area, will extend a maximum of 1,058 LF in front and 200 LF behind the antenna array. The fence will be posted with signs warning of radiation hazard from the antenna array. Beyond this fence, an area of about 69 acres, there is no hazard to personnel from radio frequency radiation from the transmitter. If three transmitters are collocated, a total area of 207 acres would be fenced.

The transmitters will be operated by civilian contractor personnel on a 24-hours per day, 7 days per week basis. Two military and 60 civilian personnel will be provided quarters at the transmitter site. A total of approximately 92 personnel will be required to operate the three transmitters, if collocated.

RECEIVER DESCRIPTION. The receivers receive and process energy backscattered from the surveillance area illuminated by the transmitters. Each receiver will consist of 372 pairs of aluminum monopole antennas (a total of 744 poles) each about 18 FT high and 6 inches in diameter. The pairs will be sited about 23 LF apart. The total length of each receiver antenna array including the ground screen and a 668 LF reflecting area is about 8,600 LF. The width of the receiver antenna array will be about 800 LF. The antenna array will not be fenced.

Each receiver will require an operational control center (OCC) consisting of operational vans, receiver equipment shelters, and other support facilities. The receivers and OCC will be operated by military and civilian contractor personnel on a 24-hours per day, 7 days per week basis. A total of 216 military and 69 civilian personnel will be required to operate three receivers and OCCs. No bachelor quarters are anticipated to be constructed on Guam for these personnel.

SITE REQUIREMENTS. Surveillance of critical areas is required to detect aircraft and ships coming from the Soviet Union, China, and Vietnam. To meet this operational requirement, the ROTHR systems must be sited in the Mariana Islands. Technical siting requirements necessitate that each transmitter and receiver be separated by 50 to 100 miles to permit bistatic (concurrent operation of the transmitters and receivers) operations, and the receiver site must be free of radio frequency interference for one mile to the front of the array, 1,200 LF behind and 700 LF on each end.

The sites required for transmitters and receivers must be generally level to reduce the cost of construction to meet the specific levelness requirements of the antenna arrays. The area in front of the transmitter and receiver antennas must also be clear of terrain and structural obstructions. A site of about 100 acres is generally necessary for each transmitter and about 200 acres for each receiver. However, the transmitter can be accommodated on a site of 69 acres and the receiver on a site of 172 acres. If the three transmitters are located in northern Tinian, an area of about 217 acres which includes 10 acres for a support facility site would be affected. If the three receivers are located in Guam, a total area of up to 516 acres could be affected.

ALTERNATIVE SITES CONSIDERED. A number of islands and island systems in the western Pacific were evaluated under selection criteria which established minimum acceptable conditions for successful ROTHR operations. Two primary criteria were initially considered in the selection of the sites for the transmitters and receivers: availability of the required land area(100 acres for the transmitter and 200 acres for the receiver); and the necessary separation distance between the transmitter and receiver sites (50 to 100 miles separation) for bistatic operations.

The western Pacific island combinations considered included Guam-Tinian; Guam-Rota; Guam-Saipan; Guam-Anatahan; Tinian-Saipan; Tinian-Rota; Tinian-Anatahan; Rota-Saipan; Rota-Anatahan; Saipan-Anatahan; and Babelthaup-Pelieliu. Sufficient land areas were not available on Saipan and Anatahan. Thus, only island combinations which included Guam, Tinian, and Rota were considered viable alternatives for the transmitter and receiver.

A site on Rota, if real estate interests to use this private land were acquired, could be used for a receiver. Acquisition of this site would not be consistent the Northern Mariana Islands Covenant which requires the U.S. Government to site facilities within the military lease area on Tinian if at all possible before considering acquisition of rights to use other areas.

ALTERNATIVE SYSTEMS CONSIDERED. Other active and passive surveillance systems were considered prior to initiation of the development of the western Pacific ROTHR program. These included radar satellite systems and aircraft surveillance. Current technology will not permit the development of a radar satellite which can be launched into stationary orbit where it could continuously stare at target areas of interest. This requires the deployment of multiple radar satellites with a near real-time reporting capability. This technology for the radar satellite systems would not be available within the time period in which the ROTHR needs to become operational.

It is not economically feasible to provide aircraft surveillance with coverage equivalent to the proposed ROTHR system. Moreover, the land area required to base sufficient surveillance aircraft would be much greater than the area required for the proposed ROTHR systems.

PREFERRED ALTERNATIVE SYSTEM. The ROTHR program is the preferred alternative to the other active and passive surveillance systems considered.

DATE FINAL EIS MADE AVAILABLE. 29 JUN 1990

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FOR
ELECTRONIC INSTALLATIONS IN THE WESTERN PACIFIC

SUMMARY OF PROPOSED ACTION (PARTS II AND III, PROJECT P-223 AND ENGINEERING SURVEYS FOR PROJECT P-225)

( ) Draft EIS (X) Final EIS

Name of Action: Electronic Installations on Tinian, Commonwealth of the Northern Mariana Islands (CNMI) and on Guam, Mariana Islands (MI)

(X) Administrative ( ) Legislative

DESCRIPTION OF THE PROPOSED ACTION. The proposed action has a defense mission that serves the interests of national security. The proposed action is the construction and operation of one electronic installation with the transmitter on Tinian, Commonwealth of the Northern Mariana Islands (CNMI) and the receiver on Guam, Mariana Islands (MI). The installation, designated as Relocatable Over-the-Horizon Radar (ROTHR) Project P-223, would include antenna towers and arrays, ground screens and support facilities constructed on each island. The ROTHR system includes transmitter antennas, receiver antennas, and an operational control center located near the receiver.

Parts II and III of this EIS examine the probable environmental impacts from construction of Project P-223 and topographic and soil surveys for Project P-225. (See Part III) If Projects P-225 and P-002 are pursued, additional project and site specific documents will be prepared to supplement the existing assessment of impacts.

The Project P-223 transmitter would be located in Tinian, within lands leased by the U.S. Government for defense purposes. Two alternative transmitter sites were considered and included the northern tip of North Field (northern site) and along the western coast (western site) northwest of West Tinian Airport.

The Project P-223 receiver and the operational control center would be located on Guam. Four alternative receiver sites were considered and included two sites on Northwest Field, a property controlled by the U.S. Air Force, a portion of Naval Communications Area Master Station Western Pacific, (NAVCAMS WESTPAC); one site on Andersen AFB Harmon Annex, a property controlled by the U.S. Air Force; and one site on private property located in the Dandan area in southeastern Guam.

PROBABLE ENVIRONMENTAL CONSEQUENCES. Construction of the ROTHR system would require removing all vegetation and other features from the project sites, about 69 acres for each transmitter, 10 acres for support facilities for the transmitter, 172 acres for each receiver, and grading

the sites to meet operational requirements. Although removal of vegetation outside of the designated areas for the transmitter and receiver would improve system performance, the U.S. Navy has determined from computer evaluations that an acceptable level of performance can be achieved without this additional clearance. No tree cutting or other vegetation removal would be required outside of the designated areas for the transmitter or receiver.

Two alternative transmitter sites were investigated on Tinian. A Federally listed threatened bird species, the Tinian Monarch, was observed to be common on both sites. The Tinian Monarch has been widely observed throughout Tinian on similar habitat to that proposed for construction of the transmitter.

Some concern has been expressed that birds which may be flying between Tinian and Saipan could strike the transmitter towers located on the northern site during certain weather conditions or at night. The western site on Tinian would have a lower potential for collisions and bird strikes. Notwithstanding this distinction, based on experience with the existing ROTHR transmitter located in southern Virginia and other similar installations in Guam, Hawaii and Alaska, there is no evidence to substantiate this concern. Mitigation measures to make obstacles clearly visible to birds, such as adjusting the transmitter site to retain large trees near the ROTHR boundaries and the use of reflective tape on the towers will provide protection for bird species flying in the area. The use of mitigation measures will be coordinated with the U.S. Fish and Wildlife Service (USFWS) and the CNMI Division of Fish and Wildlife.

Based upon a request from the U.S. Navy under Section 7 of the Endangered Species Act, in September 1989, the USFWS issued a draft biological opinion regarding construction and operation of the transmitter for Project P-223 at the northern site on Tinian. The draft biological opinion concluded that construction and operation of the transmitter at the northern site will not be likely to jeopardize the continued existence of the Mariana common moorhen or Tinian monarch, both Federally listed endangered species, and there was no designated or proposed critical habitat on Tinian. In December 1989, the USFWS issued a final biological opinion with the same conclusions set forth in the September 1989 draft document.

The transmitter will operate in the high frequency (HF) band and will create certain hazards from radio frequency radiation. A series of detailed studies of these effects were compiled by the U.S. Navy's Space and Naval Warfare Systems Command. A summary of these studies as they apply to Tinian is presented in Sections 4.1.15, 7.1.15, and 8.3.15. Based upon the results of these studies, restrictions upon certain activities, such as fuel or ordnance handling and operations involving certain types of aircraft, will be applied in close proximity to the transmitter sites. No restriction upon civil or military activities will be imposed that is incompatible with present or anticipated utilization of any airports in the Saipan/Tinian region. No restriction of access to the memorial cross or the major historical sites will be required nor will

there be any interference with normal commercial or private utilization of the nearby waters and beaches.

The ROTHR transmitters could create interference with ground-based navigation aids at Saipan International Airport and with navigation aids on-board aircraft approaching the Airport. The transmitting frequencies of the ROTHR system will be locked-out to avoid interference with these navigation systems. Flight tests and other analyses have been conducted by the U.S. Navy prior to deployment of the ROTHR systems to Tinian. The U.S. Navy will comply with regulations and requests from the Federal Aviation Administration (FAA) to ensure that navigational aids are not adversely impacted by the ROTHR transmitters. The FAA will make the final decision as to the compatibility of the transmitters with the navigational aids at Saipan Airport. If necessary, adjustments will be made to operation of the system to ensure compatibility with operations at Saipan Airport. The frequencies selected for use by the ROTHR systems will not create interference to civil defense, mobile, and HAM radio operations on Tinian or Saipan.

Accidental introduction and colonization of the Brown Tree Snake into Tinian could create significant adverse effects to bird species on the island. The Brown Tree Snake is known to be the primary cause of the decline of the bird population on Guam. The U.S. Navy will require the construction contractor and operations contractor of the ROTHR transmitters to prepare a snake inspection protocol to prevent the accidental introduction of the Brown Tree Snake to Tinian. This protocol will be as stringent as the plan previously approved by CNMI for the U.S. Air Force Pacific Barrier III (PACBAR III) project on Saipan. The Air Force protocol provided for inspection of cargo originating or transshipped through Guam prior to shipment and after landing. The U.S. Navy snake inspection protocol will meet requirements set by the USFWS and CNMI.

The transmitter will require continuous on-site generation of electrical power. Based on calculations of controlled air pollution emissions from the generators, generation of the power required to operate the Project P-223 ROTHR transmitter on Tinian will not create sufficient pollutants to be considered a "major stationary source" according to CNMI Air Quality Regulations.

In September 1987, CNMI and the U.S. Government began discussions that would entail leasing back to CNMI about 12,500 acres out of the approximately 18,000 acres of land currently designated as military lease area. Based on these discussions and a leaseback proposal from the U.S. Government, the western site would be included in the area leased back to CNMI for an initial ten-year period for agricultural uses and grazing. Use of the western site for a ROTHR transmitter would preclude leasing the site back to CNMI, and eventual use of the lands for agricultural or grazing use.

The Project P-223 transmitter and support facilities will be located outside of the North Field National Historic Landmark, a site listed on

the National Register of Historic Places. (Only a pump for potable water and appurtenances would be located within the North Field National Historic Landmark.) The U.S. Navy has initiated a Memorandum of Agreement with the CNMI Historic Preservation Officer and the Advisory Council on Historic Preservation to identify measures to protect this historic site. The receiver for the ROTHR system will be located on Guam. The receiver site, about 172 acres, will be cleared and graded to meet operational requirements. After grading, grass, other low-growth ground cover or crushed aggregate will be used to control the growth of weeds. No tree cutting or vegetation removal will occur outside of the 172-acre area.

A total of four alternative sites were considered for location of the receivers. Two of the receiver sites considered for Project P-223 are entirely in Northwest Field (northern site and Runway site). The other two sites included the Harmon Annex site and the Dandan site, privately owned land in southeastern Guam.

Based on bird and mammal surveys, the sites that include Northwest Field provide habitat for the Mariana Crow, Micronesian Kingfisher, and the Mariana Fruit Bat, all Federal and Government of Guam (GOVGUAM) listed as endangered. Construction of the receivers on these sites would require removal of some of the habitat used by these species. This habitat has been proposed as "essential habitat" by the U.S. Department of Interior Fish and Wildlife Service for maintenance of these species in the wild and eventual reintroduction of the species to Guam. Portions of northern Guam, including the northern and Runway sites for Project P-223, are being considered for designation as critical habitat, as defined by the Endangered Species Act, by the USFWS.

Based on aerial photographs, northern Guam is thought to contain from 17,300 to 24,700 acres of habitat suitable for native bird species and all of Guam from 42,000 to 49,400 acres of habitat. Depending on the site chosen for the receiver, the removal of mixed vegetation and regrowth forest habitat would range from 0.5 to 1.0 percent of the habitat vegetation for northern Guam and 0.2 to 0.4 percent for all of Guam.

The bird and mammal survey of the Harmon Annex and Dandan sites did not detect any Federal or GOVGUAM listed or candidate threatened or endangered species. A portion of the Harmon Annex site has been listed as proposed essential habitat and is under consideration for designation as critical habitat.

Research conducted by GOVGUAM has shown that predation by the Brown Tree Snake is the primary reason for the decline of the bird population on Guam. Northern Guam is believed to contain a lower concentration of Brown Tree Snakes than the central and southern portions of the island. This low density of snakes is thought to be the reason the remaining native birds have survived in the northern portion of Guam.

On February 27, 1989, the U.S. Department of the Interior Fish and Wildlife Service (USFWS) responded to a petition by the Governor of Guam to designate critical habitat for seven species (five species of birds,

the Mariana fruit bat, and the Little Mariana fruit bat) on Guam. The USFWS agreed with the merits of the petition that a critical habitat designation may be beneficial to six of the species, four species of birds and the two bat species. The Guam rail was not included. The USFWS anticipates it will issue a proposed rule to designate portions of northern Guam (most of the proposed essential habitat) and selected areas in southern Guam as critical habitat for six endangered species. The proposed receiver sites which include Northwest Field, and a portion of the Harmon Annex site could be included in the critical habitat.

As required by Section 7 of the Endangered Species Act, the U.S. Navy requested a biological opinion about the project from the USFWS. In September 1989, the USFWS issued a draft biological opinion which concluded that construction of the receiver at the Runway site will not be likely to jeopardize the continued existence of the Micronesian kingfisher, Mariana crow, or Mariana fruit bat, all three Federal and GOVGUAM listed endangered species, and that no critical habitat has been designated or proposed on Guam. In December 1989, the USFWS issued the a final biological opinion with the same conclusions set forth in the September 1989 draft document.

The biological opinion also noted that the Runway site for Project P-223 is under consideration for designation as critical habitat and that if a rule proposing to designate critical habitat is published, the U.S. Navy will be required to confer with the USFWS. In view of this, the U.S. Navy initiated a request to the USFWS to provide assistance in developing conservation recommendations in addition to those already provided in the biological opinion. The additional conservation recommendations sought are ones which could reduce or eliminate the impact to habitat which may be proposed as critical habitat.

Botanical surveys of the four alternative sites did not detect any Federal or GOVGUAM listed or candidate threatened or endangered plant species. The two sites in northern Guam were primarily mixed vegetation and regrowth limestone forest. The Harmon Annex site was primarily open grass land and mixed forest. The Dandan site included land used for agricultural purposes, grass land, and vegetation commonly found in wetlands.

The Runway site for Project P-223 would use all of the north runway on Northwest Field for construction of the receiver. In June 1986, the runways on Northwest Field were nominated as a National Historical Landmark by the U.S. Department of Interior National Park Service. This nomination is pending further analysis by the National Park Service. Regardless of the outcome of this nomination, based on discussions between the U.S. Navy, the U.S. Air Force, and the GOVGUAM Historic Preservation Officer, it appears likely that portions of Northwest Field are eligible for inclusion on the National Register of Historic Places. A Memorandum of Agreement (MOA) to ensure implementation of mitigation measures is presently being prepared for signature by the GOVGUAM Historic Preservation Officer, the War in the Pacific National Historical Park, the

Advisory Council on Historic Preservation, Andersen AFB, and the U.S. Navy.

Portions of the Dandan site are currently used for small scale agricultural production of melons and vegetable crops. This area of Guam is considered to have soils which can support commercial agricultural production. Use of the Dandan site for a receiver would not remove all of the land from agricultural use since a large part of the forward reflecting area could still be used for agricultural purposes provided the growth is limited to low growth crops such as melons and vegetables. This agricultural use is currently practiced at the southern Virginia ROTHR test and evaluation installation. Use of the Dandan site for a receiver would increase the amount of Federally controlled land on Guam by about 1,500 acres in fee and 2,600 acres in restrictive easement. Use of the Dandan site would also require removal of wetlands.

The Dandan site is located in southeastern Guam near single family residences and the receiver antennas would be clearly visible to residents and travelers in the area. Since most of the military installations are located in the central and northern sections of the island, use of the Dandan site for a receiver facility would introduce military activities into an area of Guam which currently does not have such uses.

PREFERRED ALTERNATIVE SITES. Section 2.5 of this FEIS describes the site selection process for Project P-223 and Section 5.6 identifies the preferred alternative sites as the northern site on Tinian for the transmitter and the Runway site on Andersen AFB Northwest Field in northern Guam for the receiver. The northern site on Tinian was selected as it lies within the existing military lease area and within the proposed exclusive lease area set forth on the leaseback plan. The western site on Tinian was not selected as use of the site would preclude leaseback of the land area to CNMI.

The Runway site for the Project P-223 receiver on Guam was selected as it would require the removal of 110 acres of native bird habitat, as compared to about 172 acres for the northern site. Although the radio interference tests for the Harmon Annex site showed it to be an acceptable location and it does not contain suitable habitat for endangered bird species, potential electromagnetic interference from future development of adjacent land areas made use of the site unacceptable. In addition, a series of previous studies by the DOD have identified Harmon Annex as an excess parcel. Disposal actions regarding most excess properties on Guam, including Harmon Annex, have been placed on hold pending resolution of legislative initiatives regarding disposition and clarification of alternative uses of the lands for military projects, such as ROTHR Project P-223. The Dandan site was not selected as it would have removed wetlands and required acquisition of rights to use the land and increased Federal lands on Guam.

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* Appendices A through G are contained in the Draft EIS.
** See also the Draft EIS.

INTRODUCTION

This Environmental Impact Statement (EIS) is prepared in accordance with Council on Environmental Quality (CEQ) Regulations (40 CFR 1500) for implementing the procedural provisions of the National Environmental Policy Act. As required by the CEQ regulations, the U.S. Navy has adopted its own regulations, 32 CFR Part 775, which implement the provisions of NEPA. [Ref. 1]

The CEQ Regulations (40 CFR 1502.4) require an EIS to be prepared for "major Federal actions" and that proposals or parts of proposals shall be the subject of single EIS. The CEQ Regulations also permit the coverage of general matters in a broad or program EIS with tiered or subsequent statements prepared at a later date (40 CFR 1508.20 and 28).

This EIS is comprised of three parts. Part I covers the electronic installations program, known as Relocatable Over-the-Horizon Radar, or ROTHR program being considered for the Western Pacific (Programmatic EIS). This part examines the probable environmental impacts from construction and operation of Military Construction Projects P-223, P-225 and P-002, to the extent of available information, cumulative impacts from construction of all three systems and other Federal and private projects; and means to mitigate adverse impacts. Part II examines the probable environmental impacts from the construction and operation of Project P-223. Part III addresses the engineering site surveys for Project P-225. These three sections are Tier 1. If Projects P-225 and P-002 are pursued, project specific documents will be prepared as additional tiers to supplement this document.

The Notice of Intent (NOI) to prepare this EIS was published in the Federal Register on December 24, 1987. [Ref. 2] Subsequently, scoping meetings were conducted on Saipan and Tinian, CNMI, and Guam, MI. The scoping meetings followed this schedule: two on 3 February 1988 on Saipan, one on Tinian on 4 February 1988, and two on Guam on 5 February 1988. Notices for these meetings were printed in the local newspapers to notify interested parties and to invite comments on issues to be addressed in this EIS. A total of approximately 20 people attended the meetings on Saipan, approximately 85-90 people attended the meeting on Tinian, and about a total 40 people attended the meetings on Guam. In addition, written comments were submitted to the Commander, Department of the Navy, Pacific Division, Naval Facilities Engineering Command (PACNAVFACENGCOM), Pearl Harbor, Hawaii. Public information about the project is in Appendix A.

The Draft EIS was made available on 21 July 1989 and notice of its availability published in the Federal Register on 21 July 1989. Subsequently, public hearings were conducted on Saipan and Tinian, CNMI, and Guam, MI. The public hearings followed this schedule: two on Saipan on 16 August 1989; one on Tinian on 17 August 1989; and two on Guam on 18 August 1989. Notices of these public hearings were printed in the Federal Register and local newspapers to notify interested parties and to invite testimony on the Draft EIS. (See Appendix H)

A total of approximately 17 people attended the hearings on Saipan, approximately 24 people on Tinian, and a total of about 57 people on Guam. In addition, a total of 38 written comments were submitted to the Commander, PACNAVFACENGCOM, Pearl Harbor, Hawaii. Comments/questions from the public hearings and the written comments are in Section 10.0.

PART I

PROGRAMMATIC EIS

1.0 PURPOSE AND NEED FOR THE PROGRAM

The U.S. Navy has long recognized the need to provide wide area over the horizon surveillance to support maritime tactical forces. Surveillance of critical ocean areas and maritime choke points is necessary for the defense of at-sea battle groups. Each of the proposed Relocatable-Over-the-Horizon Radar (ROTHR) systems provides the capability to detect, track, and estimate the composition of groups of ship and aircraft in a fixed angular sector (approximately 60-degrees) with ranges of 500 to 1,800 nautical miles from the radar site. Combined, the three ROTHR systems proposed for location in the Mariana Islands, (Tinian, Commonwealth of the Northern Mariana Islands and Guam, Mariana Islands) provide an unique early warning coverage of aircraft and ships coming from the Pacific coast of the Soviet Union, China, and Vietnam, including the Soviet facilities at Cam Rahn Bay. No other U.S. location in the western Pacific provides this extensive coverage position. (See Figure 1.1).

The major need for the ROTHR program stems from the shortcomings of conventional or line-of-sight land or ship based radar systems, which only have detection capability of about 20 nautical miles for low-altitude aircraft and 200 nautical miles for high-altitude aircraft. This type of conventional system provides commanders at sea with limited time (three to six minutes for low-flying aircraft and 15 to 30 minutes for high-flying aircraft) in which to decide, plan, and execute responses to enemy actions. The ROTHR systems effectively extend the time for command decisions and actions by providing long range detection and early warning of approaching naval and airborne threats at any altitude. The system can be used for overall surveillance and tracking within the coverage area, spotlighting specific regions to handle targets of special interest, or assessment of the enemy size. The proposed Navy ROTHR system is not designed to detect Intercontinental Ballistic Missiles (ICBM). The system is also not designed to locate small boats which may be lost at sea.

Over-the-horizon surveillance is attained through the use of three major subsystems: transmitter, receiver and operations control center. Radio frequency energy emanating from the ROTHR transmitter is refracted from the ionosphere in such a way that if the refracted waves hit a target (an aircraft or surface ship) on their way to the earth's surface, a portion of their energy is reflected back to the ionosphere, which then returns a vestige of the original energy (backscatter) in the direction of the receiver. The entire area under this pattern is illuminated by this system for surveillance. The ionospheric phenomenon yields a look down capability well beyond the natural horizon. Because illumination occurs through ionospheric refraction at more than 30 miles altitude, no aircraft flying at any altitude within the effective coverage area of the radar can avoid detection.

By themselves, the proposed ROTHR systems do not satisfy the overall surveillance requirements for the national defense, but rather provide surveillance of specific areas in the western Pacific. The proposed system can be considered part of a larger coordinated surveillance system which includes other U.S. Navy ROTHR sites in Alaska and U.S. Air Force

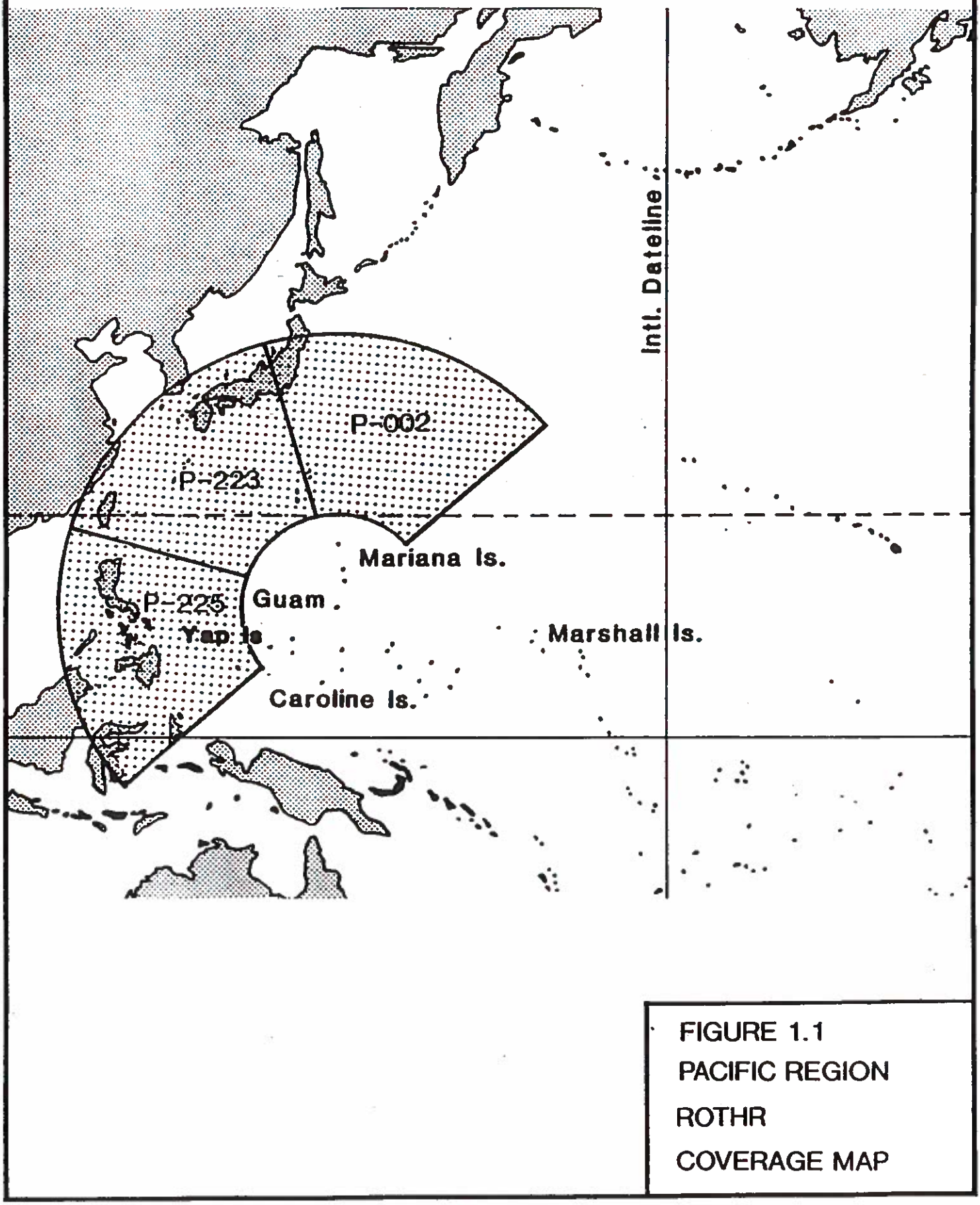


FIGURE 1.1
PACIFIC REGION
ROTHR
COVERAGE MAP

Over-the-Horizon Backscatter (OTH-B) sites in the continental United States and Alaska. Information from all these systems can be correlated with data from other sources for dissemination to fleet and tactical commanders.

The system is designated as relocatable because the transmitters, receivers, and operational control center can be moved to previously prepared transmitter and receiver sites within a two-month period. The systems are designed to be useful for 20 years. While other broad area surveillance systems may be introduced during this 20-year period, analyses conducted by the U.S. Navy to date show that the ROTHR will provide an important complementary capability to every type of sensor technology now conceived. The ROTHR systems are integral components of the entire network of detection systems and are vital to the national defense.

2.0 ALTERNATIVES INCLUDING THE PROGRAM DESCRIPTION

2.1 PROGRAM DESCRIPTION

The proposed program is to construct and operate up to three separate stand-alone ROTHR systems consisting of transmitters (XMTRs), receivers (RCVRs), and Operational Control Centers (OCCs) located near the RCVRs. The ROTHR systems would be essentially the same and operate in a similar manner regardless of the sites selected for the components. Each system would operate independently of the others. The siting of one system will not limit or restrict siting or other decisions with regard to the other systems. Moreover, although collocation of the XMTRs or RCVRs avoids duplication of support facilities such as dining and berthing facilities, telephone/communication and utility systems, and standby generators, collocation is not an operational necessity but would reduce the amount of cleared land required.

The proposed program would construct and operate up to three transmitter systems on Tinian within lands which are subject to long term lease agreement between the U.S. and CMNI. Construction of each antenna would require removal of all vegetation and other features within the 69-acre site needed for the antenna arrays, ground screens, access and service roads, drainage system, and operational facilities. (Note, an area of 58 acres is required to accommodate the transmitter. An additional 11 acres may be cleared to balance the amount of grading and filling and to construct the drainage system. The total cleared area for the transmitter is 69 acres.) Construction of support facilities would require clearing an additional area of about 10 acres.

The proposed program would also construct and operate up to three receiver antenna systems and OCCs on Guam. Construction of each antenna would require removal of all vegetation and other features within the 172-acre site needed for the antenna arrays, ground screens, access and service roads, and operational and support facilities. Portions of the cleared area will be subsequently replanted with grass or other suitable ground cover, or covered with crushed aggregate to control the growth of weeds.

2.2 TRANSMITTER DESCRIPTION

Each XMTR will consist of 34 vertical antenna towers, including the sounder antenna, and 34 vertical support poles. The low band antenna will consist of 16 126-FT high towers and 16 36-FT high support poles sited 35 linear feet (LF) apart. The total length of the low band antenna array is 525 LF. The 126-FT antenna towers will form the back of the XMTR and will be located 118 LF behind the 36-FT high support poles. All of the towers would be open lattice construction and the support poles standard wood utility poles. The low band antenna curtain will extend from the front to back of each pair of antenna towers and support poles and will consist of vertically hung wires spaced 8 LF apart. See Figures 2.1 and 2.2.

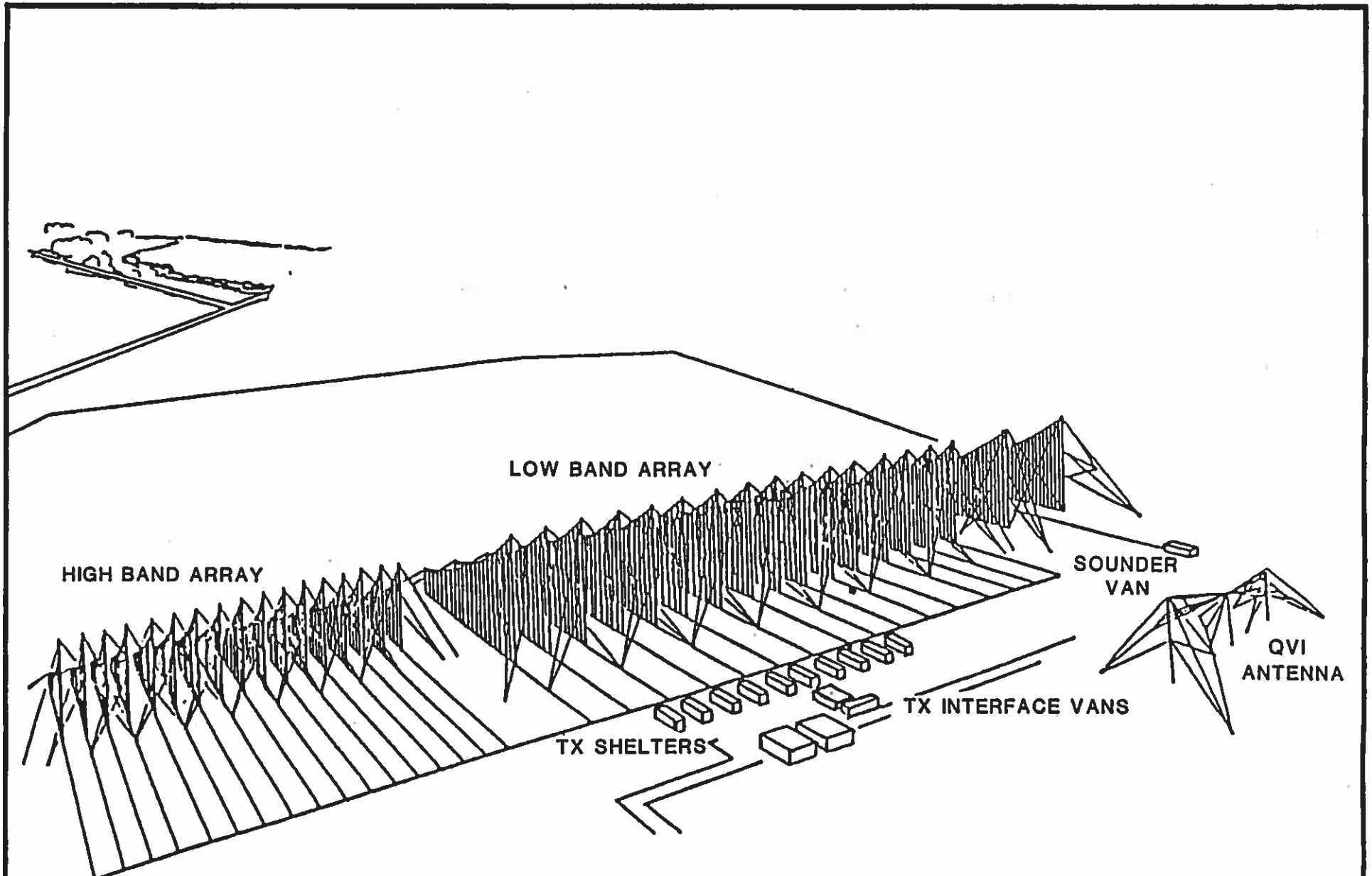
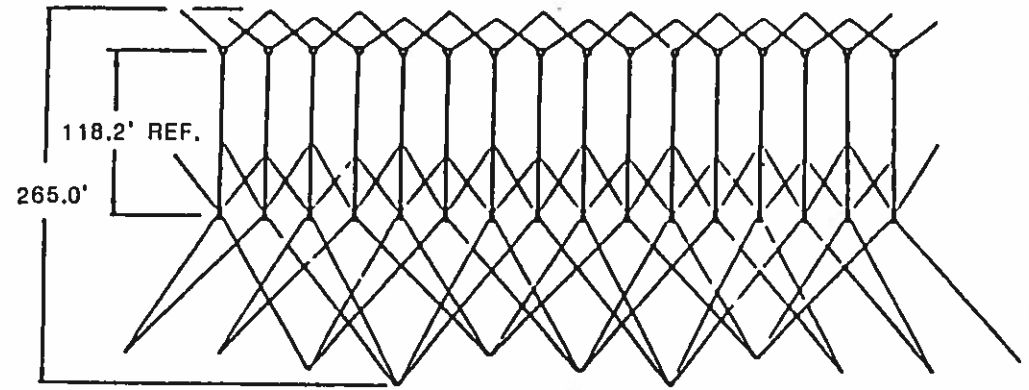
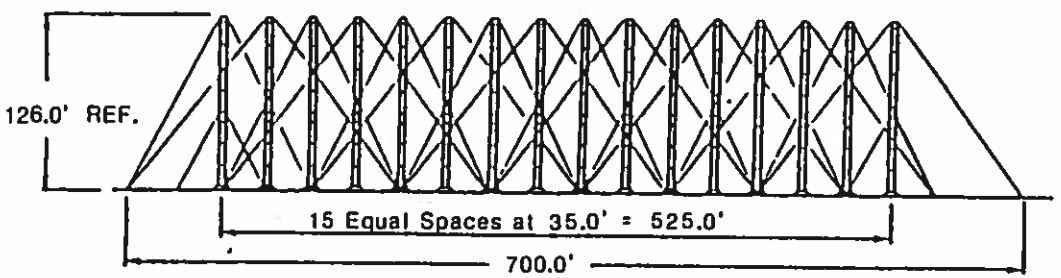


FIGURE 2.1

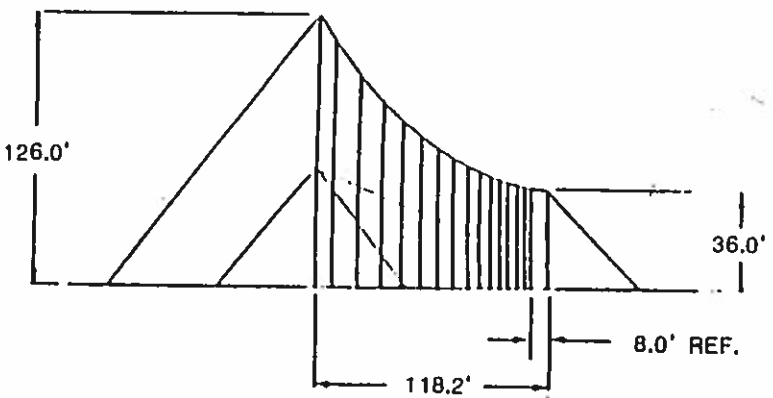
PICTORIAL VIEW, TYPICAL TRANSMIT SITE



Plan View



Elevation View



Side Elevation

NOTE: LOWER LEVEL GUYS ARE SHOWN FOR FIRST & LAST TOWERS ONLY FOR CLARITY.

FIGURE 2.2

LOW BAND TRANSMITTER ANTENNAS

The high band antenna array will consist of 16 72-FT high towers and 16 17-FT high support poles sited 17.5 LF apart. The total length of the high band antenna is 262.5 LF. The 72-FT antenna towers will form the back of the XMTR and will be sited 67.13 LF behind the 17-FT high support poles. The high band antenna curtain will extend from the front to back of each pair of antenna towers and support poles and will consist of vertically hung wires spaced 6 LF apart. See Figure 2.3.

Each antenna tower will be anchored with eight guy wires to withstand wind speeds of 140 knots. The ground screen for each XMTR will consist of bare wires laid on the ground surface and anchored with hand driven anchor rods. Each transmitter ground screen and reflective field will cover approximately 69 acres and will be covered with low growth vegetation or other planted material, or crushed aggregate to control the growth of weeds.

The antenna array and ground screen will be fenced with five-strand wire fence on four sides. The fenced area, called the radiation hazard area or personnel exclusion fence area, will extend a maximum of 1,058 LF in front and 200 LF behind the antenna array. The fence will be posted with signs warning of the radiation hazard from the antenna array. A detailed description of the effect of ROTHR radio frequency (RF) radiation on living organisms has been prepared by the U.S. Navy and is summarized in Sections 4.1.15, 7.1.15, and 8.3.15. [Ref. 3]

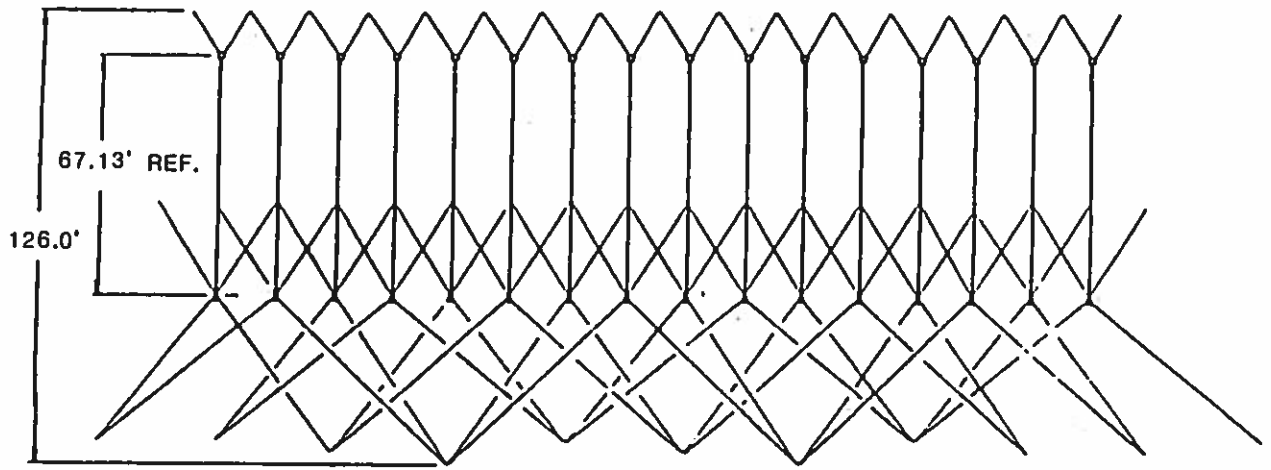
In addition to the antenna array and ground screen, the major facilities needed for operation of one ROTHR transmitter system include 14 operational vans and a 1,640 SF support building. Other facilities to be located on a 10 acre support site include personnel berthing, power generation, fuel storage, public works, roads, communications and water pumping and storage facilities. The above facilities are not available at any of the alternative sites and will need to be constructed.

2.2.1 Transmitter Operating Characteristics

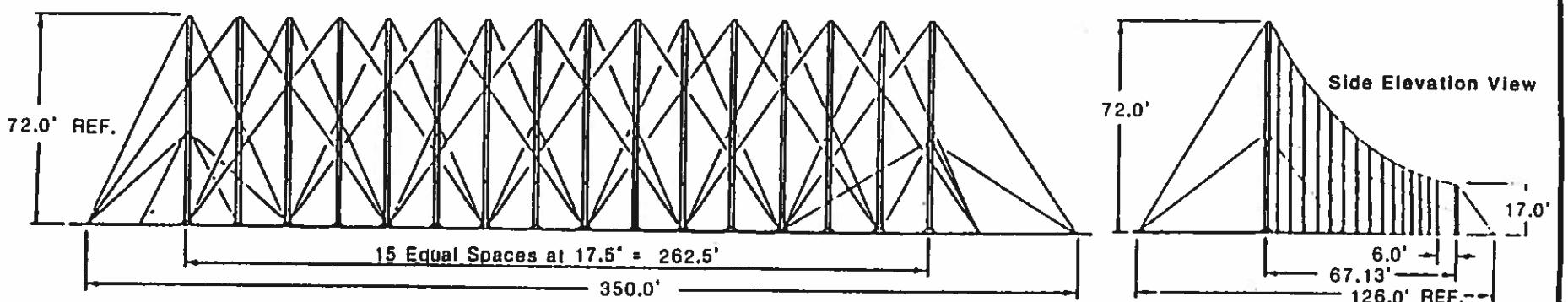
The ROTHR transmitters will transmit in the frequency range from 5 megahertz (5,000,000 cycles per second) to 28 megahertz (MHz). Each ROTHR transmitter system is composed of sixteen transmitter units each capable of transmitting power between 5 kilowatts (5,000 watts) and 20 kilowatts (kW) simultaneously. Based on this design, one system can produce up to 200 kW of peak power. (The power output of the transmitter will be 6 units at 20 kW; 6 units at 10 kW and 4 units at 5 kW, for a total of 200 kW.) Each ROTHR system will transmit only one frequency at a time.

The XMTRs will transmit signals by continuous wave (CW) transmissions which are interrupted for radar frequency changes. These interruptions will last between one-half and one second. Each CW transmission will last typically between 2.5 to 20 seconds, depending upon the availability of frequencies and radar tasking.

The physical characteristics of the antenna arrays allow the transmitted power to be directed along a line normal to the orientation of the antenna arrays. The directed power can then be "steered" in eight degrees



Plan View



Elevation View

NOTE: LOWER LEVEL GUYS SHOWN FOR FIRST & LAST TOWERS ONLY FOR CLARITY.

FIGURE 2.3

HIGH BAND TRANSMITTER ANTENNAS

increments between plus and minus 32 degrees. The steering is accomplished by a digital computer system programmed to phase the area. The cleared area in front of the antenna array is required so the beam can be formed having an elevated takeoff angle. This will permit the beam to be refracted or bounced off the ionosphere.

A discussion of radio frequency utilization by ROTHR and evaluation of possible radio frequency interference (RFI) with other users has been prepared by the U.S. Navy and is summarized in Sections 4.1.15, 7.1.15, and 8.3.15. [Ref. 3]
Additional discussion is in Section 10.0 Response to Comments.

2.2.2 Transmitter Support Facilities

In addition to the antenna, each ROTHR transmitter will require support facilities for the assigned personnel. The facilities required to support one ROTHR system include:

- An 17,000 SF combination personnel quarters, dining, recreation, and first aid facility;
- A 1,500 SF public works shop and storage facility;
- A 1,640 SF operations and maintenance building;
- A 10,000 SF power plant facility to house three 1,200 KW, 4.16 KV generators;
- One 200,000 gallon above-ground fuel storage tanks contained within an impervious containment area;
- Communications and utilities systems;
- A potable water well and two 50,000 gallon above-ground water storage tanks;
- Access and service roads;
- Septic tanks and leach lines for sewage disposal, and
- Approximately 9,100 LF of personnel exclusion fencing. [Ref. 4]

Collocation of the transmitters within close proximity will eliminate the complete duplication of the above facilities. Each additional ROTHR transmitter will only require one more generator and fuel storage tank, if constructed as an add-on to the first power plant. The personnel support building, public works shop and utility systems would be expanded with each additional ROTHR system. However, collocation of the support facilities and the transmitters is not an operational necessity.

These support facilities will be owned by the U.S. Navy and not rely on support from utility systems on Tinian. The support facilities will be located adjacent to the transmitters. The operating and maintenance

contractor will be responsible for maintenance of the facilities.

2.2.3 Transmitter Construction

Construction of the XMTRs and support facilities on Tinian would be contracted to civilian companies under normal contracting procedures established for this type of project. Military personnel are not expected to be used for project construction. The contractor would be responsible for transporting all equipment, material, and supplies to the project sites. Although this would be determined by the contractor, all of the equipment, material, and supplies are expected to be brought in by ship and barge to Tinian. Military aircraft will not be used to transport equipment, material, and supplies to the North Field runways or to West Tinian Field during construction. However, military aircraft may be used for deployment of the ROTHR systems once the antenna site has been prepared.

The contractor will provide for restoring roads used to move equipment, material and supplies to pre-construction condition, if they become deteriorated due to construction activities. These conditions will be incorporated into the construction contract awarded by the U.S. Navy. Similarly, the contractor and all military commanders will be responsible for meeting all the requirements for inspection of equipment, material, and supplies to prevent the accidental introduction of the Brown Tree Snake. Portions of the dock area in Tinian Harbor are leased to the DOD as part of the lease agreement with CNMI. The using party would be responsible to repair damage which might occur during loading or unloading operations at the DOD dock area.

The construction contractor's employees on Tinian can be expected to number between 50 to 100 persons during the peak construction period. These personnel will be housed at either the construction site or in facilities in the town of San Jose. The use of personnel from Tinian during the construction period and purchase of goods and services from Tinian and other areas of CNMI can be expected. However, the extent cannot be determined at this time.

All vegetation removed on the sites will be disposed of through on-site burning. The construction contractor will be directed by the U.S. Navy to coordinate with local agencies concerning the disposition of trees removed from the site, if they are not burned. Materials deemed to be of no value to the local community will be burned on site. The construction contractor will be notified by the U.S. Navy to allow the removed vegetation to be sufficiently cured to prevent excessive smoke during burning operations. Disposal of vegetation as firewood may be considered if there is a demand for it.

All project-related debris such as building materials and other solid waste will be disposed of in accordance with procedures established in the construction contract. No material will be moved into adjacent areas or pushed over nearby cliffs.

The time required to prepare the site will vary according to the selected

location, available facilities, and actual site topographic conditions. Approximately two years have been scheduled for completion of site preparation for one transmitter system. Once a site has been prepared, the operating system can be installed in approximately two months.

2.2.4 Transmitter Operational Data

The transmitters will be operated and maintained (O&M) by two military personnel and 16 civilian contractor personnel for Project P-223, 13 for Project P-225, and 13 more for Project P-002, on a 24-hour per day, 7 days per week basis. In addition, the contractor will provide Base Operations Support (BOS) to operate the Navy support facilities. BOS services will be provided by 34 civilian contractor personnel for Project P-223, by an additional 7 for Project P-225, and by an additional 7 for Project P-002. The personnel positions will not be civil service positions. The two military personnel will be permanently located on Tinian. Initially, all civilian personnel (O&M and BOS) for the transmitters are expected to be provided by the Prime Equipment Contractor, Raytheon Corporation. All of the positions for O&M functions are highly technical. Although local personnel will be considered, due to the state of the art specialty training required, the scope of local hirings for O&M is not known at this time.

Most of the positions for BOS services will be non-technical. Some of the personnel are anticipated to be hired from Tinian or other areas in CNMI. A total of approximately two military and 90 civilian personnel will be required to operate, maintain, and provide base support for the three transmitters, if collocated. About 52 personnel will be required for Project P-223, an additional 20 personnel for Project P-225, and an additional 20 personnel for Project P-002. If the transmitters are not collocated, each transmitter will require 52 personnel to operate, maintain, and provide base support for the system.

Quarters for 34 personnel are proposed to be provided to support the initial 52 personnel for Project P-223. An additional 13 quarters will be provided for Project P-225 and the same number for Project P-002 so all essential personnel would be in the proximity of the transmitter at all times. The remaining 32 personnel will use facilities in the town of San Jose.

2.3 RECEIVER DESCRIPTION

Each RCVR antenna array will consist of 372 pairs of aluminum monopole antennas (a total of 744 poles) each about 18 FT high and 6 inches in diameter. (See Figure 2.4) The antenna poles will be bolted to ceramic base plates mounted on direct-buried concrete foundations. The monopole antennas will not be anchored with guy wires. The pairs of antenna poles will be sited about 23 LF apart. The total length of the RCVR antenna array is approximately 8,600 LF. Each monopole antenna will be capable of withstanding wind speeds of 140 knots. The 800 LF width dimension for each receiver antenna will contain a 568 LF wide reflecting area in front of the ground screen, a 132 LF wide ground screen within the antenna poles and a 100 LF clear area behind the ground screen.

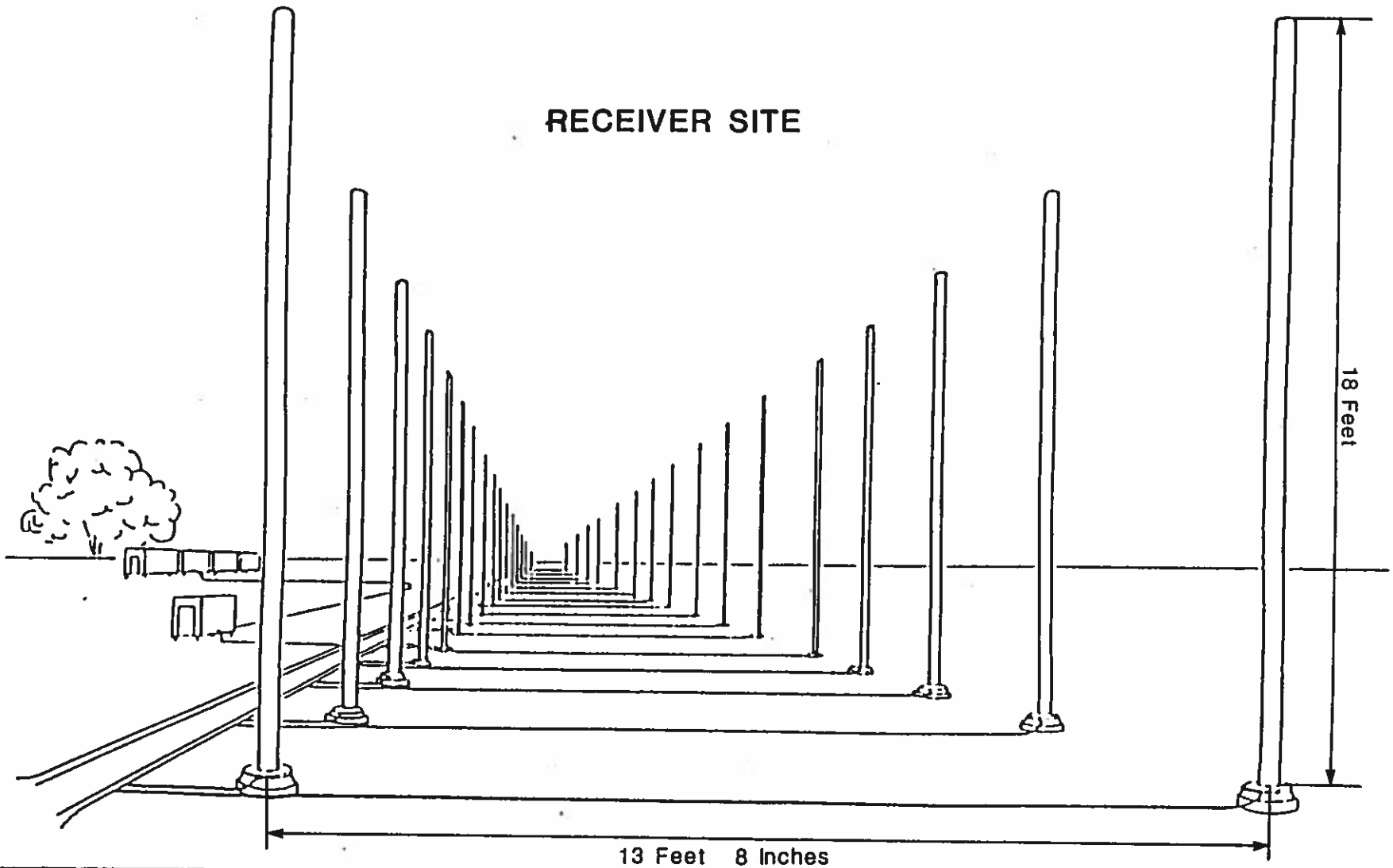


FIGURE 2.4

PICTORIAL VIEW RECEIVER SITE

The ground screen for each RCVR will consist of a 44 LF wide area of bare wires and an 88 LF wide area of insulated wires laid on the ground surface and anchored with hand driven anchor rods. The antenna array and ground screen will not be fenced. In addition to the antenna array and ground screen, other facilities needed to operate each RCVR include a 60-FT high QVI antenna, 3 operational vans, 13 receiver equipment shelters, a van support building, and an emergency generator building. [Ref. 1] Each of the OCC's is composed of 16 interconnected operational vans, an uninterruptable power supply (UPS) van, a 8,400 SF van support building, and an emergency generator building to house one 400 KW generator. A similar 400 KW generator would be necessary to support each OCC.

2.3.1 Receiver Operating Characteristics

The receivers receive and process energy backscattered from the surveillance area illuminated by the transmitters for both target detection and propagation management purposes. The OCC functions to evaluate and control the operation of the radar through the use of ionospheric information and spectrum monitor data.

2.3.2 Receiver Support Facilities

Facilities will be required to operate the RCVRs and provide support for the assigned personnel. The support facilities for each receiver site include:

- One 1,200 SF emergency generator building to house a 400 KW, 13.8 KV generator;
- One 1,200 SF operations and maintenance building;
- Underground communications and utilities systems;
- One 4,000 gallon above-ground fuel storage tanks contained within an impervious containment area;

All of these support facilities will be owned by the U.S. Navy. All power for operation of the RCVRs would be supplied from existing U.S. Navy power plants on Guam or purchased from GOVGUAM.

2.3.3 Receiver Construction

Construction of the RCVRs, OCC, and support facilities on Guam would be contracted to civilian companies under normal contracting procedures established for this type of project. Military personnel are not expected to be used for project construction. The contractor would be responsible for transporting all equipment, material, and supplies to the project sites. The contractor would also be responsible for submitting necessary plans and for securing required permits and authorizations from the responsible agencies on Guam and for coordinating all construction activities with the U.S. Navy.

Construction of the receiver project sites would require removal of all

vegetation from approximately 172 acres for each ROTHR system. The antenna reflecting area is 8,600 LF long by 800 LF wide. In addition, the antenna reflecting area requires a 25 LF clear area in front and back and about 50 LF on each end (total dimensions to be cleared 8,700 LF by 850 LF). A small area 200 LF by 500 LF is necessary for the support facilities.

No clearing of trees in front of this area will be required as part of the construction activity. The U.S. Navy has determined that an acceptable level of performance can be achieved without clearing of trees outside of the designated area. Topographic data is still required in order to establish finish array elevations and to confirm existing terrain elevations. However, based on preliminary topographic data available for Project P-223 on Northwest Field, excavation in front of the antenna reflecting area will not be required. The other northern sites would also not require excavation in front of the antenna.

Vegetation would be removed from the project sites and replaced with slow, low-growth vegetation or other suitable ground cover after grading to meet the technical requirements for construction of the RCVRs. The vegetation from each site would be disposed of by on-site burning within a secure area surrounded by exposed bare mineral soil, appropriate fire breaks and other necessary safety precautions. All necessary precautions required to prevent accidental fires would be taken before burning. Necessary permits would be obtained by the contractor prior to burning. The construction contractor will be required to ensure compliance with permit requirements and safe practices. Material not readily burnable would be disposed of by burial, on-site or at an approved landfill.

The construction contractor will be directed by the U.S. Navy to allow the removed vegetation to be sufficiently cured to prevent excessive smoke during burning operations. Disposal of vegetation for firewood or for craft use may be considered, if there is sufficient demand and appropriate security and Government liability measures can be satisfied for public access.

All project-related debris will be disposed of in accordance with the procedure approved for the construction contract. No material will be placed into adjacent areas or pushed over nearby cliffs.

Borrow material required to construct the receiver sites will be obtained from existing borrow sites located on military controlled lands on northern Guam. Once the site has been cleared and prepared, the construction contractor would also be responsible for establishing the slow, low-growth vegetation or other suitable ground cover. However, only a general maintenance concept can be identified at this time. The construction contractor will devise a plan, for review and acceptance by the Navy and coordination with GOVGUAM agencies, that will address the establishment and maintenance of ground cover for those portions of the receiver site that are to remain free of encroachment by woody stemmed plants and trees. Specific details for ground cover and/or follow-on maintenance will be prescribed by the operations contractor.

2.3.4 Receiver Operational Data

The RCVRs and OCC will be operated by military and civilian contractor personnel on a 24-hours-per-day, 7-days-a-week-basis. A total of approximately 216 military personnel, 72 for each RCVR and OCC, will be permanently located on Guam to operate the three RCVRs and OCCs. Based on current statistics for Navy personnel on Guam, about 123 military personnel will be accompanied by dependents. The remaining 93 military personnel will be unaccompanied. The U.S. Navy personnel will be assigned to the Fleet Surveillance Support Command.

Initially, civilian operating personnel for the RCVRs are expected to be provided by the prime contractor, Raytheon Corporation. Non-technical personnel are anticipated to be hired from Guam or other areas in the western Pacific. Although local personnel will be considered for all positions, due to the training required, the scope of local hiring for technical operating positions is not known at this time. A total of approximately 69 civilian personnel will be required to operate the three RCVRs and OCCs. With location of the OCCs on Guam, about 44 civilian personnel will be required for Project P-223, an additional 15 personnel for Project P-225, and an additional 10 personnel for Project P-002. If the OCCs are not collocated, more than 44 civilian personnel may be required for each OCC facility depending on the available support services from nearby military installations.

The military personnel will be assigned to family and bachelor housing facilities in accordance with existing military housing assignment policies. The latest family housing survey for Guam indicates there is sufficient family housing within a one-hour driving time of any of the proposed RCVR sites. Thus, construction of additional family housing is not anticipated for the ROTHR projects.

2.4 SITE REQUIREMENTS

2.4.1 Operational Siting Requirements

Surveillance of critical areas is required to detect aircraft and ships coming from the Soviet Union, China and Vietnam, including the Soviet facilities at Cam Rahn Bay. To meet this operational requirement, the ROTHR systems must be sited in the Marianas Islands as shown in Figure 1.1.

2.4.2 Technical Siting Requirements

For the ROTHR system to accomplish the surveillance mission the following criteria must be met:

- The transmitter and receiver must be separated by 50 to 100 miles to permit bistatic operation.

- The receiver site must be free of radio frequency interference (RFI) for one mile to the front of the array, 1,200 LF behind and 700 LF on each end.

2.4.3 Physical Siting Requirements

To reduce site preparation costs to meet the specific levelness criteria of the antenna array, the site for the transmitter and receiver should be generally level. The area in front of the transmitter and receiver antennas must be clear of obstructions. A prospective site must have about 100 acres for the transmitter facility and about 200 acres for the 8,600 FT long receiver antenna. However, due to the environmental concerns about the removal of forest areas, the XMTR and RCVR reflecting areas were reduced to minimum thereby 69 acres for the XMTR facility and 172 acres for the RCVR facility are being applied to the Guam/Tinian ROTHR systems only.

2.5 ROTHR ALTERNATE LOCATIONS

The alternative sites identified in this EIS for locations for the ROTHR XMTRs and RCVRS have undergone analysis involving a number of different criteria. Two primary criteria were initially considered in the selection of the sites; availability of the required land area; and the necessary separation of the transmitter and receiver sites (50 to 100 miles separation) for bistatic (concurrent operation of the transmitters and receivers) operations. Thus, sites were only considered that offered approximately 100 acres of relatively flat land available in the general configuration of the XMTR and 200 acres for the RCVR. See Appendix J for further discussion of these factors.

2.5.1 Islands Meeting Technical Requirements

Based on these two primary criteria, the following combinations of alternative island locations (see Figure 2.5) in the western Pacific were considered:

Island Combinations	Separation Distance (Miles)
Guam-Tinian	105
Guam-Rota	43
Guam-Saipan	118
Guam-Anatahan	190
Tinian-Saipan	10
Tinian-Rota	60
Tinian-Anatahan	85
Rota-Saipan	70
Rota-Anatahan	145
Saipan-Anatahan	75
Babelthaup-Peleliu	38

2.5.2 Islands Meeting Technical and Physical Siting Requirements

Of the island combinations examined, only those which included Guam, Tinian, and Rota were considered viable alternatives for the transmitter or receiver. Land areas of approximately 100 acres for the transmitter and 200 acres for the receiver on relatively flat terrain were not available on Saipan and Anatahan.

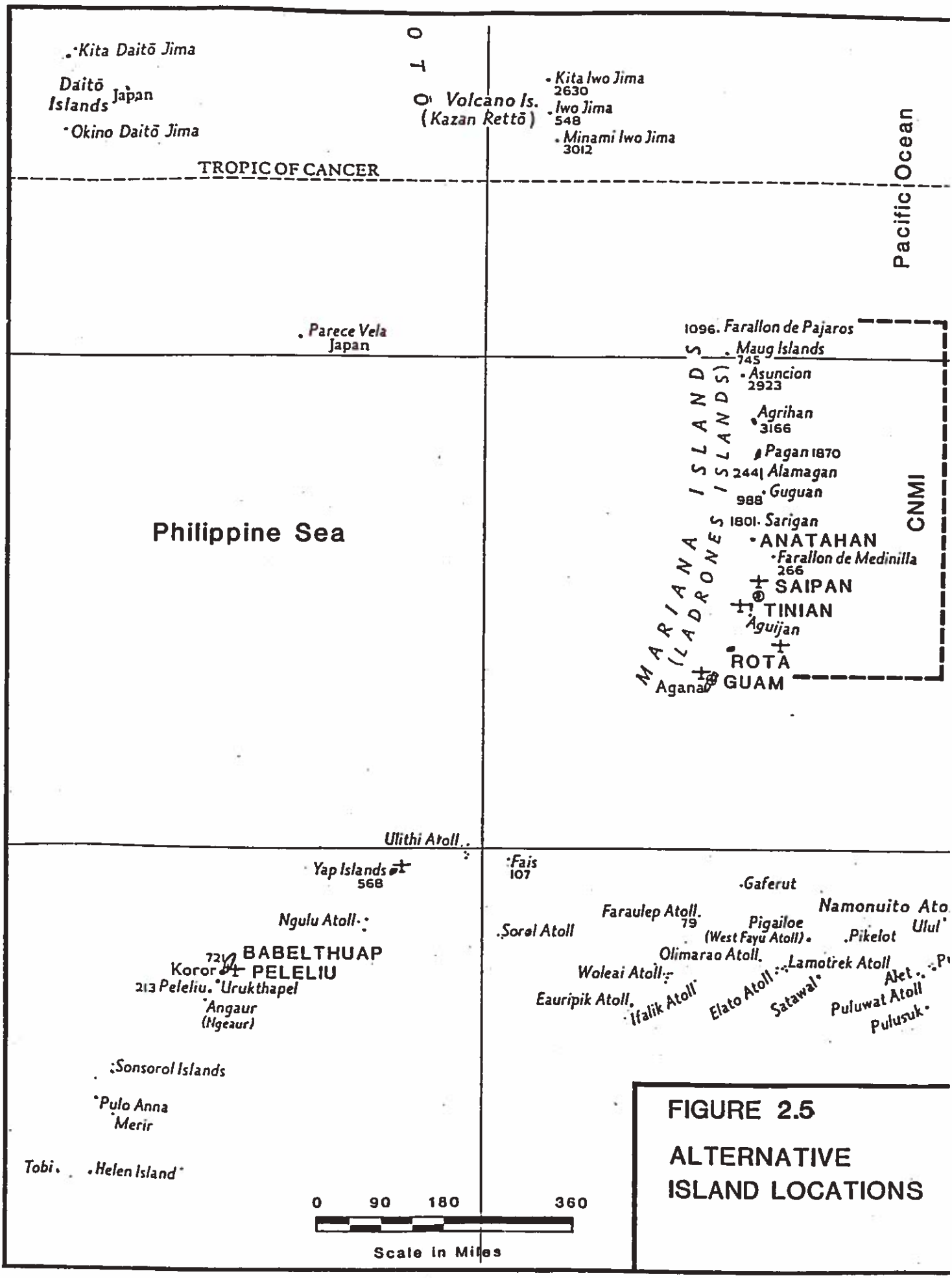


FIGURE 2.5

ALTERNATIVE ISLAND LOCATIONS

Island combinations meeting both the technical and physical siting requirements are:

- o Guam - Tinian;
- o Guam - Rota; and
- o Tinian - Rota

2.5.2.1 Transmitter Site Selection Criteria. The operational criteria considered in the transmitter site selection included:

1) Size of the proposed site; (Initially, areas of about 100 acres were considered for the transmitter. Based on current design criteria, the transmitters will require 69 acres.)

2) Possible interference with existing communication operations;

3) Possible interference with existing ordnance operations;

4) Location within established explosive safety hazard zone; and

5) Location within 100 miles of the Circularly Disposed Antenna Array (CDAA) operations.

The DOD has directed that over-the-horizon high frequency backscatter transmitter radars, such as the ROTHR, must be located 100 miles from Circularly Disposed Antenna Array (CDAA) operations. A CDAA, also known as the Wullenweber facility, is located at NAVCAMS WESTPAC. This 100 mile separation requirement precludes the ROTHR transmitter from being sited on Guam or Rota. [Ref. 74]

Use of the military lease area on Tinian for XMTRs was considered viable. Most of the potential sites on Tinian would be relatively accessible via the existing World War II paved roads.

Sites on Rota, if real estate interest to use land was acquired, could not be used for transmitters, only receivers, due to the CDAA operational criterion explained above. Acquisition of sites on Rota would not be consistent with the Northern Mariana Islands Covenant which requires the U.S. Government to site facilities within the military lease area on Tinian if at all possible before considering acquisition of rights to use other areas.

Based on this analysis, the sites remaining for further evaluation for a transmitter would be located on Tinian. Appendix J contains additional discussion of the siting requirements.

2.5.2.2 Receiver Site Selection Criteria. The operational criteria considered in the RCVR site selection included:

1) Size of the proposed site. (Initially areas of about 200 acres were considered for the receiver. Based on latest design criteria, the receiver will require about 172 acres.);

2) Location within established explosive safety hazard zone;

3) Possible interference from existing communication operations;

4) Possible electromagnetic interference from vehicular traffic and other community facilities;

Sites on Rota could only be used for receivers. However, sites on Rota were eliminated from further consideration for the same reasons previously discussed.

Use of the military lease areas on Tinian for receivers was considered viable. Most of the potential sites on Tinian would be relatively accessible via the existing World War II paved roads. However, Tinian was eliminated from further consideration for receiver sites since the transmitter could not be located on Guam and Rota due to the 100-mile separation distance required for the CDAA operation as previously discussed.

Based on the above, the sites remaining for further evaluation for the receivers would be on Guam. Appendix J contains additional discussion about the siting requirements.

2.6 REASONABLE ACTION ALTERNATIVES

A number of different detection systems were analyzed prior to initiation of the development of the ROTHR system. These included a number of active and passive sensor systems and platforms, radar satellites and air-borne surveillance aircraft. The two systems which seemed possibly useful as alternatives to deployment of the ROTHR systems are discussed below.

2.6.1 Radar Satellite Systems

The Navy has been investigating the feasibility of space based radar systems for ocean surveillance for the past 30 years. The Soviets have launched a crude radar ocean surveillance satellite system. It can be used to provide rough locations on naval forces. The challenge, however, is to provide locational data on both ships and aircraft and to do so frequently and accurately enough to fulfill surveillance needs. Current technology will not permit the development of a radar satellite which can be launched into stationary orbit where it could continuously stare at target areas of interest. Therefore, any satisfactory radar satellite system must revisit the target area frequently especially to track supersonic aircraft. This requires the deployment of many, highly-capable radar satellites with a near real-time reporting capability, a very expensive undertaking. Significant technical advances over existing systems would be required to develop a wide area surveillance system capable of detecting ships and aircraft. New technology would also be required for computer systems to analyze and relay data received by the satellites to tactical commanders at sea. Eight or more satellites would be required to accomplish the same mission as the proposed ROTHR systems.

2.6.2 Aircraft Surveillance Systems

Radar systems on-board the Air Force Airborne Warning and Control System (AWACS) aircraft have the capability to track aircraft and ships beyond the range of ground- or ship-based radar. These systems are capable of locating targets in specified patrol areas. These highly capable aircraft, however, are designed primarily for air battle control.

The area which can be surveyed by an AWACS aircraft flying at 29,000 feet is nominally 125,664 square miles. A single ROTHR system can illuminate a Primary Coverage Area (PCA) of nominally 1,669,900 square miles. It would require more than 14 AWACS aircraft continuously airborne to illuminate the equivalent ROTHR system PCA.

In order to maintain 14 aircraft continuously airborne, a minimum of 62 aircraft would be required. This number considers the transit time for the aircraft to get to and from their onstation orbit area. It does not consider any spare or maintenance aircraft for contingencies. Two to three aircraft would takeoff and land every hour of the day. Basing and operating the AWACS would require large land areas to site airfields and support facilities. Thousands of personnel would be required to support and maintain these aircraft.

2.6.3 No Action Alternative

The no action alternative would not construct the ROTHR systems on Tinian and Guam. This option would preclude development of early warning radar coverage along the western Pacific Coast. Naval battle groups would have to rely on existing ship based radar systems which have detection capability of about 20 nautical miles for low-altitude aircraft and 200 nautical miles for high-altitude aircraft. The no action alternative gives ship commanders time in term of minutes to decide, plan and execute responses which affect the mission and lives of men of the battle group.

2.6.4 COMPARISON OF ALTERNATIVE SYSTEMS

The following matrix provides a comparison of the major factors considered in the use of the ROTHR system and the alternative detection systems described in Sections 2.6.1 and 2.6.2.

FACTOR	ROTHR	RADAR SATELLITE	AIRCRAFT SURVEILLANCE
Area coverage	1.6 million square miles per system	Unknown	Limited to individual aircraft capability
Continuous coverage	24-hour/day	Multiple satellites required/unknown	62 aircraft required per day for equivalent ROTHR coverage
Land requirements	100 acres for transmitter 200 acres for receiver	Unknown	Airfields must be developed
Available Sites	Tinian/Guam	Unknown	Forward bases must be developed
Existing technology	Existing systems	Technology must be developed	Existing systems
Detection capability	Ships and aircraft	Technology must be developed	Ships and aircraft

3.0 AFFECTED ENVIRONMENT

3.1 TRANSMITTER LOCATIONS (TINIAN)

3.1.1 Introduction

Tinian is the second largest island in the Commonwealth of the Northern Mariana Islands. (Figure 2.5) It lies approximately 2.75 miles south-southwest of Saipan, about 100 miles northeast of Guam and approximately 3,800 miles west of Honolulu. An uninhabited island, Aguiguan, a part of the Municipality of Tinian, lies about five miles southwest of Tinian. Tinian is about 12.5 miles long and six miles wide, with a total land area of about 39.2 square miles or 25,100 acres. [Ref. 5]

In February 1975, the then Mariana Islands District of the Trust Territory of the Pacific Islands entered into a Covenant to establish the Commonwealth of the Northern Mariana Islands (CNMI). The accompanying Technical Agreement with the United States sets forth that certain lands in the Northern Mariana Islands would be leased to the U.S. for defense purposes. [Ref. 6] Included in the lease area is 17,798 acres on the northern portion of Tinian. [Ref. 7] This area represents about 71 percent of the total land area of the island.

As previously discussed, about 12,500 acres of the 17,798 acres being leased by the U.S. could be leased back to CNMI for an initial ten-year period, if certain conditions are met by both parties. The U.S. would retain about 5,500 acres as U.S. Exclusive Use Area according to the proposed leaseback agreement. Land uses in the leaseback area would be limited to grazing and agricultural uses.

The population of Tinian in April 1987 was 1,025 persons, excluding approximately 500 alien workers. Almost all of the population of Tinian lives in the southern portion of the island, with the main concentration in the Village of San Jose. On November 3, 1986, the Northern Mariana Islands became a Commonwealth of the U.S. Thus, residents of Tinian are U.S. citizens.

3.1.2 Physiography and Topography

Tinian is comprised five physiographic units. The northern flatland encompasses about seven square miles. The other areas include the central flatlands and cliffs arising from the shorelines and the southern and eastern mountains.

3.1.3 Soil Characteristics

Soils on the island include the Dandan-Chinen complex, a mixture of Dandan clay loam and Chinen clay loam. Dandan soil is moderately deep and well drained. It formed in sediment over porous coralline limestone. Chinen soil is shallow and well drained. Runoff is slow for both soil types and with only a slight hazard of water erosion.

3.1.4 Geological Characteristics

The Mariana Islands lie on the crest of the Mariana submarine ridge, curving from Guam north-northeastward, northward, and then north-northwestward. The southern Mariana Islands are flanked by a zone of active volcanoes approximately 20 miles to the west and by the Mariana Trench, located about 125 miles to the east. This island arc, or arcuate structure, is one of several on various parts of the earth. Although no two are exactly alike, they share a common characteristic of extreme structural or seismic instability. Tinian can anticipate seismic shocks, both minor and severe. [Ref. 9]

Tinian's landscape reflects a geologic history that combines volcanic/tectonic activity with a series of reef-building and erosional phases. At times during the history of the island, large faults have transected its mass and moved separate blocks in different directions relative to one another.

3.1.5 Meteorology

The climate of Tinian is tropical oceanic, characterized by generally high temperatures with narrow fluctuations of diurnal temperatures. It is also characterized by high humidity (annual mean relative humidity 80%), generally persistent tradewinds, and very narrow changes in year round temperatures.

The mean monthly temperature varies from 76°F in February to 80°F in June, September, and October. Extremes in temperature range from the high 80's during the wet season (July through October) to the low 70's during the dry season (February through April).

The annual rainfall on Tinian averages about 80 inches, based upon best estimates. There appears to be minor variations in rainfall over Tinian. This is primarily believed to be the result of the small land mass and the absence of any high mountain peaks to induce orographic influences on the weather.

One of the phenomena of weather on Tinian is the occurrence of typhoons that are accompanied by high winds and heavy rains. It is expected that once in three years, a typhoon will pass within 60 miles of Tinian, causing heavy rainfall and high winds exceeding 50 knots damaging crops and property. [Ref. 5]

Wind data are not available for the project sites or other locations in northern Tinian. However, based on wind data from Saipan, the airport on Tinian, and general weather conditions, generalizations about wind conditions on Tinian can be made. These generalizations indicate in well exposed locations wind speeds average 11 to 14 miles per hour during the periods of strongest trades (November through April). Further, trade winds (northeast and east) are dominant at all times. [Ref. 9]

Although data on air quality is not available for Tinian, the lack of significant stationary and mobile sources of emissions and the trade wind

conditions would indicate good air quality on Tinian.

3.1.6 Hydrology

Most of the water resources studies on Tinian were conducted during the 1940's and later modified in 1960 by the Chief of Engineers, U.S. Army. These studies show Tinian has two distinct Ghyben-Herzberg lens aquifers, one in the northern portion of the island and the other in the central portion. In this type of aquifer the less dense fresh water floats on top of the denser salt water. This groundwater system is generally recharged by rainfall. [Ref. 9]

3.1.7 Fauna

Over the years, a number of research studies on the birds of Tinian have been conducted to determine the numbers and kinds of species on the island. Some of these studies date to 1823. The most recent bird surveys covering large portions of Tinian were conducted in 1984 when the military lease area (17,798 acres or 71 percent of the island) was extensively surveyed. The bird surveys were part of a comprehensive survey of the natural resources on the island. [Ref. 5]

The findings of the 1984 study identified a number of bird species. A comparison of the findings of the 1984 survey and the Federally listed endangered or threatened species are of particular interest. These Federally listed species include the Common moorhen (Gallinula chloropus guami), Mariana mallard (Anas oustaleti), Micronesian megapode (Megapodius laperouse laperouse), Island swiftlet (Aerodramus vanikorensis bartschi), and the Tinian Monarch (Monarcha takatsukasae). [Ref. 5]

One of these species, the Mariana mallard, is thought to be extinct. Another one, the Micronesian megapode was thought to be extinct, but was rediscovered during the 1984 survey. A population of about 100 Common moorhens, a waterbird species, is thought to exist in Lake Hagoi, a wetland located west of the North Field runways. The Island swiftlet, which has not been seen on Tinian since 1976, was not observed during the 1984 surveys. [Ref. 5]

The 1984 study also included surveys for mammals on Tinian, including the Mariana fruit bat (Pteropus mariannus mariannus). Surveys for the Mariana fruit bat were conducted at nine locations within the military lease area during the early morning and evening periods when the mammals are most active. No Mariana fruit bats were seen in the military lease area during the 1984 study. It is believed that overhunting is the cause for their decline on Tinian. The 1984 study indicated that "the military lease area appears to contain sufficient food resources to sustain a fruit bat population of at least several hundred animals." [Ref. 5]

The mammal fauna of Tinian is composed of 12 species, 11 of which have been introduced by humans. Of the introduced animals, the sambar deer and possibly the Polynesian rat have become extirpated on the island. Three species of introduced mammals--the musk shrew, house mouse, and roof rat--presently occur in wild or feral populations in the military lease

area. Four other mammals--the horse, pig, cow, and goat--are thought to occur in the military lease area as domestic animals only. Cats and dogs exist in domestic and feral populations. [Ref. 5]

3.1.8 Flora

The northern flatlands of Tinian contain primarily disturbed vegetation consisting of tangantangan with an understory of forbs and grasses. The remaining native species on the island are found primarily on the cliffsides which have not been disturbed. Portions of the central, western, and southern areas are currently used for agricultural purposes, including grazing of cattle and growing of crops, fruits, and vegetables.

3.1.9 Population

The latest complete population data for Tinian were collected in the 1980 census. According to that data, there were 866 persons on the island with about 82% of the population located in the Village of San Jose. The median age of the population in 1980 was 17.8 years. [Ref. 11] As a comparison, in 1980, the median age for Hawaii was 28.3 years.

The latest population estimate for Tinian is 1,025 persons (1987). There are no military personnel stationed on Tinian. [Ref. 12]

3.1.10 Land Use, Plans, Policies, and Controls

Outside of the military lease area, the Municipality of Tinian has the full responsibility for planning, as well as developing all facilities and services for the Tinian civilian community. A proposed land use plan for public lands on Tinian was included in the Physical Development Master Plan for the Commonwealth of the Northern Mariana Islands prepared for the Office of Transition Studies and Planning in 1978. The purpose of the land use plan was to provide a framework for the management of change and future growth. [Ref. 13]

In addition, CNMI has developed a Coastal Resources Management Plan (CRMP) to address protection of its natural resources and establish procedures to enforce the provisions of the Plan. Accordingly, CNMI has established a "two-tier" approach for protection of its natural resources. Within the first-tier, all activities are subject to regulation under CRMP. The second tier boundary includes all other lands wherein only certain major uses or activities would be subject to the CRMP. CNMI has excluded from its coastal management area "all lands which are under the sole jurisdiction of or are held in trust by the Federal Government, its officers or agents". [Ref. 14] Rules adopted by the Coastal Resources Management Office provide that:

Federal activities and development projects which directly affect the coastal zone must be conducted or supported in a manner which is, to the maximum extent practicable, consistent with the CRM Program. Federally licensed or permitted activities and the provisions for federal financial assistance for activities affecting land or water uses of the coastal zone must be consistent with the CRM Program. Furthermore, any federal agency

proposing to undertake any development project in the coastal zone shall insure that the project is, to the maximum extent practicable, consistent with the CRM Program. The implementation of these Federal consistency provisions will be carried out in accordance with Section 307 of the CZMA and Federal Regulations at 15 CFR, Part 930 [Ref. 15]

Locally, land use on the island is primarily controlled by the municipality by "common sense" rules and the Physical Development Plan and CRMP. Although there have been previous attempts to establish zoning codes applicable for CNMI, at this time, Tinian has not adopted a zoning code for the island. [Ref. 12]

The Covenant to establish the CNMI and its companion Technical Agreement also required that 6,458 acres within the 17,798-acre military lease area on Tinian be leased back to the CNMI for other uses, provided certain restrictions were met. An additional 6,800 acres (approximately) was added to the leaseback area during negotiation of the military lease in the early 1980's.

The Technical Agreement also provided that 38 parcels of land within the military lease area be leased back to the original private owners. CNMI has acquired title to all of these parcels through purchase, land exchange or condemnation. However, the right of CNMI to use its power of condemnation for this purpose was challenged in court and the matter remains unresolved and on appeal. Because of this appeal, CNMI has not been able to fulfill its obligation under the 1983 military lease agreement to provide the U.S. with a title opinion stating it owns the former privately owned 38 parcels. Figure 3.1.1 shows the various leaseback areas.

The Covenant and Technical Agreement provide the basic terms to be covered in all leaseback agreements. However, the CNMI and the U.S. are currently negotiating to reach the exact terms of the leaseback agreement for Tinian.

In September 1987, a Civilian Military Advisory Council was established to try to resolve the lease back issue. The Council was composed of the CNMI Governor, the Mayor of Tinian, representatives from the CNMI Attorney General's office and Municipality of Tinian Council, and military representatives from the Commander Naval Forces Marianas (COMNAVMAR).

After a series of meetings of the Civilian Military Advisory Council, the U.S. has proposed to lease back to CNMI for an initial ten year period approximately 12,500 acres of the approximately 18,000 acres in the military lease area. Under the provisions of the latest lease back proposal dated January 1989, the U.S. would retain the North Field area (about 4,000 acres) for exclusive use and the remainder of the military lease area would be leased back to CNMI for agricultural and grazing uses. The U.S. also proposes to retain a 1,500-acre area south of North Field for military purposes. (See Figure 3.1.2)

This area is subject to continuing discussions between the CNMI and the U.S. Under the Covenant the U.S. retains the right to terminate the lease

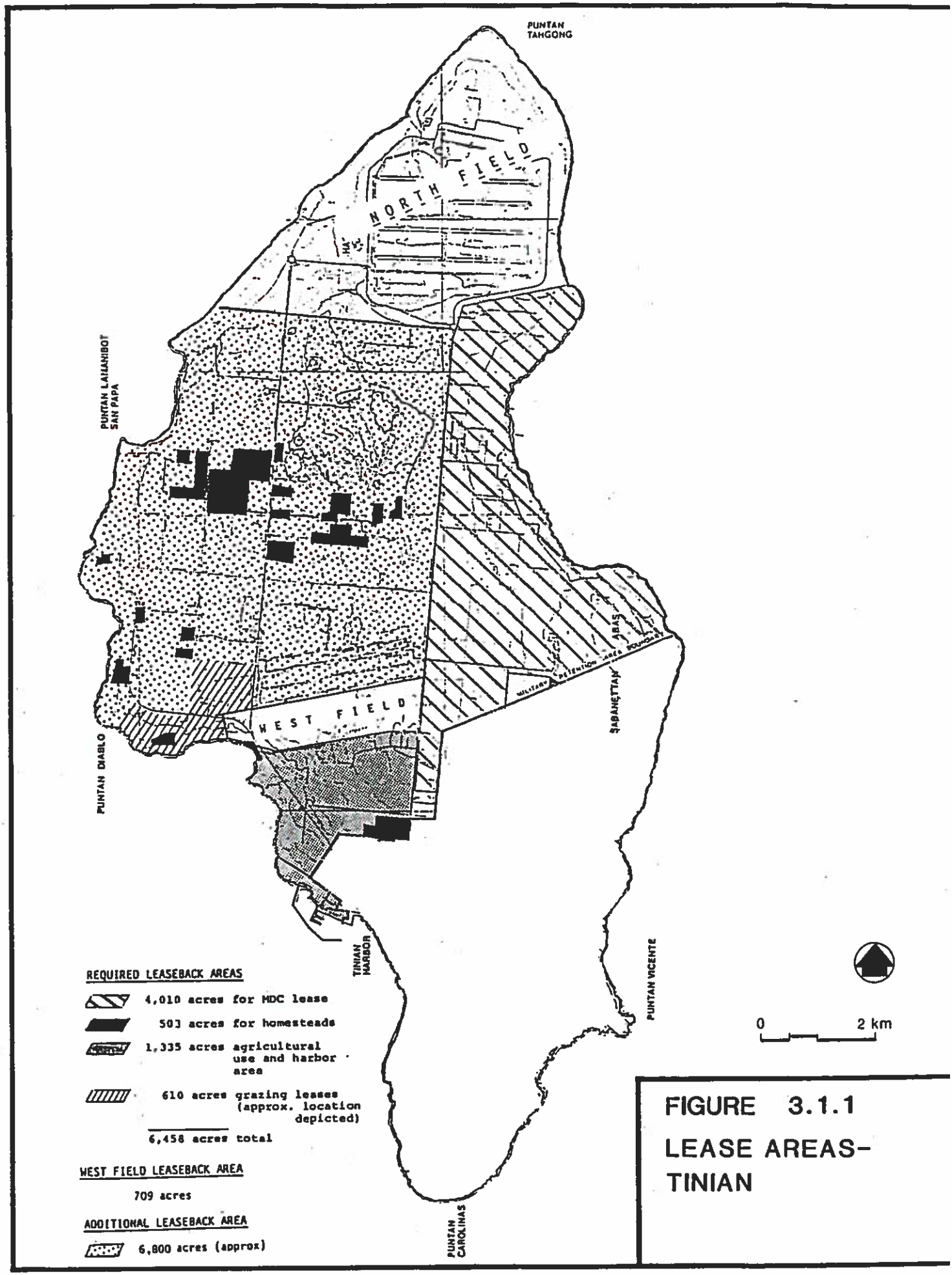


FIGURE 3.1.1
LEASE AREAS-
TINIAN

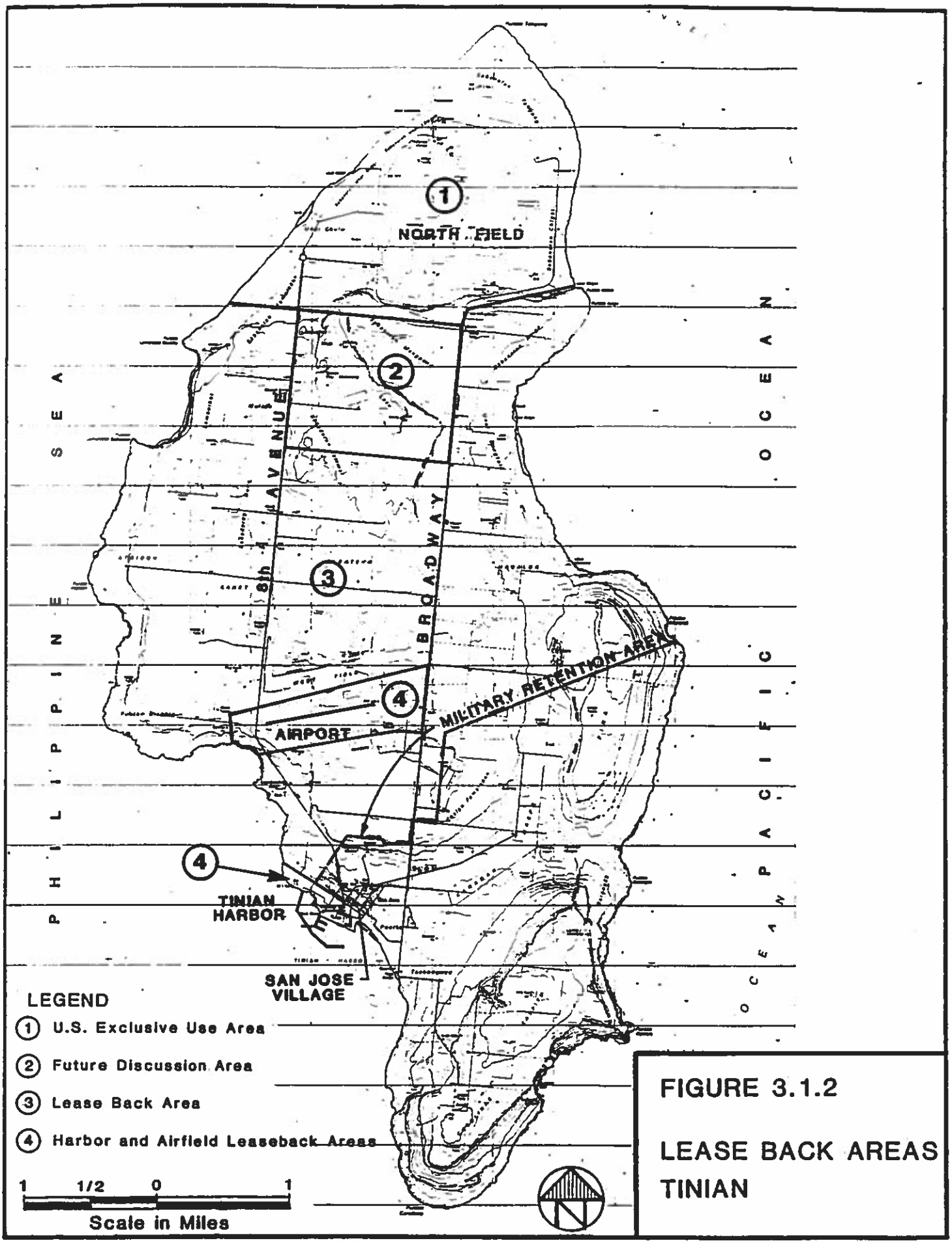


FIGURE 3.1.2

LEASE BACK AREAS
TINIAN

back on a one year notice.

The military lease also established that shoreline areas in and around the military lease area will remain open to fishermen at all possible times. However, the shoreline areas may be closed to comply with safety, security and hazardous risk during military exercises. [Ref. 6] The ROTHR transmitters will not require the closure of shoreline areas.

3.1.11 Infrastructure

The Municipality of Tinian provides electricity and telephone services, potable water, medical care, police and fire protection, and the school system. Electricity is currently supplied by three electrical generators. Two new generators have been installed and began operating on 1 July 1988. Currently, Tinian has three 1,000 KW generators, or a generating capacity of 3,000 KW. Peak demand on Tinian is currently between about 1,400 KW to 1,600 KW. The system operates with no unplanned outages. [Ref. 12 and 18]

The underground cable telephone system is capable of supplying the populated portion of the island with telephone service. A microwave system connects Tinian with Saipan, Rota and Guam. [Ref. 12]

All potable water on Tinian is supplied by ground water wells. Two tanks, a 500,000 gallon tank and a new 250,000 gallon tank, provide water storage. A three-phase $1.1 million project would replace most of the water distribution pipes within the village of San Jose. The water sources, storage and distribution are sufficient to meet current and future needs. Water quality on Tinian is good. [Ref. 12]

The Tinian Health Center opened in October 1985, and includes acute care facilities, maternity care, laboratories, X-Ray and emergency care. It is designed for short-term care. Complex cases or those requiring long-term care are sent to Saipan. The facilities are sufficient for current and future needs. [Ref. 12]

Police and fire protection are provided on a 24-hour basis by the Municipality of Tinian. One of the two fire trucks is always stationed at the airport. Police and fire protection services and equipment are adequate for current and future needs. [Ref. 12]

The school system on Tinian accommodates Grades 1 through 11. Grade 12 is held on Saipan. Two more classrooms and a cafetorium have been added to the school. With this construction, the school can accommodate additional students without further expansion. [Ref. 12 and 18]

3.1.12 Economic Characteristics

Agriculture and government services provide the primary economic base for Tinian. The agriculture base includes cattle and pig raising and crop production, mostly melons and, within the military lease area, sorghum. The government sector provides about 60 percent of the total employment on Tinian. The major government functions are public works, medical care,

police and fire protection, natural resource, and administration. Although increasing in importance, tourism is currently only a small part of the economic base of Tinian. [Ref. 12]

3.1.13 Aeronautical Activities

4.1.13.1 Saipan International Airport. Saipan International Airport is a commercial airfield with a single 8,700-foot long by 200-foot wide runway, (Runway 7/25), which accommodates commercial air carrier, air taxi, general aviation and military aircraft operations. The airport is owned and operated by the CNMI Commonwealth Ports Authority. The airport conducted approximately 15,600 aircraft operations during the 12-month period ended July 1987, according to the latest available data. Almost all the operations, 95 percent, were either air taxi (69 percent of the total operations) or air carrier (26 percent). [Ref. 19] Japan Airlines (JAL), Continental Air Micronesia, All Nippon Airways and Northwest Airlines, the major commercial air carriers provide service with 747, DC-10 and 727 series aircraft. Freedom Air currently provides air taxi service with Twin Otter and single engine aircraft. Guam Mariana Airline recently started scheduled commuter flights from Guam to Saipan. [Ref. 20]

Runway 7 is a precision instrument runway with navigational aids which include a Non-directional Beacon (NDB), Visual Approach Slope Indicator (VASI) and a complete Instrument Landing System (ILS), with approach lights, glide slope indicator, runway centerline guidance and Distance Measuring Equipment (DME). Runway 25 is equipped with DME and an NDB. [Ref. 21] The airport is not equipped with a control tower.

3.1.13.2 West Tinian Field. West Tinian Field is located within the military lease area. The runway and certain areas are leased to CNMI by the Federal Government under a joint use agreement similar to the one which governs the use of NAS Agana on Guam. CNMI retains exclusive use of the terminal facilities.

West Tinian Field has a single 5,986 LF long by 150 LF wide runway (Runway 8/26), which accommodates primarily air taxi operations. During the 12-month period that ended 27 July 87, approximately 6,850 air taxi operations were conducted at West Tinian Field. The airport is not equipped with navigational aids or with a tower. [Ref. 22]

Freedom Air currently provides air taxi service to West Field from Saipan on a schedule of 12 times per day with single engine aircraft.

3.1.14 Archaeological/Historical Resources

The earliest initial settlements in the Northern Mariana islands are thought to date to no earlier than about 1600 BC. Several areas of Tinian are date to the Latte phase which extended from about AD 800 to 1668. Remnants of the this period of Tinian's history can still be found on the island. This period was followed by a Spanish/missionary period (1668 to 1899), the German period (1899 to 1914), and the Japanese period from 1914 to 1944. The latest phase from 1944 includes the period of major

U.S. activities on the island.

The major archaeological features of the island include a number of Latte stone sites which are found in isolated locations. The North Field National Historic Landmark comprises a large portion of the northern end of the island.

3.2 RECEIVER LOCATIONS (GUAM)

3.2.1 Introduction

Guam is the southernmost and largest of the Mariana Islands. (Figure 2.5) It lies approximately 1,200 miles east of the Philippines and 3,700 miles west of Hawaii. Guam is approximately 30 miles long and tapers in width from 8.5 miles in the north to four miles at the central waist, and widens to 11.5 miles in the south. Guam's land area, exclusive of coral reefs, is 212 square miles. Twelve small uninhabited limestone islands are located along its reef.

Guam is an Unincorporated Territory of the United States acquired from Spain in 1898. The population in July 1985 was estimated to be 118,300 persons, including non-immigrant aliens and members of the U.S. Armed Forces and their dependents. The island is self-governed, and Guamanians are U.S. citizens.

The U.S. Government controls approximately 44,500 acres on Guam, about one-third of the Territory's area. Approximately 96% of the Federal land is under the jurisdiction of the Department of Defense. The U.S. Navy and the U.S. Air Force each control one-half of this land, with a portion managed by the U.S. Department of the Interior. [Ref. 23]

3.2.2 Physiography and Topography

Guam exhibits three major physiographic features, the northern plateau, the central mountains, and the southern mountains. These areas are fairly distinct and provide the island with a unique character.

3.2.3 Soil Characteristics

Soils on Guam are also divided into three broad categories which reflect the geological and physiographic characteristics. The major soil areas include upland soils on limestone rocks, upland soils on volcanic rocks, and coastal and valley soils.

3.2.4 Geologic Characteristics

Guam is located in an active seismic zone. Physical evidence of previous earth movements is displayed on Guam's surface in many physical structures, such as folds and fault lines. A major fault is located in the northern portion and extends offshore.

3.2.5 Meteorology

Guam has a warm tropical climate with two seasons, a five month wet period from July to November with an average monthly rainfall of 11 inches, and a seven month dry period from December to June with an average rainfall of four inches per month. [Ref. 27] The average rainfall in northern Guam is 94 inches per year.

Normal winds are easterly trades of less than 12 knots. During late summer, winds tend to be more variable.

Typhoons are fairly common in Guam with an expected incidence of one to two storms every year, mainly during the August to November period. Every three to four years, a major typhoon can be expected to cause severe damage to the island. In 1976, Typhoon Pamela struck Guam directly, with winds gusting up to 160 miles per hour. [Ref. 27]

3.2.6 Hydrology

The Guam Environmental Protection Agency (GEPA) has classified all marine surface and underground waters on Guam in order to implement water quality and erosion control standards. In 1982, the GEPA published the Guam Northern Lens Study (GNLS) which examined ground water resources in Northern Guam. The GNLS indicates the northern sites are located over a basal ground water aquifer. Results of the surveys taken during the GNLS indicate the ground water of northern Guam to be of excellent quality, unusually free of pollutants. [Ref. 28]

3.2.7 Fauna

Based on much of the research conducted to date, the northern area of Guam appears to be part of the habitat for the remaining bird population of the island. Numerous surveys have been conducted in the northern portion of the island, including a number on Northwest Field and, on NAVCAMS WESTPAC properties. These surveys have reported a number of species which are Federal and GOVGUAM listed as endangered or threatened.

The decline of forest birds and the Mariana Fruit Bat have caused the GOVGUAM Division of Aquatic and Wildlife Resources in cooperation with the U.S. Fish and Wildlife Service to prepare recovery plans for these species. The primary purpose of these recovery plans is to restore Guam's population of these species. Although the plans have not been finalized by the U.S. Fish and Wildlife Service, a key part of these proposed plans is the designation of areas as "essential habitat" for these species. Proposed plans for the forest birds and fruit bat have designated portions of northern Guam, including the northern sites, as essential habitat for the recovery of these species. Essential habitat is a designation used in the recovery plans to designate important habitat areas and to show areas where habitat should be preserved for reintroduction of endangered forest birds and bats. Essential habitat is not defined in the Endangered Species Act and not afforded the Federal protection established for critical habitat. (See Appendix E) Figure 3.2.1 shows the forest birds and bats proposed essential habitat.

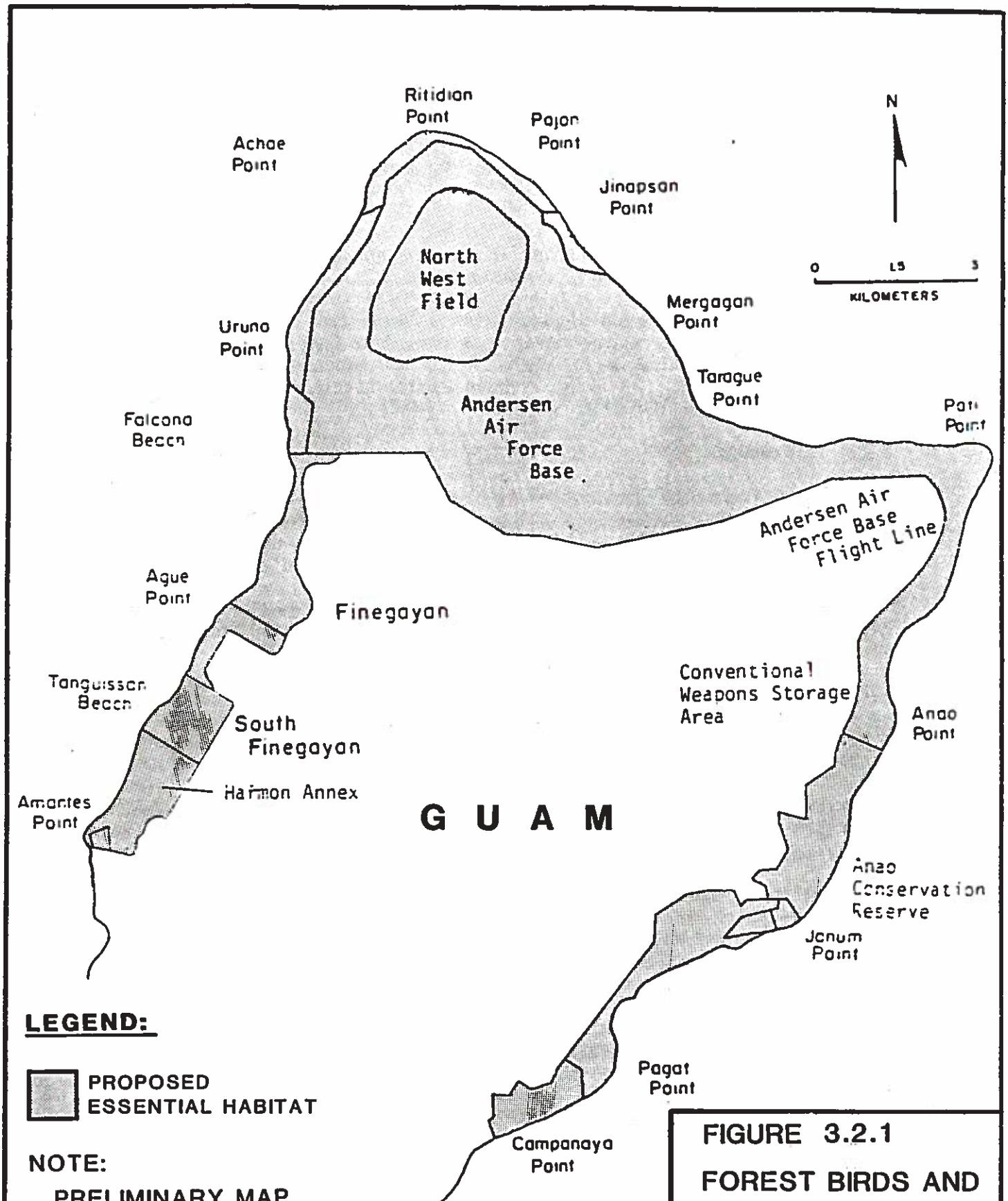


FIGURE 3.2.1

FOREST BIRDS AND BATS PROPOSED ESSENTIAL HABITAT

In December 1987, the Sierra Club Legal Defense Fund, representing the National and Marianas Audubon Societies, petitioned the USFWS to designate, on an emergency basis, critical habitat on Guam.

In March 1988, the Governor of Guam similarly requested the Secretary of the Interior to commence emergency critical habitat designation procedures as a result of the Navy's reported plans to construct up to three radar receiver installations on Guam. The Governor advised Interior that a total area of 1,600 acres of land would be adversely affected by one project (Project P-223). U.S. Navy projections indicated that for all three projects, if installed on their initial prospective sites, a maximum of 500 acres of assorted vegetation would be affected on Guam. Present (1990) calculations indicate that if Project P-223 is located on the preferred Runway site, no more than 110 acres of secondary forest would be removed while a total of 1,670 acres around the receiver would need to be access-restricted and free of most human structural interference. In that way, an area of 1,670 acres would be required to be preserved in its naturally vegetated state.

On July 1988, the Secretary of Interior replied to the Governor of Guam that the emergency rule-making process would not be used for considering critical habitat designation as the species' habitat was protected through the provisions of Section 7 of the Endangered Species Act and "the current plight of Guam's endangered species is largely the result of predation by the Brown Tree Snake, not loss of habitat, ..." The Secretary concluded that an emergency situation did not appear to exist. [Ref. 29]

Subsequently, on February 27, 1989 the USFWS responded to the original petition by the Governor of Guam to designate critical habitat for seven species on Guam, five species of birds, the Mariana fruit bat and the Little Mariana fruit bat. The USFWS agreed with the merits of the petition that a critical habitat designation may be beneficial for six of species (all except the Guam rail). The USFWS indicated that such designation would protect important habitat necessary to support the recovery of these six species. [Ref. 30]

As of this writing, the USFWS intends to issue a proposed rule to designate portions of northern Guam and selected areas in southern Guam as critical habitat for the six species of native forest birds and fruit bat. Although not certain at this time, most of the area currently proposed as essential habitat in the forest bird recovery plan (See Figure 3.2.1) may be included in the designated critical habitat. [Ref. 33]

3.2.8 Flora

A significant proportion of the vegetation of Guam has been affected by human disturbance. The northern plateau is covered by a mixed forest of vegetation, most of which has been subjected to some disturbance. In the southern half of the island, there are extensive areas of grasslands.

3.2.9 Population

In July 1985, the population of Guam was estimated to be 118,300 persons,

including nonimmigrant aliens and members of the U.S. Armed Forces and their dependents. [Ref. 36] The latest detailed data on members of the U.S. Armed Forces is for July 1984 when about 23,200 military personnel were on Guam. (See Table 3.2.1)

TABLE 3.2.1
Summary of Military Population
(July 1984)

Category	Active Duty	Dependents
Navy	6,670	6,036
Air Force	3,995	5,563
Army	38	69
Marines	413	160
Coast Guard	130	90
TOTAL	11,246	11,918

Source: Ref. 38

3.2.10 Land Use Plans, Policies, and Controls.

Since there is no municipal government in the Territory, land use outside military installations is under the control of the Government of Guam (GOVGUAM). This control is exercised through the Comprehensive Development Plan (CDP). In addition, Guam has adopted a Guam Coastal Management Plan (GCMP) which designates the entire island as a "coastal zone", as defined by the Coastal Zone Management (CZM) Act (16 U.S.C. 1451-1464) of 1972. Thus, all of the Territory's land and sea areas and land use related planning and regulatory agencies, programs, and laws fall within the concern of the GCMP. The issuance of Executive Order 78-37 on November 15, 1978 by the Governor of Guam permitted the 18 GCMP policies to take legal effect and directed the appropriate agencies to implement them. [Ref. 37]

Section 304(1) of the CZM Act excludes from the coastal zone:

> "Lands the use of which is by law subject solely to the discretion of or which is held in trust by the Federal Government, its officers or agents."

While these Federal lands are geographically excluded from jurisdiction of the Coastal Management Program, this exclusion:

> "Does not remove Federal agencies from the obligation of complying with the consistency provisions for Section 307 of the Act when Federal actions on these excluded lands have spillover impacts that significantly affect coastal zone areas, uses, or resources within the preview of a State's management program." (Section 923.33(c).) Further, "in excluding Federal Lands ... a State does not impair in any way any of its rights or authorities over Federal lands that

exist separate from this program." (Section 923.33(c)(2).)

Section 307(c)(1) of the CZM Act requires that:

> "Each Federal Agency conducting or supporting activities directly affecting the Coastal Zone shall conduct or support those activities in a manner which is, to the maximum extent practicable, consistent with approved State management programs." [Ref. 37]

The Bureau of Planning, in the Office of the Governor, is the lead agency to determine consistency of Federal activities with the GCMP. While federal lands are excluded from the coastal zone, activities on Federal lands that directly affect GOVGUAM or private properties must be consistent to the maximum extent practicable with the GCMP. [Ref. 37] The Bureau of Planning had developed a Procedures Guide for Achieving Federal Consistency with the Guam Coastal Management Program to aid Federal agencies in compliance with the GCMP. [Ref. 39]

In addition to the land use plans set forth by GOVGUAM Bureau of Planning, as previously discussed, the U.S. Fish and Wildlife Service has prepared an Endangered Forest Bird Recovery Plan for Guam, and a Recovery Plan for the Mariana Fruit Bat and Little Mariana Fruit Bat on Guam. These Recovery Plans address a number of issues related to recovery of species and preservation of "essential habitat" which could be utilized for eventual reestablishment of the endangered bird species and bats.

3.2.11 Radio Frequency Interference (RFI)

RFI-free zones around receiving antennas are normally desirable to prevent interference with the receiving capabilities of the antennas. Generally, land uses should be controlled within a one mile radius of the antenna to prevent development of an incompatible use which would interfere with operation of the antenna. Ownership of the land or restrictive easements are normally used to control land uses within the one mile radius. Land use control extending to a two mile radius is recommended for certain sensitive antennas, such as a Circularly Disposed Antenna Array (CDAA). [Ref. 24]

3.2.12 Explosive Safety

Storage facilities for explosives and ordnance have a designated safety radius, or Explosive Safety Quantity Distance (ESQD), based upon the Net Explosive Weight (NEW) handled in the facility. The types of buildings and structures, and activities within the ESQD arc are limited. [Ref. 45]

3.2.13 Aesthetic Considerations

The northern plateau of Guam limits visibility to short distances because of the lack of viewing points. The southern mountains of island provide a number of view sheds wherein large areas can be seen from one location.

3.2.14 Archaeological/Historic Resources

The prehistory and history of Guam is divisible into the following time units:

- o Prehistoric period: 1500 BC to 900 AD;
- o Latte period: 900 to 1521;
- o Spanish period: 1521 to 1898;
- o First American period: 1898 to 1941;
- o Japanese occupation: 1941 to 1944;
- o Second American period: 1944 to present.

Many of the archaeological and historic features of Guam are set forth in the Guam Historic Preservation Plan Map. See Appendix G.

4.0 ENVIRONMENTAL CONSEQUENCES

4.1 TRANSMITTER SITES (TINIAN)

4.1.1 Introduction

This section describes the environmental consequences of constructing and operating the ROTHR program transmitters. The effects are organized according to the information presented in Section 3.1. Only the impacts of the ROTHR program are discussed in this section. No site specific direct effects are discussed.

4.1.2 Physiography and Topography

Construction of the transmitters would require the project sites be cleared of vegetation and leveled to meet the levelness criteria. The clearing would alter the topographic characteristics of the selected sites.

4.1.3 Soils Characteristics

Impacts to soil characteristics would depend upon the sites selected for the receivers.

4.1.4 Geologic Characteristics

The base of the antenna towers and the guy wire anchorage systems will require excavations below the existing ground during construction activities. The excavations will not alter the geologic conditions of the project sites.

Tinian is located in a region of seismic instability. Thus, the antennas will be subject to hazards from earthquakes. In the event of a severe earthquake and antenna failures, they would buckle at the point of failure. This design will confine any hazard from a severe earthquake to the project sites.

4.1.5 Meteorology

Due to the relatively small area of Tinian, the impacts to air quality would be similar for any project site regardless of location.

Clearing and grading the project sites could create dust and temporarily impact air quality, if conducted during the three month dry season, from February through April. Water spraying of the area being cleared will mitigate adverse impacts from dust. Emissions from operation of gasoline and diesel-fueled heavy equipment would also temporarily impact air quality. These adverse effects would last only during the operation of mechanical equipment. Any pollutants and particles to be emitted will be dispersed by winds on the island.

Once construction is complete, impacts on air quality would occur from operation of the power plant and vapor from losses associated with the three 200,000 gallon fuel storage tanks. Currently, three 1,200 KW generators are being planned for installation under Project P-223. One additional 1,200 KW generator will be installed for Project P-225 and one additional 1,200 KW generator for Project P-002. Only three will be used to generate the necessary power for operation of the installations and support facilities. The remaining two will be used as an online spare and an offline maintenance spare.

These generators would be housed in power plants and were assumed to operate at different load factor capacities to determine air quality impacts. The Defense Fuel Supply Center is conducting a marketing survey to determine contract fuel support for the fuel requirements for the transmitters. No additional fueling facilities are contemplated as part of any of the projects. For analysis purposes, the power plant was assumed to be located with the northern sites. The alternative project sites would be supported from a single power plant facility.

The U.S. Environmental Protection Agency (EPA) has published emission factors for stationary point sources of emissions such as engines used for generators. [Ref. 47] Based on the published EPA emission factors, the Nitrogen Oxides (NO_x) emission factor for the Waukesha generators [Note, the Waukesha generator is used as an example of the type of large bore diesel generator which might be used for power generation in Tinian.], and the demand power requirements for each system and support facilities, pollutant emissions from the power plant can be estimated. Analysis indicates the annual uncontrolled pollutant emissions from operation of the generators installed to operate each ROTHR system would be as shown below:

Uncontrolled Pollutant Emissions
Project P-223

	Tons/Year*
Particulates	16.5
Nitrogen Oxides (NO_x)**	180.6
Carbon Monoxide (CO)	43.6
Volatile Organic Compound (VOC)	4.9
Methane (0.5)	
Non-Methane (4.4)	
Sulfur Dioxide (SO_2)	19.6

* Based on: Operation of one 1,200 KW generator at .9722 load factor.

** Measured as NO_2

Uncontrolled Pollutant Emissions
Project P-225

		Tons/Year*
Particulates		12.2
Nitrogen Oxides (NO_x)**		133.3
Carbon Monoxide (CO)		32.2
Volatile Organic Compound (VOC)		3.5
Methane	(0.3)	
Non-Methane	(3.2)	
Sulfur Dioxide (SO_x)		14.4

* Based on: Operation of one 1,200 KW generator at .7175 load factor.
** Measured as NO_2

Uncontrolled Pollutant Emissions
Project P-002

		Tons/Year*
Particulates		12.2
Nitrogen Oxides (NO_x)**		133.3
Carbon Monoxide (CO)		32.2
Volatile Organic Compound (VOC)		3.5
Methane	(0.3)	
Non-Methane	(3.2)	
Sulfur Dioxide (SO_x)		14.4

* Based on: Operation of one 1,200 KW generator at .7175 load factor.
** Measured as NO_2

Uncontrolled Pollutant Emissions
Project P-223; P-225; P-002 (Summary)

		Tons/Year*
Particulates		41.0
Nitrogen Oxides (NO_x)**		447.1
Carbon Monoxide (CO)		108.0
Volatile Organic Compound (VOC)		11.9
Methane	(1.1)	
Non-Methane	(10.8)	
Sulfur Dioxide (SO_x)		48.4

* Based on: Operation of three 1,200 KW generators at .8025 combined load factor.
** Measured as NO_2

This analysis shows the primary pollutant of concern from the diesel engine generators is NO_x, which readily forms in the high temperature, pressure, and excess air environment found in these engines. Lesser amounts of carbon monoxide and hydrocarbons are also emitted. Sulfur dioxide emissions will usually be quite low because of the negligible sulfur content of diesel fuels. [Ref. 47].

The major variables affecting NO_x emissions from diesel engines are injection timing, manifold air temperature, engine speed, engine load and ambient humidity. In general, NO_x emissions decrease with increasing humidity. [Ref. 47]

Because NO_x is the primary pollutant from diesel fuel engines, control measures to date have been directed mainly at limiting NO_x emissions. The most effective NO_x control technique for diesel engines is fuel injection retard, achieving reductions (at eight degrees of retard) of up to 40 percent. Additional NO_x reductions are possible with combined retard and air/fuel ratio change. [Ref. 47]. The controlled pollutant emissions to operate each ROTHR System are shown below:

Controlled Pollutant Emissions Project P-223		Tons/Year*
Particulates		16.6
Nitrogen Oxides (NO_x)**		108.3
Carbon Monoxide (CO)		43.6
Volatile Organic Compound (VOC)		4.9
Methane	(0.5)	
Non-Methane	(4.4)	
Sulfur Dioxide (SO_2)		19.6

* Based on: Operation of one 1,200 KW generator at .9722 load factor.
** Measured as NO_2

Controlled Pollutant Emissions Project P-225		Tons/Year*
Particulates		12.2
Nitrogen Oxides (NO_x)**		80.0
Carbon Monoxide (CO)		32.2
Volatile Organic Compound (VOC)		3.5
Methane	(0.3)	
Non-Methane	(3.2)	
Sulfur Dioxide (SO_2)		14.4

* Based on: Operation of one 1,200 KW generator at .7175 load factor.
** Measured as NO_2

Controlled Pollutant Emissions Project P-002		Tons/Year*
Particulates		12.2
Nitrogen Oxides (NO_x)**		80.0
Carbon Monoxide (CO)		32.2
Volatile Organic Compound (VOC)		3.5
Methane	(0.3)	
Non-Methane	(3.2)	
Sulfur Dioxide (SO_2)		14.4

* Based on: Operation of one 1,200 KW generator at .7175 load factor.
** Measured as NO_2

Controlled Pollutant Emissions Project P-223; P-225; P-002 (Summary)		Tons/Year*
Particulates		41.0
Nitrogen Oxides (NO_x)**		268.3
Carbon Monoxide (CO)		108.0
Volatile Organic Compound (VOC)		11.9
Methane	(1.1)	
Non-Methane	(10.8)	
Sulfur Dioxide (SO_2)		48.4

* Based on: Operation of three 1,200 KW generators at .8025 combined load factor.
** Measured as NO_2

Other NO_x control techniques exist but are not considered feasible because of excessive fuel penalties, capital cost, or maintenance or operational problems. These techniques include exhaust gas recirculation (EGR), combustion chamber modification, water injection and catalytic reduction. [Ref. 47]

On April 17, 1986, the Director of the Department of Public Health and Environmental Services of the Commonwealth of the Northern Mariana Islands proposed amendments to the Air Pollution Control Regulations. On December 15, 1986, these regulations were adopted. In general, the CNMI Air Pollution Control Regulations use definitions set forth in the Clean Air Act (CAA) of 1977. Both the Regulations and CAA define a "major stationary source": as any stationary source which emits, or has the potential to emit, 250 tons per year or more of any air pollutant regulated under the CAA. Further, the Regulations and CAA define "potential to emit": as the capability at maximum design capacity to emit a pollutant after the application of air pollution control equipment. Annual potential shall be based on the maximum annual rated capacity of the stationary source assuming continuous year-round operation. [Ref. 48]

Based on these definitions and the calculated controlled pollutant emissions, the power plants for Projects P-223 and P-225 would not be

considered a major stationary source. However, the addition of the pollutant emissions from Project P-002 to Projects P-223 and P-225 would cause the power plant to be considered a major stationary source. Notwithstanding this definition, the design criteria will require that the power plant configuration will be designed and to operate below the emissions set forth above. In addition, there are no sensitive receptors near the proposed power plant site and that prevailing tradewind conditions would blow the emissions out to sea.

The CNMI Regulations require that a Permit to Operate and Construct be obtained for all new sources or modifications of major sources of emissions. Within 45 days after receipt of a complete application by the Chief of the Division of Environmental Quality, Department of Public Health and Environmental Services, a final determination will be made on the application. The public must be afforded an adequate opportunity to comment prior to the application being deemed complete. [Ref. 48]

The Chief of the Division of Environmental Quality shall approve an application for a Permit to Construct and Operate.

A Permit to Construct and Operate shall be issued for any term not to exceed five years, if the Chief determines that such will be in the public interest. The Chief, on application, may renew a permit for additional terms each not to exceed five years. [Ref. 48]

The power plant will satisfy the above requirements before the operating permit is issued. It will operate under the allowable emissions set forth by the Chief of the Division of Environmental Quality.

Air emissions from fixed roof fuel tanks occur under two conditions, breathing loss and working loss. Breathing loss is the expulsion of vapor from a tank through vapor expansion and contraction, which result from changes in temperature and barometric pressure. Working loss is a result of filling and emptying the tank. [Ref. 47]

The EPA has also published factors to estimate these emissions from fuel tanks. Based on these factors and the estimated fuel usage, the annual volatile organic compound (VOC) emissions from breathing losses and working losses for the three tanks would be about 28.1 tons per year. The tanks would not be considered a major stationary source.

Construction and operation of the installations and support facilities will not alter the meteorology of the project sites or region.

The antenna array will be subject to typhoons. The antennas will have a wind design of 140 knots. The design of the antennas will confine adverse impacts from antenna failures to the project site.

4.1.6 Solid and Hazardous Waste

Regardless of the site, an incinerator on Tinian will be used to dispose of solid and non-hazardous waste from the installations and support facilities. Based on a staff of 92 persons to operate all three projects

and U.S. Navy design criteria, an average of 902 pounds/day of solid waste will be generated.

None of the transmitters and ancillary equipment used at any project site will contain any hazardous substances. Thus, the environmental resources of the sites and other nearby areas will not be affected by hazardous substances.

Other waste material on the sites, such as used oil and other industrial products would be disposed according to established Navy procedures. Hazardous waste or excess hazardous materials will be collected, properly packaged, marked, labeled, for shipment to the Defense Reutilization and Marketing Office, Guam for disposal by contract. The U.S. Navy Public Works Center will assist generators with packaging, laboratory analyses, and disposal to comply with applicable regulations governing hazardous wastes.

4.1.7 Noise

Clearing and grading the project sites and constructing the antenna array and support facilities will be done by a contractor. Noise in the area will increase during this period. Operation of the installations and the power plant will create long-term impacts in an area currently not subjected to this type of noise. However, since all of the project sites are located within the military lease area and away from existing residential areas or public uses, these impacts will not be a public nuisance.

The generators, cooling radiator fans, and exhaust systems will be the primary sources of noise. As previously discussed, three 1,200 KW generators are being planned for installation under project P-223, one additional 1,200 KW generator for Project P-225 and one additional 1,200 KW generator for Project P-002. Only three of generators will be used to generate the necessary power for operation of three transmitters and support facilities. The generators will be housed within the power plant building, which will not be acoustically treated. Based on these factors, the three generators would produce a sound level of 63 dBA at 2,000 FT (the approximate distance between the power plant building and the quarters, dining, and recreation building) from the power plant building. This noise level is similar to a urban/commercial area.

4.1.8 Hydrology

Construction and operation of the transmitters and support facilities will not affect percolation of rainfall, as there will only be a minor increase in impervious surfaces over existing site conditions.

4.1.9 Fauna

Construction of the antenna array and ground screen will remove all vegetation from the project site. Removal of vegetation will result in loss of wildlife habitat and ultimately the loss of the fauna dependent

on the habitat. However, replacement of grassy areas will provide some measure of habitat for migratory shorebirds.

The Tinian Monarch, a Federally listed threatened species, is known to exist on the island. The 1984 survey of the military lease area of Tinian showed most species of birds, including the Tinian Monarch, to be widespread on the island. Thus, although resident birds will be lost from the area to be cleared, the species present on the site, including the Tinian Monarch, are found in great enough densities elsewhere on the island that the loss will not significantly impact the island wide populations.

The Island swiftlet, a Federally listed endangered species, was not observed in the 1984 survey of the military lease area. Although this species was reported in southern Saipan in 1987, it has not been seen on Tinian since 1976. Based on the lack of sitings, these species may not be moving between Tinian and Saipan. Until the species are detected on Tinian and their habitat identified, the effect of removal of habitat on the Island swiftlet cannot be assessed.

The Common moorhen, a Federally listed endangered species, was not observed during the 1984 survey of the military lease area [Ref. 7]. Since the Common moorhen is an aquatic species, it would not be expected on the sites which do not contain a freshwater wetland or other surface water body. The Common moorhen is believed to exist in the wetland areas of Lake Hagoi located immediately west of the North Field runways. Removal vegetation on non-wetland areas should not have a significant adverse effects on the Common moorhen.

The presence of endangered species on Tinian will require that the U.S. Navy initiate consultation with the USFWS as required by Section 7 of the Endangered Species Act. The USFWS must issue a biological opinion based upon their analysis the proposed program.

In addition to potential affects from habitat removal, concern has been expressed for bird strikes or collisions with the transmitter antenna towers. This concern with bird strikes and collisions would be especially true for birds which may migrate between Tinian and Saipan, or those species generally in the northern area of Tinian.

A number of studies have been conducted into the problem of bird strikes and collisions with electrical transmission line towers and other types of towers. These studies have identified the world-wide nature of the problem as the use of electrical transmission lines and other types of towers have spread to a large number of areas which previously did not have these structures. Assessing mortality and injury from bird strikes and collisions is complicated because all dead and injured birds may not be found. Predators may remove birds before they can be counted and identified, injured birds may land in nearby areas and not be found, and the birds may not be visible to the researchers. [Ref. 49, 50, 51 and 52]

Despite this limitation, the studies have identified a number of conditions under which bird strike and collisions can occur. These

include: 1) number of birds present; 2) visibility; 3) species composition or behavior of birds; 4) disturbance; and 5) familiarity of birds with the area. The worst cases of mortality appear to occur during periods when visibility is obscured by low cloud ceiling, heavy fog, or rain and high winds. Under most conditions, studies show that birds seem to be able to avoid any wire they see, and that most birds have good vision. [Ref. 52] Disturbance also seems to be an important factor. High mortality appears to occur when large numbers of birds are surprised in conditions of poor visibility. Hunters and predators may surprise a flock of birds causing them to fly into objects which they could otherwise avoid. Conditions such as a large numbers of birds feeding in a small area, under foggy conditions, and disturbance by hunters have contributed to mortality in certain areas. [Ref. 52]

Bird familiarity with an area is difficult to determine. The height at which birds fly may, under certain conditions, be high enough to provide safe passage through a hazardous area. However, under conditions of low visibility and disturbance, the same birds may fly at lower heights thereby striking objects. [Ref. 52]

The available data on the Common moorhen can be compared to this research on bird strikes and collisions to determine possible significant adverse impacts from construction of the transmitter antenna towers on the northern sites. The Common moorhen is active during the day and night, and thought to fly primarily at night. Thus, potential strikes and collisions with the transmitter antenna towers could occur under conditions of poor visibility.

The Common moorhen is not migratory, but some exchange is thought to occur between populations on Tinian and Saipan. The extent of this movement has not been clearly documented. Thus, the Common moorhen's susceptibility to strikes and collisions during migration is not known.

In addition to the Common moorhen, concern has been raised about strikes and collisions with the towers by the Island swiftlet and the Mariana Fruit Bat, both Federally listed endangered species. As previously discussed, the Island swiftlet was last seen on Tinian in 1976 and was not seen during the 1984 survey of the military lease area or during surveys of the project sites. The swiftlet is a diurnally active species and a good flyer with good eye sight. Thus, if the species were present on Tinian, the chances of the occurrence of a collision or strike with the towers would be relatively low.

The Fruit Bat, an endangered species, like other bats is active primarily at night and has good eye sight. Thus, the chances of collisions with the antennas by this species is considered remote.

Although detailed on-site investigations have not been conducted, personal and telephone interviews concerning bird strikes and collisions with towers and antennas have been conducted with the following personnel:

- Engineers at the existing transmitter site for the ROTHR system currently in operation in New Kent County, Virginia [Ref. 53];
- Transmission line engineers at Hawaiian Electrical Company on Oahu, Hawaii [Ref. 54];
- Manager of the Hawaiian Electric Renewable Energy System, Kahuku, Oahu Hawaii [Ref. 55] (Note, this facility includes a number of windmills used to generate electricity);
- Biologists at the Government of Guam Department of Aquatic and Wildlife Resources [Ref. 56], and
- Commanding Officer of the 1,000-FT high U.S. Coast Guard LORAN Station on Yap, Federated States of Micronesia (FSM) [Ref. 57].

None of these personnel reported incidents of bird strikes and collisions with antennas and towers. The manager of the Hawaiian Electrical Renewable Energy System wind farm reported two cases of mortality from bird strikes to the wind turbine blades, but no incidents of bird strikes or collisions to three meteorological towers (one 300-FT high, one 200-FT high and the third 150-FT high) or the guy wire systems for these towers. [Ref. 55] It should be noted the existing ROTHR transmitter is located in an area of high concentration of ducks and geese and public hunting is conducted nearby. The USFWS also reported that the U.S. Air Force also has antennas in Alaska in an area with a high concentration of duck and geese and has not reported a history of bird strikes. (See Appendix K) These findings suggest that the antenna towers would not present significant obstacles to birds in flight.

Several methods could be used to decrease the chance of mortality from birds strikes and collisions. One such method is to site the antenna towers and guy wires parallel to the general flight patterns of birds should decrease the chances of strikes and collisions. [Ref. 52] However, this alternative is not feasible as the transmitter signal must be directed to provide coverage in a selected area, rather than parallel to the general flight patterns of birds flying between Tinian and Saipan.

Shielding the transmitter antenna towers may be feasible. Normally, flying birds gain altitude ahead of obstacles. Barriers such as high wooden fences, walls or trees, or other visible structures can force birds to fly over wires and towers. These barriers may be effective even if much lower than the obstacle and some distance away, provided they are optimally located along the flight path. [Ref. 52] Rows of fast-growing trees such as ironwoods will be planted at close spacing along the side boundaries of the antenna site, perpendicular to the direction moorhens may fly.

Guy wire visibility will be enhanced by marking the wires with highly visible strips or mylar flagging. No lighting that could disorient the

birds will be installed on the towers, and ground lighting will be kept to the minimum required for operations and security. See Section 4.4. Accidental introduction of the Brown Tree Snake into this area of Tinian would create a significant adverse effect to the forest bird population on the island. The decline of forest birds on the island of Guam has been associated with the expansion in range of the introduced Brown Tree Snake. In addition to forest birds, Guam has experienced a significant decline in populations of rats, mice, shrews and some species of lizards. The elastic food requirements of the Brown Tree Snake make it a serious threat to fauna on many Pacific Islands. [Ref. 58]

To date, the Brown Tree Snake has not been reported on Tinian. However, there have been reports of the snake on Saipan in 1983 and in June 1986 and on Hickam Air Force Base, Oahu, Hawaii in 1986 and in Honolulu Harbor. The Brown Tree Snake is native to islands in eastern Indonesia, Australia, Papua New Guinea and the Solomon Islands. It is believed to have arrived in Guam in the late 1940's, either accidentally or deliberately to control rodents. Regardless, the Brown Tree Snake is now known to be distributed throughout the Island of Guam. [Ref. 58]

Accidental introduction of the Brown Tree Snake could eventually result in an impact to the bird population on Tinian similar to that on Guam. The movement of cargo, equipment and supplies, especially if it originates or is transshipped through Guam, could result in the accidental introduction of the snake. (Cargo shipped directly from the mainland U.S. should have a much lower risk of accidental introduction of the Brown Tree Snake.) The risk would probably be greatest during the construction period when large numbers of machinery and equipment will be required to prepare the site and construct the necessary facilities.

Once construction is completed, the risk would decline as supplies would only periodically be required. In either case, introduction of the Brown Tree Snake could initiate colonization on Tinian and, over a period of time, eventually create adverse impacts similar to those on Guam.

The chances of a new population of snakes being established on Tinian would be dependent upon the survival of a sufficient number of snakes to constitute a reproductive population. Theoretically, a single female carrying fertilized eggs could provide a clutch of eggs, which could survive. However, the chances of these snakes surviving and tolerating the genetic inbreeding of mating with individuals of the same mother and father are relatively low. [Ref. 59]

More likely, several individual snakes could arrive, successfully mate, and produce a series of juveniles. A snake population could become established, and eventually the predation of birds similar to what has occurred on Guam could occur on Tinian. It should be noted that an individual snake does not of itself constitute a potential breeding population. However, each individual does contribute to overall probability of the successful establishment of a snake population on Tinian. Thus, if a snake were to arrive by cargo and later be found, cargo of similar type must be carefully inspected to prevent recurrence of the incident. Early detection of the snake is critical to any attempt

to eradicate or control it. Recently arrived snakes will be in the immediate vicinity of the off-loaded cargo and would more likely found than if they were to disperse. [Ref. 59]

The CNMI Division of Fish and Wildlife has indicated that they consider "The Brown Tree Snake to be the single greatest threat to CNMI's wildlife resources." [Ref. 10] The Division of Fish and Wildlife conducted a snake control workshop in September 1986 to combat this threat. The workshop included visits to Tinian, Saipan and Rota to inspect cargo handling facilities and procedures, and to recommend snake control measures.

Specific problems related to military activities in North Field identified during the workshop were:

(1) The shipment of a large amount of heavy machinery which had been sitting in snake infested areas of Guam on 48 hours or less notice;

(2) The difficulty of adequately inspecting this type of equipment;

(3) The unfamiliarity of military personnel with the seriousness of the Brown Tree Snake threat;

(4) The difficulty of maintaining continuous communication with military personnel because of high turnover; and

(5) The difficulty of detection in the North Field area because the adjacent lands are excellent snake habitat. Further, since North Field is not used frequently by military personnel or visited by the civilian population, snakes may not be detected for a long period of time, which may be sufficient for permanent colonization. [Ref. 10]

During 1985, a cooperative agreement was developed for quarantine inspection of all military aircraft with cargo landing at North Field. To date, the cooperation between the military and the Customs and Quarantine officers has been satisfactory. [Ref. 10] Further discussion on the control of the Brown Tree Snake is in Section 4.4, Means of Mitigating Potentially Adverse Impacts.

The projects would remove feral mammal habitat. Mammals are known to exist on the island. Three species of introduced mammals, the musk shrew, house mouse, and root rat, have been observed on previous surveys. Depending upon the site, domestic mammals, horse, pig, cow and goat, may be present. Construction of the installations would displace the individuals on the project sites to other habitat. The overall population of feral mammals on Tinian should not be significantly affected.

4.1.10 Flora

Construction of the antenna arrays and ground screens would require removal of all vegetation on the receiver sites. After grading the site, grass or other suitable ground cover will be planted.

4.1.11 Social and Economic Characteristics

Construction of the XMTRs and support facilities will be done by a contractor. The number of construction workers are expected to be between 50 to 100 persons during the peak construction period. For the most part, workers would be imported to Tinian to construct the XMTRs and support facilities. Spending of wage and salary payments by these workers for goods and services on Tinian would have a beneficial impact to the local economy. Purchases of goods and services by the contractor would also generate short-term beneficial economic effects on Tinian.

Once construction is completed, the transmitters will be operated by a civilian contractor personnel. These personnel positions will not be civil service. When all three transmitters are operational, a total of 90 contractor personnel will be employed, approximately 42 personnel for operation and maintenance (O and M) of the transmitter and 48 personnel to provide base operations support (BOS). (Approximately 50 workers would be employed for Project P-223, an additional 20 for Project P-225 and an additional 20 for Project P-002).

Spending of wage and salary payments by these workers for goods and services would have a beneficial impact to the economy of Tinian. In addition, although not fully established at this time, the contractor may purchase a portion of the goods and services required to support the ROTHR systems from the local area. The economic benefits from these purchases, which include fuel purchases for support vehicles, would accrue to the Tinian economy.

The operations contractor will be responsible for hiring personnel to operate the ROTHR Systems. The extent of hiring of Tinian residents by the operations contractor is not known at this time, although many of the BOS personnel are expected to be hired from Tinian or other areas in CNMI. Moreover, it should be noted, the Technical Agreement between the U.S. and CNMI provides that:

> To the extent practicable, appropriate United States Military and civilian authorities or contractors executing United States Government contracts will attempt to utilize the resources and services of people of the Northern Mariana Islands in construction, development, supply and maintenance activities in the Marianas. Further, United States military and civilian authorities will, whenever practicable, provide technical and training assistance to the people of the Northern Mariana Islands in accordance with applicable United States law to assist in their achievement of necessary skills. [Ref. 6]

Although not yet a major economic activity, tourism provides employment and income to the residents of Tinian. Currently, tourists arrive from Saipan via commuter flights to West Tinian Airport or via boat and then normally spend the day visiting sites on the island, including the North

Field National Historic Landmark and the Memorial Cross at the northern tip of the island. Projects P-223 and P-002 have been sited to ensure that the road to the Memorial Cross will remain open for unrestricted use for motor vehicles or tour buses.

Hunting and other food gathering activities near any of the ROTHR systems will be restricted to areas outside of the personnel exclusion fence and the areas occupied by the personnel support facilities. No hunting or other food gathering activities will be permitted within the personnel exclusion fence. Hunting activities near any of the ROTHR systems which involve the use of firearms, bows, traps, or any other types of weapon will have to be restricted to areas established by a joint agreement by CNMI and Tinian authorities who control hunting and the ROTHR Facilities Commander.

4.1.12 Infrastructure

Some long-term workers assigned to operate the ROTHR systems would be provided housing, recreation, and first aid care as part of the support facilities. Other workers are expected to use housing in the town of San Jose. The power plant and potable water system will be owned by the U.S. Navy and will provide for the entire requirements of the ROTHR systems and support facilities. The ROTHR systems will not use municipal utility systems on Tinian for water or power.

The prime construction contractor will be responsible for restoring the roads used to move equipment, material and supplies to preconstruction condition, if they become deteriorated due to construction activities. Similarly, the prime construction contractor will be responsible for restoring the Tinian docks and dock area to preconstruction condition, if they become deteriorated due to construction activities. These conditions will be incorporated into the construction contract awarded by the U.S. Navy and should prevent significant adverse effects to the road system and docks during the construction period for the ROTHR systems.

Once construction is complete and operation of the ROTHR systems has begun the military would be responsible for maintaining roads within the exclusive use military lease area necessary for operation of the ROTHR transmitter. However, once activities on the island increase due to construction and operation of the ROTHR transmitters, an increase in vehicle traffic can be expected. The traffic can be expected to increase the maintenance needs of the road system. To account for this factor, the military would fund the maintenance of certain roads within the leaseback areas to insure that they are usable for purposes of operating the ROTHR transmitters. If a higher level of road maintenance is desired by CNMI within the leaseback area, CNMI would be responsible for the added cost. Therefore, common use road maintenance would be shared. Similarly, at Tinian Harbor, the U.S. Government would fund maintenance and repair if necessitated by a military requirement.

Once ROTHR construction is complete, the project is expected to return harbor use to normal operational levels, and accordingly, no major repair or maintenance projects are anticipated. If this is not sufficient for

CNMI purposes, the CNMI would be responsible for the added cost under the proposed leaseback agreement or possible future joint use agreement.

4.1.13 Archaeological and Historic Resources

The impacts to archaeological or historic resources will depend upon the site selected.

4.1.14 Aesthetic Characteristics

The relatively flat terrain of the northern flatlands of Tinian and the existing dense vegetation in most areas, should limit visibility of the antenna towers to short distances. Notwithstanding this condition, the transmitters and support facilities will be an intrusion into the visual environment of Tinian.

4.1.15 Electromagnetic Radiation

4.1.15.1 Radio Frequency Electromagnetic Radiation (RFEMR). RF radiation is part of the electromagnetic radiation spectrum which applies to frequencies between 3 kilohertz (kHz) and 300 gigahertz (GHz). A variety of commercial communications and data systems are made possible by transmitting information via electromagnetic waves. For example, most amplitude modulated (AM) radio stations transmit signals in the frequency range of 550 kHz to 1,600 kHz, while most frequency modulated (FM) radio stations transmit in the frequency range of 88 MHz to 108 MHz. The ROTHR system transmits an frequency modulated continuous wave (FMCW) signal in the frequency range of 5 to 28 MHz.

As with all large radio transmitters, the RFEMR emitted by the ROTHR system can be harmful to humans, animals, combustible fuels and electronic equipment unless proper distances are maintained from the transmitting antennas. The factors which determine these proper distances are widely varied and complex when considering, for instance, what power levels become harmful to humans versus electronic equipment. To address these factors and to establish safe separation distances specific to ROTHR, the Space and Naval Warfare Command has prepared a publication titled "Electromagnetic Effects Associated with the Relocatable Over-the-Horizon Radar, short titled "ROTHR E^3 Study". [Ref. 3] The basis of the ROTHR E^3 Study is explained by the two objectives used to develop the document:

1. To present the U.S. nationally recognized standard and DOD policies concerning the safe exposure levels of personnel, volatile fuels, ordnance, and electronically controlled aircraft to non-ionizing electromagnetic fields.

2. To present calculations, studies and technical papers which determine safe separation distances from the ROTHR transmitting antennas in compliance with recognized standard and policies.

The ROTHR E^3 Study is available for public review. The following discussions are to present a summary of the topics addressed in the ROTHR E^3 Study as they apply to the alternative transmitter sites on Tinian.

4.1.15.2 Biological Exposure. Time varying electromagnetic fields, such as those previously discussed, have the characteristic of motion or propagation and are most often referred to as Electromagnetic Radiation (EMR). Unfortunately, RFEMR is often linked, erroneously, to the known biological hazards of ionizing radiation (X-rays, Gamma rays, and particle beam energies). Even moderate levels of ionizing radiation are dangerous because they have sufficient quantum energy to expel an electron from a molecule. This expulsion leaves the molecule positively charged and thereby affecting its interactions with neighboring molecules. In biological systems this ionization can alter their functions fundamentally and often irreversibly. [Ref. 61]

By contrast, the quantum energies from RFEMR are so much smaller that, even at very high intensities, their primary effect is to agitate or vibrate molecular structure rather than to ionize them. The effect of this agitation is to produce heat. Beyond this distinction lies the primary concern; at what threshold do the biological entities begin to experience the effect of heat or hyperthermia caused by prolonged exposure to RFEMR?

To begin, at most population centers, ambient levels of RFEMR are from sources such as radio and television broadcasts and from naturally occurring electromagnetic radiation such as thunderstorms. In humans, the heat produced by such exposure is undetectable above the heat produced by the normal metabolic rate and physical activity. Even at moderate levels of intentional RFEMR exposure the thermoregulatory capability of mammals and birds can adequately accommodate dissipation of the added heat load. However, under sufficiently high levels of RFEMR exposure the thermoregulatory capacity becomes inadequate and the continuation of exposure will begin to distress or possibly damage the organism.

The knowledge that adverse effects to humans were sometimes associated with exposure to high powered radio signals has existed since the earliest times of radio communications. Over the last several decades research has emerged which describes the thresholds at which adverse effects will begin to occur. In identifying these thresholds and seeking to compare results of various experimental data, researchers developed specific methodology to quantify the "dose" of electromagnetic energy that an exposed subject had received. This methodology is called specific absorption ratio (SAR) and describes a dose of electromagnetic energy in terms of the amount of energy absorbed per unit time per unit mass or per unit volume.

The U.S. Air Force School of Aerospace Medicine has performed some of the most comprehensive analysis available concerning the mechanism by which energies from RFEMR are coupled to whole body biological entities. Their work is published and titled "Radiofrequency Radiation Dosimetry Handbook" report SAM-TR-78-22 (second edition) and SAM-TR-80-32 (third edition), copies may be obtained from the U.S. Air Force School of Aerospace Medicine, Aerospace Medical Division, Brooks Air Force Base, Texas.

On the basis of dosimetry and decades of experimental data, a consensus standard was developed by the American National Standards Institute (ANSI) to limit human exposure to RFEMR. [Ref. 75] The most recent release of

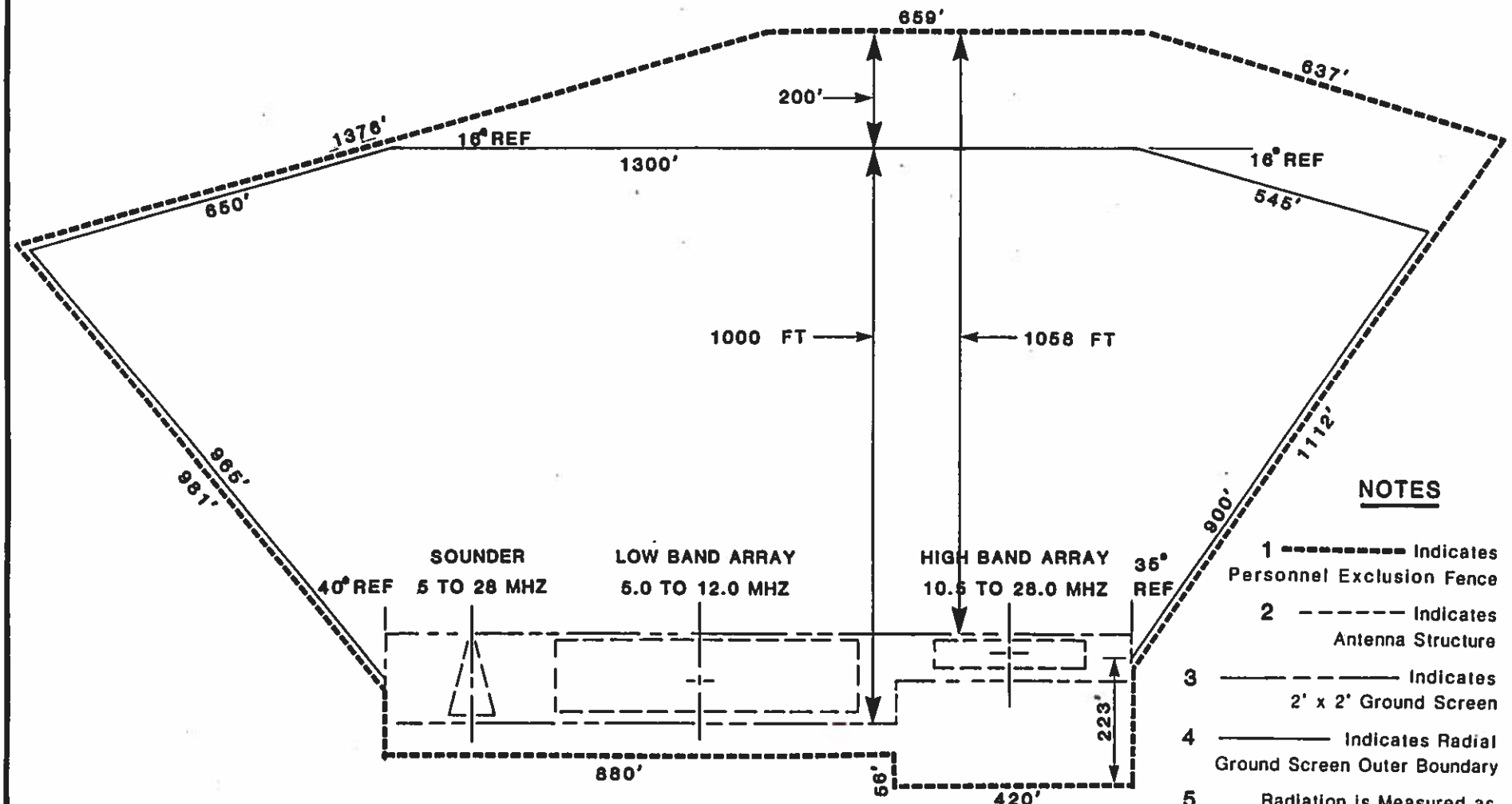
the ANSI standard is the 1982, C95.1. The ROTHR system only operates between 5 and 28 MHz, known as high frequencies (HF), the ANSI standard specific for HF are given as follows: the free space plane-wave power density should not exceed a value greater than 900/F2 in units of milliwatts per centimeter squared (Mw/cm2) (where F denotes frequency in megahertz) for a period greater than six minutes. Since 1982, the ANSI subcommittee responsible for C95.1 has met at least once a year to review the new experimental data and to continually assess the validity of the standard. Recently, the subcommittee has considered the results of 321 of the most recent reports concerning the potential health effects of RFEMR. They have again concluded that the current recommendations presented in ANSI C95.1 remain applicable.

Using the recommendations published in the ANSI standard and an analysis of the ROTHR transmitter antenna patterns, the ROTHR E^3 Study has developed a personnel exclusion zone shown in Figure 4.1.1. The area will be enclosed by a continuous fence and will be conspicuously marked with appropriate warning signs. All power levels of electromagnetic fields which exceed the recommendations of ANSI C95.1 will remain well within the boundaries identified by the fence. The analysis which determined the fence location is presented in section 5.2.1 of the ROTHR E^3 study. This analysis considers all modes and aspects of the ROTHR transmitter operations and has been confirmed by direct measurement of the electromagnetic fields surrounding the ROTHR transmitter in New Kent, Virginia. [Ref. 3]

Animal species able to penetrate the fenced boundary were also considered in the ROTHR E 3 Study. Analysis presented section 5.2.2 of the ROTHR E^ 3 Study shows that smaller animals are very inefficient absorbers of energy carried by HF electromagnetic fields. Using specific absorption rates developed by the School of Aerospace Medicine and calculating the maximum field strengths around the ROTHR antennas, the analysis shows that the ROTHR transmitter does not emit a powerful enough HF field to create an adverse rise in the body temperature of animals smaller than that of a beagle-sized dog. [Ref. 3]

Furthermore, as discussed in the ROTHR E^3 Study, no hazard exists to passengers of airborne vehicles in the vicinity of the transmitters at any range, except for helicopters hovering within the zone.

4.1.15.3 Hazards to Fuel and Flammable Atmospheres (HERF). If a strong enough electromagnetic field is present when two metal objects contact one another, a small spark may be generated. If combustible liquids or vapors are present, an explosion may occur. For example, when the two metal objects are a fueling nozzle and an aircraft fuselage fuel fitting, there is potential for explosive detonation of fuel vapors or liquid depending upon factors such as volatility of the fuel, fuel/air ratio and strength of the spark. The ROTHR E^3 Study discusses the application of existing standards to ROTHR RF transmission characteristics in detail and provides guidance for the establishment of a restricted zone for combustible atmospheres. [Ref. 3]



Navy Space and Naval Warfare
Systems Command PMW-144
Washington D.C. 20363-5100

PERSONNEL EXCLUSION AREA (ROTHR HERP ZONE)

FIGURE 4.1.1

No operations involving transfer of volatile fuels or flammable gases such as natural gas and propane will be permitted in the vicinity of the ROTHR transmitters on Tinian within the limits of the ROTHR HERF Restricted Zone depicted in Figure 4.1.2. Fueling operations outside of the given zone will not be at risk. Signs will be posted in areas with public access warning visitors about fueling activities.

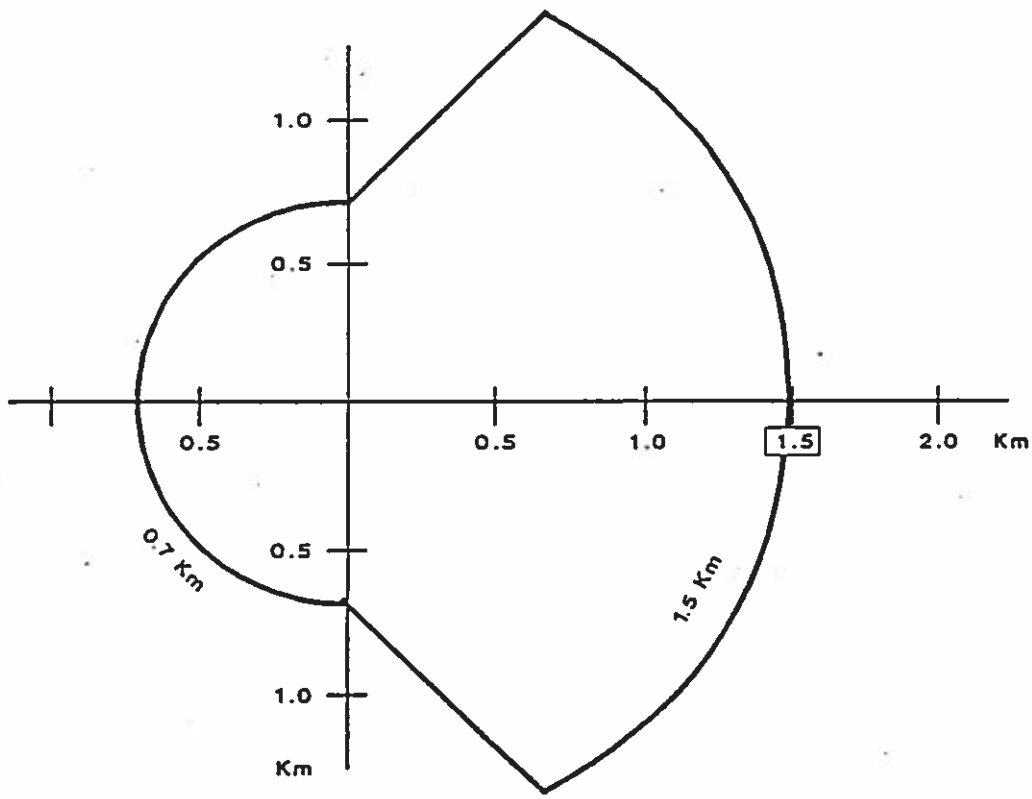
4.1.15.4 Hazards to Ordnance (HERO). The ROTHR E^3 Study discusses in detail the hazards posed by electromagnetic radiation to various types of ordnance. Particular reference is made to standards developed by the U.S. Navy, the leading agency currently involved in testing and certifying its ordnance systems to RF environments. Several restricted zones in the vicinity of the ROTHR transmitters have been identified outside of which various types of ordnance may be safely carried, handled, loaded, tested and disassembled.

HERO Susceptible Ordnance. Civil or military aircraft containing only HERO SUSCEPTIBLE cartridge actuated devices (CADs) such as fire extinguisher actuators may normally be safely flown anywhere in the vicinity of the ROTHR transmitters. However, since some CADs have demonstrated susceptibility to RF emissions in the HF spectrum, restricted zone has been established extending 700 meters in front of the antenna and up to an altitude of 650 feet. All aircraft carrying CADs may safely operate outside of the limits of this zone. The boundaries of the HERO Restricted Zone for CADs is depicted in Figure 4.1.3.

Flights of aircraft carrying other, more potent forms of ordnance (mostly military aircraft) will be restricted according to their degree of susceptibility to electromagnetic radiation. Ordnance or explosives certified HERO SUSCEPTIBLE in the presence of HF radiation greater than 10 or 20 volts per meter may be safely carried outside the limits of Figure 4.1.4. The largest restriction zone applies to 10 volt per meter susceptibility. The 20 volt per meter susceptibility zone is bounded by the smaller area.

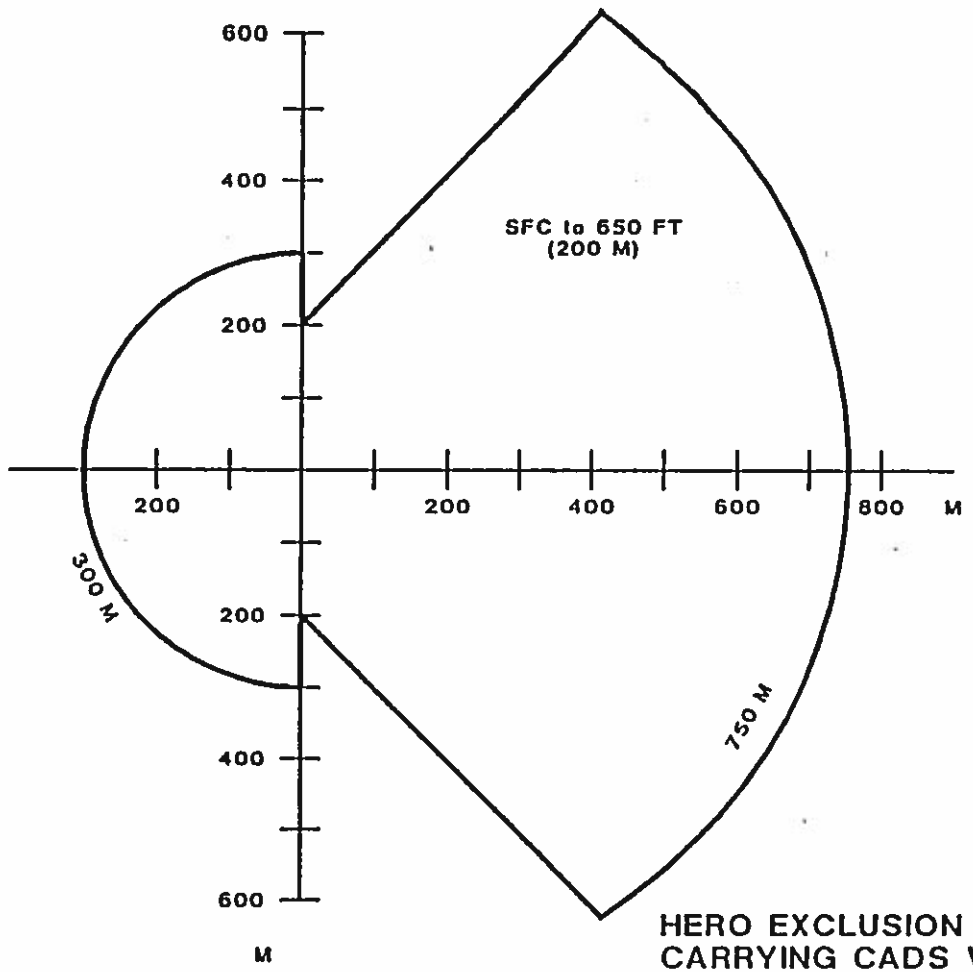
For HERO SUSCEPTIBLE ordnance which has not been tested, operations must remain clear of the limits of Figure 4.1.5 until actual susceptibility limits of the ordnance are determined by test. Operations with HERO SAFE ordnance are unrestricted.

HERO Unsafe Ordnance. Ground operations involving the handling of ordnance as HERO UNSAFE should not be conducted within the boundaries of Figure 4.1.6. Activities which meet this criterion include munitions factories, ordnance depots and military airfields were ordnance is loaded, tested or otherwise handled in an unsafe configuration. When the ROTHR transmitter is located very close to the shoreline as with Tinian, the boundary shown in Figure 4.1.6 may be extended due to the more favorable propagation characteristics of seawater compared to land. The degree to which this will actually occur will be determined by the electromagnetic field strength survey which will be conducted as the system is activated.



ROTHR HERF ZONE
28.0 MHz
0.0884 W/M^2

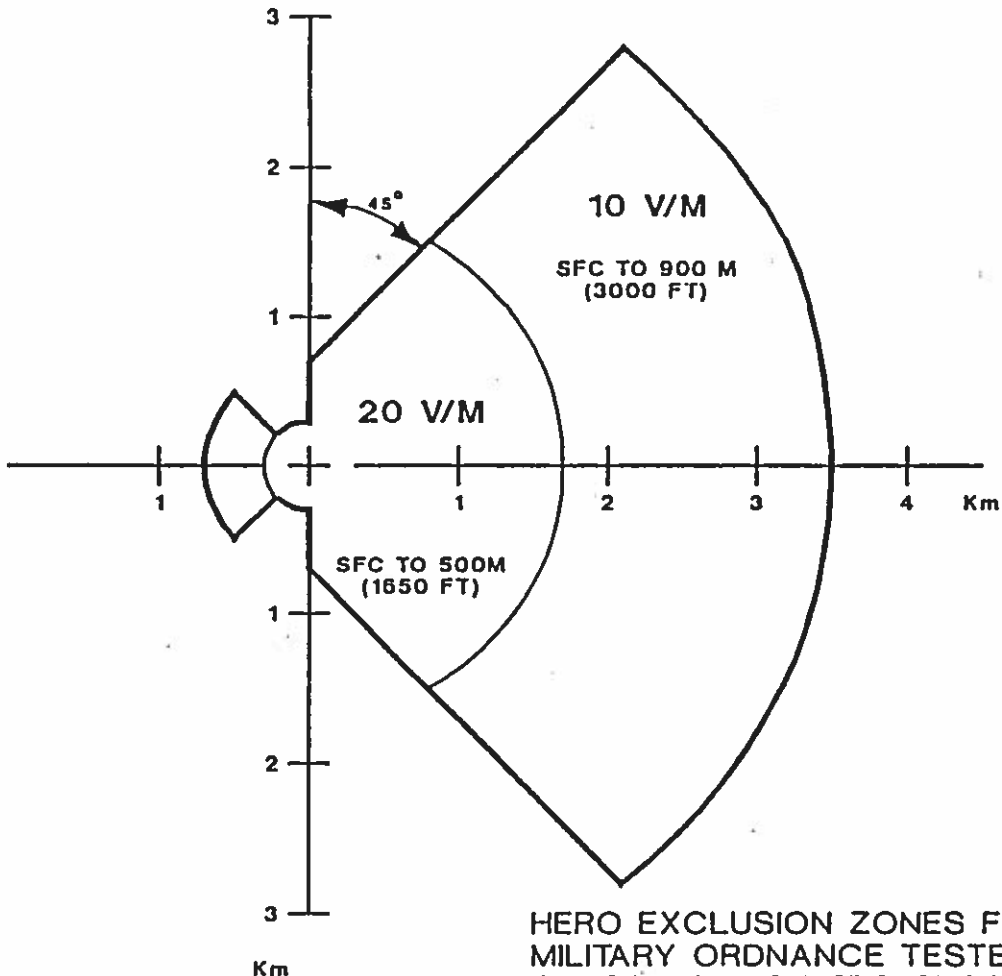
FIGURE 4.1.2
ROTHR HERF
RESTRICTED ZONE



HERO EXCLUSION ZONE FOR AIRCRAFT CARRYING CADS WHICH ARE SUSCEPTIBLE AT 20 V/M OR GREATER WITH FUSELAGE ISOLATION OF 10 dB

ROTHR HERO RESTRICTED ZONE

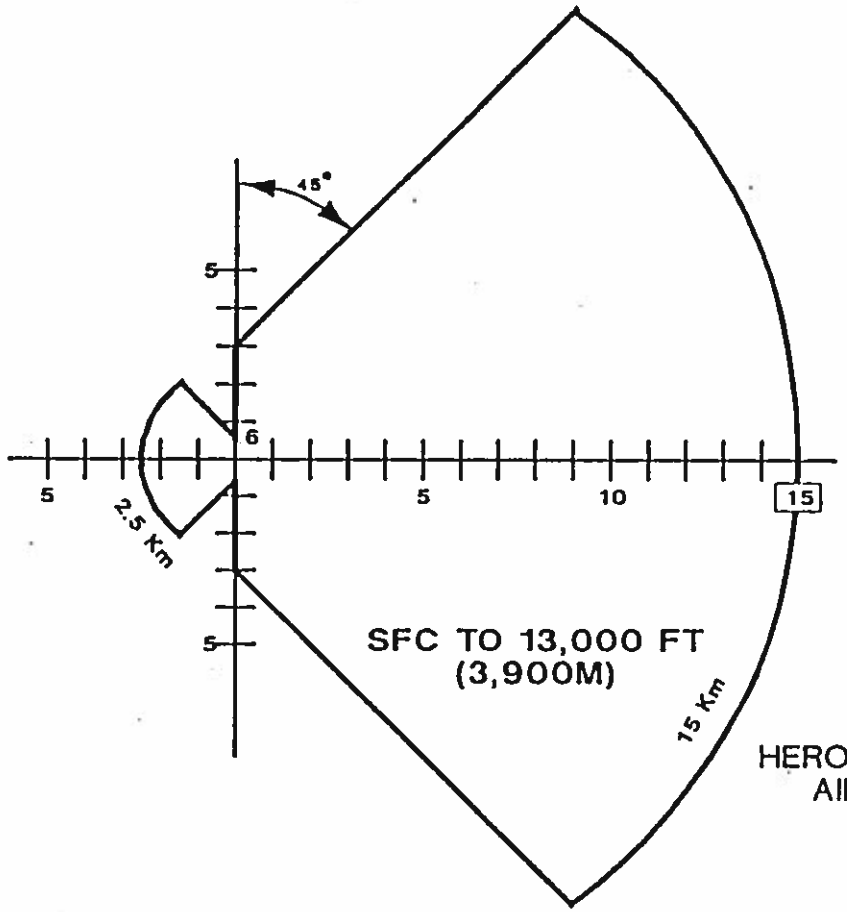
FIGURE 4.1.3



HERO EXCLUSION ZONES FOR MILITARY ORDNANCE TESTED AND CLASSIFIED AS HERO SUSCEPTIBLE AT FIELD STRENGTHS GREATER THAN 10 AND 20 V/M

ROTHR SPECIFIC HERO SUSCEPTIBLE RESTRICTED ZONE

FIGURE 4.1.4

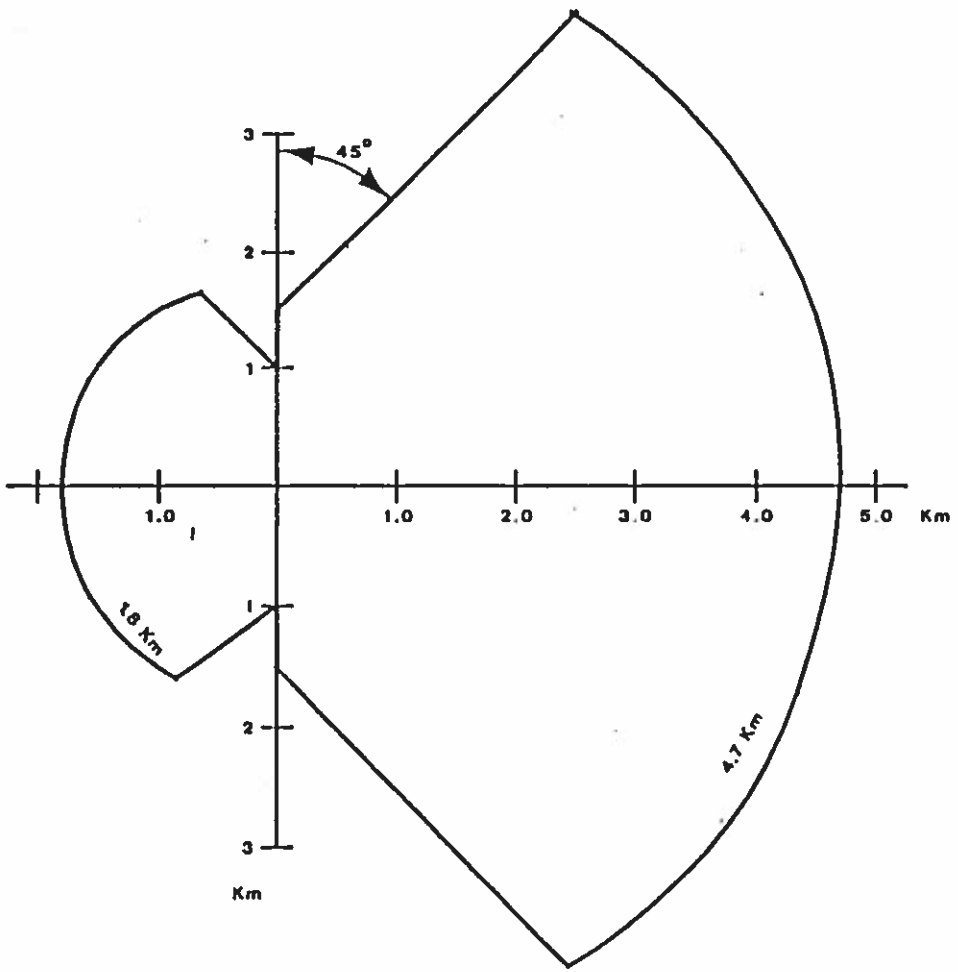


HERO EXCLUSION ZONE FOR MILITARY AIRCRAFT CARRYING UNTESTED ORDNANCE CLASSIFIED AS HERO SUSCEPTIBLE

(2.0 V/M)

ROTHR HERO SUSCEPTIBLE RESTRICTED ZONE

FIGURE 4.1.5



ROTHR HERO UNSAFE ZONE
GROUNDWAVE PROPAGATION - LAND

ROTHR HERO UNSAFE RESTRICTED ZONE

FIGURE 4.1.6

4.1.15.5 Radio Frequency Interference (RFI). RFI involves interference with one's use of the airwaves caused by another's use of the same medium. Examples are: Two Ham Operators talking on the same frequency or distortion of a local TV stations' signal caused by harmonics from someone else's transmission on a lower frequency. This type of interference is manifested in three basic forms:

1. Frequency Crowding - This is caused by two or more users all attempting to use the same frequency simultaneously.

2. Harmonic Interference - This occurs when a transmission at one frequency injects enough RF energy into higher frequencies that are harmonic multiples of the fundamental to interfere with users on those frequencies. Although all radio transmissions produce harmonics, most of the harmonics are too small to interfere with other users.

3. Front End overload - Because of limited dynamic range in the "front end" of many radio receivers, automatic gain control (AGC) circuits are often used to adjust this range up and down depending upon the strongest frequency present within this frequency coverage. The effect is analogous to turning the volume down on your radio when the music gets too loud for your ears (or your speakers) and then being unable to hear the music when it gets real soft. In the same way, the AGC in a radio receiver's front end might turn down the volume due to a strong signal at one frequency far enough to lose weak signals at all the other frequencies, including the frequency to which the receiver is turned. [Ref. 3]

The ROTHR transmitter will not transmit on any frequencies in the 5-28 MHz band that are reserved for dedicated use by others (e.g., Ham radio bands, search and rescue, land and sea mobile, etc.). The frequencies are blocked by the computer software according to a data base of prohibited frequencies programmed for each site.

Furthermore, when preparing to transmit the ROTHR transmitter selects its frequency by monitoring the band of interest for unused channels. This ensures that the system will not interfere with other users and also ensures that the radar will achieve its optimum performance. The ROTHR transmitter transmits on available channels on a "non-to-interfere" basis.

Harmonic content of the ROTHR signal is specified to be more than 80 dB (a factor of 100,000,000) lower in power than the primary signal. This fact will preclude harmonic interference with TV and radio stations, navigation aids, etc., that operate in the frequency bands above ROTHR. However, in the unlikely event that any harmonic interference is experienced, the fundamental ROTHR frequency that generates the interference can be added to the ROTHR's list of prohibited frequencies to correct the problem.

Experience with the prototype system operating in New Kent, VA, has produced no documented radio or television interference over the last two

years although two towns exist within ten miles of the site and several houses stand within a few hundred yards of the transmitter.

4.1.16 Aeronautical Activities

4.1.16.1 Saipan International Airport. Potential impacts which might occur to Saipan Airport will depend upon the project site.

4.1.16.2 West Tinian Field. Potential impacts which might occur to West Tinian Field will depend upon the project site.

4.1.17 Possible Conflicts Between the Proposed Action and the Objectives of Federal, State, and Local Land Use Policies and Controls

The Coastal Zone Management Act (CZM) of 1972 as amended (P.L. 92-583) requires Federal agencies conducting or supporting activities directly affecting the coastal zone to be consistent to the maximum extent practicable with approved local coastal management programs. The CZM Act requires that any Federal agency undertaking any development project in the coastal zone shall ensure that the project is consistent to the maximum extent practicable with approved local management programs (Section 307(c)). [Ref. 14]

Federal agencies must ensure that their activities are consistent to the maximum extent practicable with the enforceable, mandatory policies of the management program, but need not evaluate effects for which there are no mandatory or recommended policies (15 CFR Part 930.39). The U.S. Navy will implement a consistency determination based upon the selected site.

4.1.18 Energy Requirements and Conservation Potential of Various Alternatives and Mitigation Measures

Energy will be required to construct and operate the electronic installations. The amount of energy used during construction will depend upon the type and number of pieces of equipment used by the construction contractor. This information is not known at this time.

The electrical system for the XMTR will use a secondary 120/208 volt, three-phase, four wire 60 hertz service. The total connected load for the electronic installations, with equipment and support facilities will be 4.2 MW, the demand load will be less. [Ref. 4] The ROTHR systems will not use the municipal utility system for power.

4.1.19 Irretrievable and Irreversible Resource Commitments

Site preparation and related construction activities would employ a wide variety of trades and skills, and machinery to ensure rapid completion of the XMTR and related support facilities. Most of the skills required are expected to be imported from other labor markets, though local workers and equipment will be used to the extent feasible.

Materials used for construction of the XMTRs and related support facilities would be irretrievably committed during the period of

operations. Once committed to the project site, use of the materials at other locations is not considered practicable.

Construction of the XMTRs will require removal of vegetation currently used by certain bird species and other wildlife on Tinian. Once the vegetation has been removed, the XMTRs areas will be maintained with low-growth vegetation or covered with crushed aggregate to control weeds. Forests and trees similar to those currently on the project sites would not be allowed to grow back. The forests and resources on the project sites will be irretrievably lost.

Previous surveys of native birds on Tinian indicate their ability to adapt to changes in land uses on the island. Thus, this commitment of resources is not a significant adverse effect.

4.1.20 Short-Term Use Versus Long-Term Productivity

Use of the project sites for XMTRs would preclude other uses, as the ground screen and reflecting area must be kept clear of structures and facilities to ensure efficient operation of the system. Once the XMTRs and support facilities are dis-established, the project areas could be used for other purposes as the surface disturbance will be minimal. Thus, the short-term use of the project sites would not foreclose long-term productivity.

The electronic installations have a strategic defense mission that is in the interest of the national security of the United States. Thus, the long-term productivity from the use of the project sites for XMTRs would outweigh any short-term losses from other uses of the sites.

4.1.21 Urban Quality, Historic and Cultural Resources

Depending upon the selected sites and the nearby existing dense vegetation, the visibility of the transmitters should be limited. Regardless, the transmitters and support facilities will be a contrast to the undeveloped character of most areas of the military lease area.

4.1.22 Means of Mitigating Potentially Adverse Effects

See Section 4.4 for a discussion of mitigation measures.

4.2 RECEIVER SITES (GUAM)

4.2.1 Introduction

The following sections describe the environmental consequences of constructing and operating the ROTHR program receivers on Guam. The effects are organized according to the information presented in Section 3.2. Only the impacts of the ROTHR program are described in this section. No site specific direct effects are discussed.

4.2.2 Physiography and Topography

The area for the receivers and support facilities will be cleared by mechanical means of all vegetation and other features and graded to specified requirements of the RCVR. Cutting, filling and grading the project site will permanently alter the topographic conditions of the selected sites.

4.2.3 Soil Characteristics

The construction contractor will be responsible to devise a plan for review and acceptance by the Navy and coordination with GOVGUAM agencies, that will address grading plans and erosion control measures.

4.2.4 Geologic Characteristics

The bases of the antenna and anchoring systems will require excavations below the existing ground surface. These excavations will be compacted during the construction activities. They will not alter the geologic conditions of the selected sites.

Guam is a seismically active area. Thus, the antennas will be subject to hazards from earthquakes. In the event of a severe earthquake and antenna failures, they would collapse to the base or buckle at the point of failure. This design will confine any hazard from a severe earthquake to the project sites.

4.2.5 Meteorology

Clearing and grading of any of the project sites could create dust, if conducted during the seven month dry season, from December to June. This impact would occur during the clearing period. Water spraying of the area being cleared will be used to mitigate adverse impacts from dust.

Upon completion of construction, the major portion of the project sites will be covered with low-growth vegetation or crushed aggregate. Thus, significant adverse impacts to air quality from dust should not occur.

Vegetation on the project site will be disposed of by on-site burning within a secure area surrounded by exposed bare mineral soil. Necessary permits would be obtained by the contractor prior to burning operations. The construction contractor will be notified by the U.S. Navy of the requirement to allow the removed vegetation to be sufficiently cured prior to burning to prevent excessive smoke during burning operations. This requirement will minimize adverse effects from smoke during burning of vegetation.

Once construction is complete, impacts on air quality would occur only during periods of emergency generator use. One 400 KW emergency generator would be needed to support each OCC and one 400 KW emergency generator for each receiver. These periods of generator use are not predictable. However, if the generators were to be operated for 30 days per year, about 2.5 days per month, for 24 hours per day, the nitrogen oxides emissions,

with control measures, would be 0.75 tons/year. As a comparison, the Clean Air Act define a "major stationary source": as any stationary source which emits, or has the potential to emit, 250 tons per year or more of any air pollutant regulated under the Clean Air Act. Thus operation of the stand-by emergency generators should not cause significant adverse impacts to the air quality on Guam.

Construction and operation of the RCVRs at any project site will not alter the meteorology of the project site or region.

The antennas will be subject to typhoons. The antennas will have wind design of 140 knots. The design of the antennas will confine adverse impacts from antenna failures to the project site.

4.2.6 Solid and Hazardous Waste

The antennas and ancillary equipment used by the RCVRs will not contain any hazardous substances. Thus, the environmental resources of the northern project sites and other nearby areas will not be affected by hazardous substances.

Solid and non-hazardous waste from the operation of the receivers and ancillary facilities will be collected and be disposed according to standard Navy procedures. The operations contractor will be notified of this requirement.

4.2.7 Noise

Clearing the project sites and constructing the antennas will be done by a contractor. Noise in the area of the project site will increase during this period. Since the northern sites are not located near residential areas or public roads, these impacts will not be a nuisance. Similarly, long-term noise impacts from operation of the installation at the northern sites will not be a public nuisance.

Each emergency generator will be housed within a power plant building located near the receiver or OCC. Each of the receivers would require one 400 KW generator and one OCC will require one 400 KW generator for use in emergency situations. The periods of generator use are not predictable. However, if the generator were to be operated in an emergency situation, the noise be about 63 dBA at 500 LF during operation of all three 400 KW generators. This noise level is typical of urban areas.

4.2.8 Hydrology

Construction and operation of the RCVRs and support facilities will not adversely affect percolation of rainfall, as only a minor portion of the required area will be covered with impervious surfaces.

4.2.9 Fauna

The general decline of the bird population is a great concern on Guam. Loss of habitat from vegetation clearing for the receivers or other

adverse impacts could be a serious threat to the declining bird population of the island. The USFWS has listed ten bird species and two bats as endangered species on Guam. GOVGUAM has listed 15 bird species and three bats as endangered species. At the time the USFWS listed these species, August 27, 1984, designation of areas of critical habitat was not considered prudent. The USFWS indicated that a determination of critical habitat would result in no known benefit to the species involved. [Ref. 66]

In February 1989, the USFWS agreed with a petition requesting designation of critical habitat for most of the areas designated as essential habitat in the draft Guam Forest Birds and Fruit Bat Recovery Plans. The USFWS is in the process of developed a proposed rule and writing the economic analysis regarding the critical habitat designation.

The presence of endangered species on certain areas of Guam will require that the U.S. Navy initiate consultation with the USFWS as required by Section 7 of the Endangered Species Act. The USFWS must issue a biological opinion based upon their analysis of the proposed program.

4.2.10 Flora

Construction of the receivers at any of the project sites would require removal of all vegetation within the 850 LF wide by 8,700 LF long area. No vegetation or trees will be removed outside of this designated area.

4.2.11 Social and Economic Characteristics

Construction of the RCVRs will be done by a contractor. If a contractor from Guam is used, most of the beneficial effects of spending of wage and salary payments would accrue to the local economy. Purchases of goods and services by the contractor would also generate beneficial secondary economic effects throughout Guam.

Once construction is complete, each ROTHR system will require about 72 military personnel (a total of 216 personnel for all three systems) to operate the receiver and OCC and to perform other necessary functions. Since the ROTHR systems will be under the control of the Fleet Surveillance Support Command, a command currently not stationed on Guam, the military personnel will be new to the island.

In addition to the military personnel, the ROTHR systems will use a civilian contractor for operation and maintenance of the installations. The civilian contractor is expected to use a total of 69 civilian personnel to operate all three ROTHR systems, according to the following estimates: Project P-223, 44 personnel; Project P-225, 15 personnel; and Project P-002, 10 personnel. Some of the technical personnel in positions requiring extensive training may be brought to Guam by the operation and maintenance contractor, while other personnel may be hired from Guam. Eventually, the technical positions could be filled by personnel from Guam.

Some of the new military and civilian personnel can be expected to bring dependents, including school age children, when they move to Guam. The population impact of these military and civilian personnel can be estimated using established U.S. Navy planning factors and data derived from the characteristics of existing Naval personnel on Guam. Based on these factors, the distribution of married and unaccompanied personnel are shown on the following table:

	Military		Civilian	
Project	Married	Unaccompanied	Married	Unaccompanied
P-223	41	31	25	19
P-225	41	31	9	6
P-002	41	31	6	4
Total	123	93	40	29

The three ROTHR systems will ultimately involve a total of 695 military and civilian personnel and their dependents. The estimated total population impacts for all three ROTHR systems for married military and civilian personnel and their dependents can be seen on the following table:

	Military		Civilian	
Project	Personnel	Dependents*	Personnel	Dependents
P-223	41	103	25	63
P-225	41	103	9	23
P-002	41	103	6	15
Total	123	309	40	101

* Based on 2.5 dependents for each married personnel. [Ref. 69]

One of the primary concerns related to the addition of a new population to an area such as Guam is the housing requirements for personnel and their dependents. Previous analysis has been performed by the Navy to address the housing concern for bachelors and accompanied personnel. According to this information, the unaccompanied or bachelor military personnel will be housed in available existing military quarters throughout the island. No new military quarters will be constructed as part of this project. [Ref. 69]

Similarly, no additional family housing is expected to be constructed on Guam as part of this project. The latest family housing data for Guam shows that the available housing stock on the island is sufficient to house the military personnel and their dependents without the construction of additional family housing units. [Ref. 69]

In addition to the total population impacts, it is possible to estimate the school age dependents associated with each system and for all three ROTHR systems using established Naval planning factors. [Ref.70] Based on this information, a total of 140 school age children will be associated

with the three ROTHR systems. The estimated school age population by grade in school is shown in the following table:

	Military			Civilian		
Project	K (a)	1-6 (b)	7-12 (c)	K (a)	1-6 (b)	7-12 (c)
P-223	3	21	11	2	13	7
P-225	3	21	11	1	4	2
P-002	3	21	11	--	3	2
Total	9	64	33	3	20	11

(a) Based on .08 pupils per family. [Ref. 70]
(b) Based on .52 pupils per family. [Ref. 70]
(c) Based on .26 pupils per family. [Ref. 70]

The school age dependents of the ROTHR personnel are expected to use the public school system on Guam. Currently, the military does not operate Department of Defense Dependent Schools (DODDS) for eligible dependents on Guam. Thus, all school age dependent children will have to use the Guam public school system. [Ref. 71]

Although there have been previous declines in enrollment, some of the schools on Guam are currently operating near design capacity. The impact of additional students would especially be severe on schools in northern Guam, the area with the highest current growth. Data on the schools in northern Guam show the following utilization information:

School	% Utilization
Simon Sanchez High	95%
F.B. Leon Guerrero Middle	90
Dededo Middle	90
Finegayan Elementary	98
Yigo Elementary	93
Andersen Elementary	90
M.A. Ulloa Elementary	87
Wettengel Elementary	87
Harmon Loop Elementary	87

Source: [Ref. 71]

Based on this information, additional school enrollment in the elementary or middle grades could require construction of additional class rooms or dispersion of the students to schools in other areas of the island. Additional high school students could be accommodated in converted buildings or through new construction of facilities. [Ref. 71]

The impact on the school system will occur over a three to four year period as the ROTHR systems are constructed and become operational. The impact to the school system will not occur at one time. Thus, although there will be an impact, the school system would have time to determine the best option to accommodate the additional enrollment.

4.2.12 Radio Frequency Interference

The proposed installation is a receiver, and as such will not emit electromagnetic radiation. Similarly, it will not interfere with any radio frequency in use on Guam. The proposed receiver installations will create no adverse impacts to persons or to radio reception on Guam.

The RCVR will require a Radio Frequency Interference (RFI) free zone of one mile on the front, 1,200 LF behind and 700 LF from each end of the antenna area. In addition, a controlled zone extending for two miles in front of the antenna is required as a means of limiting electromagnetic interference. See Figure 4.2.1. An RFI-free zone is normally desirable around receiving antennas to prevent interference with the receiving capabilities of the antenna. No vegetation clearing is required within the RFI free zone.

4.2.13 Aeronautical Activity

The receivers should not have an effect on aeronautical activities.

4.2.14 Aesthetics

Depending upon the site selected, the receivers could be visible from nearby areas and public roadways.

4.2.15 Archaeological and Historical Resources

Depending on the site selected, the receivers may have an impact to archaeological or historic resources. If so, appropriate measures will be pursued to mitigate the adverse effects.

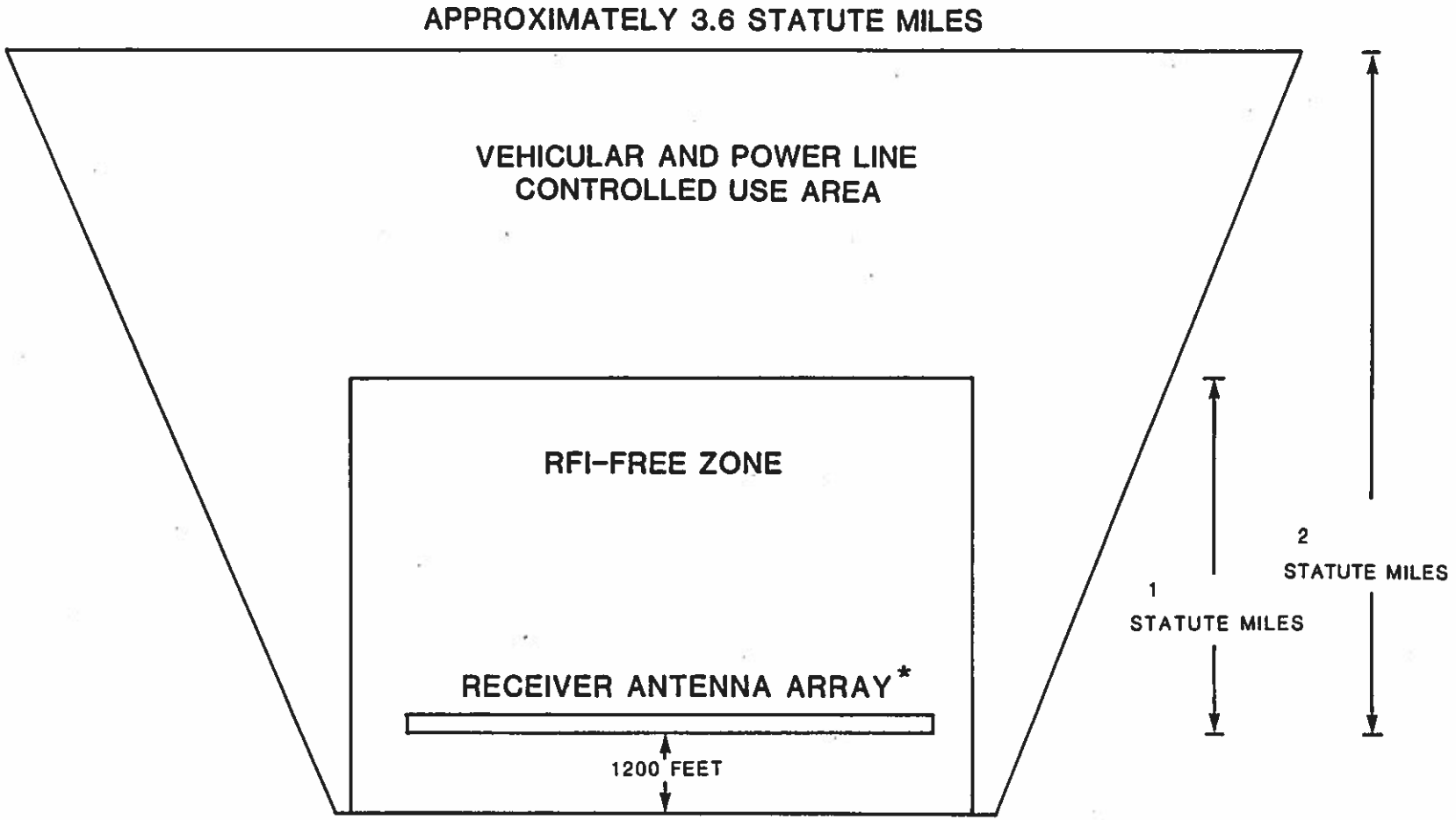
4.2.16 Indirect Effects and Their Significance

The primary indirect effect from installation of the proposed antennas would be to preclude use of the project sites for other purposes during the life of the operation. Although surface alteration to the site will involve removal of all vegetation, the project sites could be utilized for other purposes once the RCVR and support facilities are disestablished.

4.2.17 Possible Conflicts Between the Proposed Action and the Objectives of Federal, State, and Local Land Use Policies and Controls

The Coastal Zone Management Act of 1972 as amended (P.L. 92-583) requires Federal agencies conducting or supporting activities directly affecting the coastal zone to be consistent to the maximum extent practicable with approved state coastal management programs. Any Federal agency undertaking any development project in the coastal zone shall insure that the project is consistent to the maximum extent practicable with approved state management programs (Section 307(c)).

Federal agencies must ensure that their activities are consistent to the maximum extent practicable with the enforceable, mandatory policies of the management program, but need not evaluate effects for which there are



* Approximate area to be cleared: 172 Acres

RFI-FREE ZONE ROTHR RCVR

FIGURE 4.2.1

no mandatory or recommended policies (15 CFR Part 930.39). The U.S. Navy will implement a consistency determination based upon the selected site.4.2.18 Energy Requirements and Conservation Potential of Various Alternatives and Mitigation Measures

Energy will be required to construct and operate the RCVRs. The energy used during construction will depend upon the type and number of pieces of equipment used by the construction contractor. This information is not known at this time.

4.2.19 Irretrievable and Irreversible Resource Commitments

Site preparation and related construction activities would employ a wide variety of trades, skills and machinery to ensure rapid completion of the RCVRs and related support facilities. Many of the skills required are expected to be available from the local labor market, though some outside workers and equipment may be required.

Materials used for construction of the RCVRs and related support facilities would be irretrievably committed during the period of operations. Once committed to the project, use of the materials at other locations is not considered practicable.

4.2.20 Short-Term Use Versus Long-Term Productivity

Use of the project sites for a RCVR would preclude other uses, as the ground screen must be kept clear of structures and facilities to ensure efficient operation. However, small-scale agricultural production and certain types of hunting could occur on portions of the area in front of the ground screen. Once the RCVR and support facilities are disestablished, the project sites could be used for other purposes as the surface disturbance will be minimal. Thus, the short-term use of the project sites would not foreclose long-term productivity.

The installation is vital to the national security of the United States. Thus, the long-term productivity from the use of the project sites for RCVRs would outweigh any short-term losses from other uses of the sites.

4.2.21 Urban Quality, Historic and Cultural Resources

Depending upon the location of the selected sites and the condition of the nearby areas, the visibility of the receivers could be limited to short distances. However, if located near public roads the receivers would be visible to the public. In either case, the receivers would be a contrast to most areas of Guam.

4.2.22 Means of Mitigating Potentially Adverse Effects

See Section 4.4 for mitigation measures.

4.3 CUMULATIVE ENVIRONMENTAL CONSEQUENCES

4.3.1 Tinian

4.3.1.1 Fauna. Construction of three antenna arrays and ground screens will require removal of all vegetation from the three project sites, an area of about 217 acres, or about 1.2 percent of the vegetated area within the military lease area. Removal of vegetation will result in loss of habitat used by birds and mammals resident on the sites.

Clearing the project sites would displace all the resident birds from these areas and force them to seek other habitat. Based on the numbers and variety of native birds observed in the 1984 survey of the military lease area, most species present on Tinian are found in great enough densities such that any loss of species associated with a specific site will not significantly impact the island wide populations.

4.3.1.2 Flora. Construction of the three antenna arrays and ground screens would require removal of all existing vegetation on the project sites totally an area of about 217 acres, or about 1.2 percent of the total vegetated land within the military lease area. After clearing, grass or other suitable ground cover will be planted on the cleared area.

4.3.1.3 Radio Frequency Interference (RFI). The ROTHR transmitters will not transmit on any frequencies in the 5-28 MHz band that are reserved for dedicated use by others (e.g., Ham radio bands, search and rescue, land and sea mobile, etc.). The frequencies are blocked by computer software programmed for each site according to a data base of prohibited frequencies.

Furthermore, when preparing to transmit, the ROTHR transmitters will select their frequencies by monitoring the bands of interest for unused channels. This ensures that the systems will not interfere with other users and also ensures that the radar will achieve its optimum performance. The ROTHR transmitters transmit on a "not-to-interfere" basis.

Harmonic content of the ROTHR signal is specified to be more than 80 dB (a factor of 100,000,000) lower in power than the primary signal. This fact will preclude harmonic interference with TV and radio stations, navigation aids, etc., that operate in the frequency bands above ROTHR. However, in the unlikely event that any harmonic interference is experienced, the fundamental ROTHR frequency that generates the interference can be added to the ROTHR's list of prohibited frequencies to correct the problem.

Experience with the prototype ROTHR system operating in New Kent, VA, has produced no documented radio or television interference over the last two years although two towns exist within ten miles of the site and several houses stand within a few hundred yards of the transmitter.

4.3.1.4. Other Foreseeable Projects. There are no known Federal foreseeable projects on Tinian. Other public agency or private developments are not known.

4.3.2 Guam

4.3.2.1 Fuana. Construction of the three antenna arrays and ground screens will require removal of all vegetation from the project sites, an area of up to 172 acres for each receiver, or a total of 516 acres. Removal of vegetation will result in loss of habitat used by birds and mammals resident on the sites.

Clearing the project sites would displace any resident birds and mammals from these areas and force them to seek other habitat. Depending upon the site selected, endangered forest bird species may be present in the area.

4.3.2.2 Flora. Construction of three receviers would require removal of all existing vegetation on the project sites, an area of up to 516 acres. Depending on the selected sites, this vegetation may provide habitat for species of birds and mammals, and may be used for recreational hunting.

4.3.2.3 Radio Frequency Interference. The ROTHR receivers will not emit electromagnetic radition or interfere with radio frequency use on Guam regardless of the selected sites. However, the ROTHR receivers will require an RFI-free zone. Depending on the selected site, nearby land uses and certain activities could adversely affect the operation of the receivers. These uses and activities may require mitigation measures to ensure adequate operation of the receivers.

4.3.2.4 Other Foreseeable Projects. In addition to construction and operation of the ROTHR receivers, other potential sites have been identified for development in the northern portion of Guam near the Northern sites.

Federal Projects. The Department of the Navy and Department of the Air Force have identified various military construction projects for a number of years into the future. Some of these projects involve construction of new buildings or structures and others addition or alteration to existing facilities. Moreover, the projects could involve areas which have not been developed and others could involve previously cleared areas.

The Department of the Navy projects at NAVCAMS WESTPAC are as follows:

Install Fire Protection System
Addition to Bldg 112
Theater
Replace Transformers
Library
Security Fence
Air Conditioning System Alterations
Small Arms Range Alteration

The Department of the Air Force projects at AAFB are as follows:

Install Lighting, MAC Apron
Upgrade Security System, MMS Area
Construct Munitions Support Equipment Storage Facility
Install Security Fence
Replace Security Fence
Install Interior Lights
Bury Pipeline
Construct Small Arms Range
Construct WRM Storage
Construct WRM Storage
Construct Primary Water Supply
Construct DCM Complex
Install Base Perimeter Fence
Construct Power Generating Plant

As previously discussed, some of these projects could involve removal of habitat currently used by the remaining bird species in this area of Guam. This habitat removal would be in addition to that which would occur with construction of the receivers at the northern site or the Runway site.

Private Projects. Most of the private property in northern Guam is located along the shoreline below the cliffline which surrounds Ritidian Point. One of the private parcels lies along the northwestern coast, Urunao Beach, and the other along the northeastern coast, Jinapsan Beach.

In their request for access to the U.S. Air Force and U.S. Navy, Guam Urunao Resort Corporation (GURC) included a conceptual design for 430-acres of their property located below the cliffline. This conceptual design includes a mixed use development area consisting of hotels, conference center, commercial/retail, restaurants, museum, two condominiums, an 18-hole golf course, golf clubhouse, and a small craft marina. Access to the site would be from Northwest Field Perimeter Road and along the existing access road to the Naval facilities on Ritdian Point.

At this time, the request for access to the Jinapsan Beach property does not reveal details of any proposed development.

Preliminary review of the development proposal and the access request indicate that the ROTHR project would not prohibit either proposal from being considered. Similarly, the proposals would not adversely affect the operation of the ROTHR receiver.

Ultimate development of the Urunao Beach site and, depending on the proposal, the Jinapsan Beach site would create environmental consequences related to each project. These consequences would be cumulative, or in addition, to those identified for the ROTHR receivers on the Northern sites.

These cumulative consequences would included additional generation of solid waste, an increase in vehicle traffic with resultant increase in

noise and pollutant emissions from vehicles, an increase in population, if an immigrant work force is necessary, an increase in consumption of water for the 18-hole golf course, hotels, condominiums, restaurants, and other uses, and a change to the character of the area.

In addition, the development of either property would remove habitat used by some of the bird species remaining in this area of Guam. Since granting the access request would constitute a Federal action, as defined by NEPA, appropriate environmental documentation, coordination, and consultation with Federal agencies would be required.

Portions of southeastern Guam have been proposed for private development. One current proposal called the Dandan Estates & Country Club is near the Dandan receiver site. The development would encompass about 500 acres, or an area over twice the size of the ROTHR receivers, and includes a 200-room hotel, 122 townhouses, 200 condominium units, and two golf courses.

This development would generate additional vehicle traffic, an increase in air pollutant emissions and noise from the vehicle traffic, an increase in the water requirements for the two golf courses, residential and hotel units, and a change in the open space character of the Dandan area. .

4.4 Means of Mitigating Potentially Adverse Effects

4.4.1 Tinian

4.4.1.1 Habitat Loss. The proposed site plans for the transmitters include measures which have been incorporated into the design to decrease habitat loss and potential adverse environmental impacts. The grading plan for the transmitters will limit vegetation removal to the designated area and retain all of the trees in the surrounding areas. Retaining the trees would divert birds from flying in the direction of the antenna array. [Ref. 52]

4.4.1.1 Brown Tree Snake. In addition, the U.S. Navy is fully committed to work with CNMI agencies to design and implement a snake prevention plan to prevent accidental introduction of the Brown Tree Snake into Tinian, as further discussed below. The agreed upon plan will be applicable to civilian contractors and to military commands that may transport equipment, material, supplies, and personnel to Tinian. This snake protocol will apply to surface and air transportation of equipment, material, supplies and personnel during the construction, deployment, or operational phases of the project. Specific measures applicable to cargo originating from or transshipped through Guam will be incorporated into the snake prevention plan.

As previously discussed, the CNMI Division of Fish and Wildlife considers the Brown Tree Snake to be the single greatest threat to CNMI's wildlife resources. [Ref. 10] Measures to prevent the accidental introduction of the Brown Tree Snake to Tinian will have to involve the cooperation and diligence of a number of entities including the U.S. Navy, its contractors and government agencies on Guam, Saipan and Tinian. Cargo and equipment bound for Tinian originating in Guam or being transshipped through Guam

presents the greatest hazard for the accidental introduction of the Brown Tree Snake to Tinian. Brown Tree Snakes could hide in the cargo and equipment as it leaves Guam and arrive in Tinian and eventually become established.

At present, there are no known biological controls for the Brown Tree Snake. Although the snake mite has some potential as a biological control, the lack of information on potential secondary impacts has made it difficult to warrant the use of snake mites at this time. [Ref. 58]

Since there is a high population density of snakes on Guam, mitigation or control measures should be used on Guam and Tinian. These measures were discussed and reviewed during workshops held in Saipan, Rota and Tinian in September 1986. [Ref. 10] Specific measures on Guam include:

- Control of snakes in and around warehouses, material and equipment storage areas;
- Stringent inspection of cargo and equipment prior to shipment from Guam;
- Special inspection attention to high risk cargo such as lumber, pipes, construction material, automobiles, heavy equipment and machinery, and large unsealed crates; and
- Requirement that high risk cargo be certified as being snake-free prior to loading for shipment. [Ref. 10]

Mitigation or control measures applicable to the North Field area and the commercial port on Tinian discussed during the September 1986 workshop include:

- Stringent inspection of cargo and equipment after arrival, especially those shipments arriving from Guam;
- Construction of a fenced cargo and equipment area for holding material after unloading on Tinian. Snakes would have to climb the fence to leave the area and could be detected;
- Searches for snakes in the cargo holding area from 2000 to 2200 hours (8:00 to 10:00 P.M) the night following the unloading of high risk cargo, as the snakes are nocturnal;
- Conduct of full-scale control efforts immediately, in the event of a snake sighting to eliminate it before a colony can become established; and,
- Post instructions with immediate notification procedures in the event of a snake sighting at cargo entry points. [Ref. 10]

The construction of the U.S. Air Force Pacific Barrier III (PACBAR III) Project on northern Saipan presented a similar situation as the ROTHR project. The accidental introduction of the Brown Tree Snake to snake-

free Saipan poses the same threat as introduction of the snake to Tinian. As a mitigation measure for the PACBAR III project, the prime contractor, Black Micro Corporation of Guam, a subsidiary of Black Construction Corporation, prepared a plan entitled," An Implementation Plan to Prevent Importation of Harmful Insects, Rodents and Especially Brown Tree Snakes." [Ref. 65] The plan identified "high risk equipment and materials" as equipment and materials originating from Guam, especially those not containerized or not in completely sealed containers. Cargo imported from elsewhere and unloaded, stocked and reloaded for transshipment from Guam was also identified as high risk cargo. This category included those in breakbulk condition or not in completely sealed containers.

The Black Micro Corporation plan presented guidelines to prevent the accidental transport of the Brown Tree Snake from Guam. [Ref. 65] Specific guidelines included:

- Appointment of a quarantine officer to visually inspect cargo in Guam prior to shipment;

- Thorough cleaning, by high pressure water blaster to remove all foreign materials, such as dirt, grease, grass, weeds, insects, and snakes, of all equipment being shipped from Guam whether by ship or air;

- Inspection of all incoming cargo at the destination by an appointed quarantine officer immediately upon arrival or within 12-hours of off-loading cargo; and

- In the event of a snake sighting, the quarantine officer shall take all efforts to capture and eradicate the snake, then contact the CNMI snake control team.

Specific guidelines for shipment of high risk material included:

- Visual inspection by the quarantine officer in Guam prior to shipment of high risk cargo such as lumber, pipes (PVC, cast iron and ductline), hollow blocks, crates, and other material where snakes could hide; and

- Visual inspection by the quarantine officer at the destination (Tinian).

All cargo moving via surface ship or air either originating in Guam or transhipped through Guam was subjected to these procedures. This requirement extended to material shipped directly by the Contractor or via a freight forwarder. All types of high risk cargo were required to be treated in this manner.

An inspection check list covering 16 items and a signed verification by the quarantine officer was included in the Black Micro Construction implementation plan. [Ref. 65]

The U.S. Navy has not as yet selected a prime construction contractor for any of the ROTHR projects. However, once selected, each prime construction contractor will be required to develop a snake protocol at least as stringent as the one prepared by Black Micro Construction. Use of a protocol modeled after Black Micro Construction plan will ensure that personnel handling high risk cargo in Guam and in CNMI will be familiar with the established inspection and notification procedures. The final protocol for the ROTHR will be established by the U.S. Navy in conjunction with appropriate CNMI and Government of Guam agencies, and the prime construction contractors. The prime contractor for operation of the ROTHR systems will also be required to establish a similar snake protocol.

4.4.2. Guam

4.4.2.1 Habitat Loss. The proposed site plan for the receiver also includes mitigation measures to limit adverse environmental impacts. The requirement to limit obstructions in the area in front of the receiver antenna array has been removed to minimize the amount of tree clearing required at a site. The previously established requirement would have required tree removal or cutting for objects protruding above a one (1) degree slope. Elimination of this requirement will limit vegetation removal to only the designated site. Trees outside of the designated area will not be disturbed.

PART II

PROJECT P-223 EIS

5.0 ALTERNATIVES INCLUDING THE PROPOSED ACTION

5.1 PROJECT DESCRIPTION

The proposed project is to construct and operate Project P-223 which consists of one transmitter, one receiver, and an Operational Control Center (OCC) located near the receiver. As previously discussed, Project P-223 is one of three stand alone ROTHR systems proposed for construction and operation in Tinian and Guam. Although all three systems will be essentially the same and operate in a similar manner, Project P-223 will be sited and oriented to provide surveillance of a specific area. The siting, construction, and operation of Project P-223 will not affect the ROTHR other systems.

The proposed project would construct and operate one transmitter on Tinian, within lands which have been leased to the U.S. for defense purposes, and one receiver on Guam. The transmitter will require removal of all vegetation within the 58-acre site needed for the antenna arrays, and ground screens; the 11-acre area needed to balance the amount of grading and filling and to construct the drainage system; the 10-acre area for the operation support facilities, or a total of 79 acres. The receiver will require removal of all vegetation within the 172-acre site for the antennas and ground screens.

5.2 PURPOSE AND NEED

See Section 1.0 for purpose and need for the project.

5.3 TRANSMITTER DESCRIPTION

The proposed transmitter description, operational characteristics, and support facilities are described in Section 2.0.

5.4. RECEIVER DESCRIPTION

The proposed receiver description, operational characteristics, and support facilities are described in Section 2.0.

5.5 PROPOSED ALTERNATIVE SITES

5.5.1 Proposed Transmitter Sites (Tinian)

Two sites for Project P-223 on Tinian, both within the military lease area, have been identified for possible construction of the transmitter and support facilities. The first site lies north of the North Field runways (northern site) and the second near the western coast of Tinian (western site), northwest of West Tinian Airport. Figures 5.1, 5.2, and 5.3 show the proposed transmitter sites.

5.5.2 Proposed Receiver Sites (Guam)

Three locations Project P-223 on Guam have been identified for the

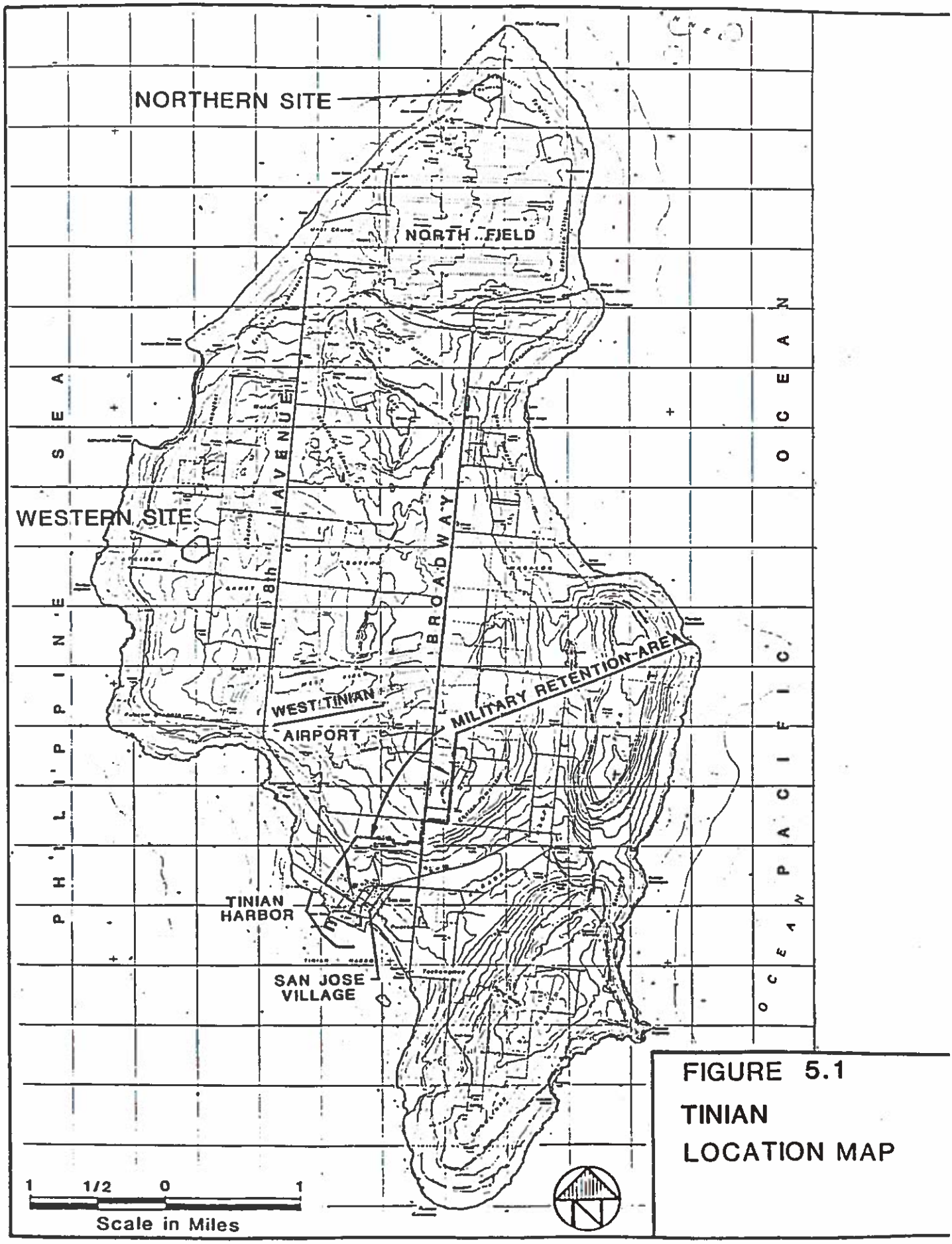


FIGURE 5.1
TINIAN
LOCATION MAP

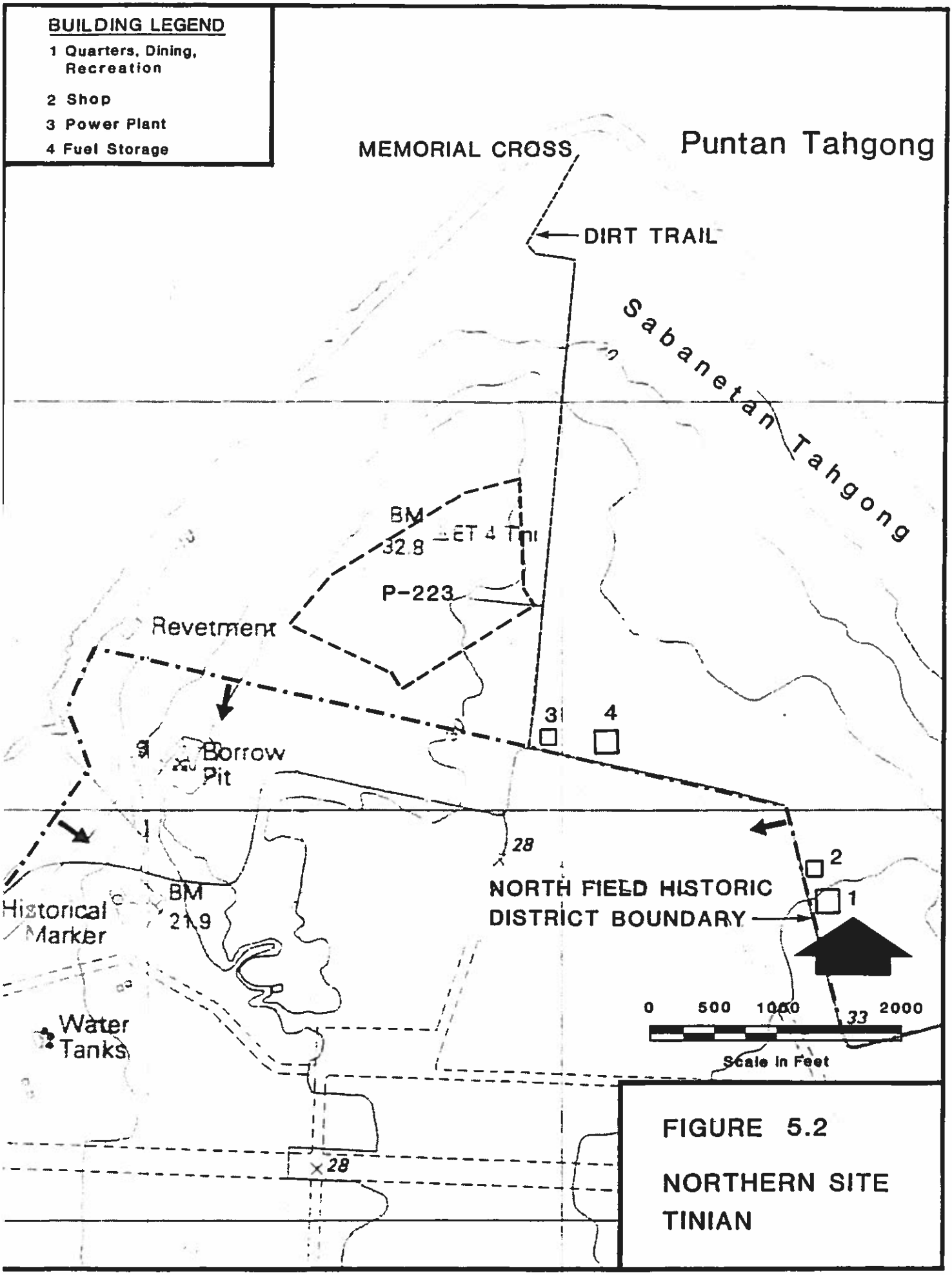


FIGURE 5.2

NORTHERN SITE

TINIAN

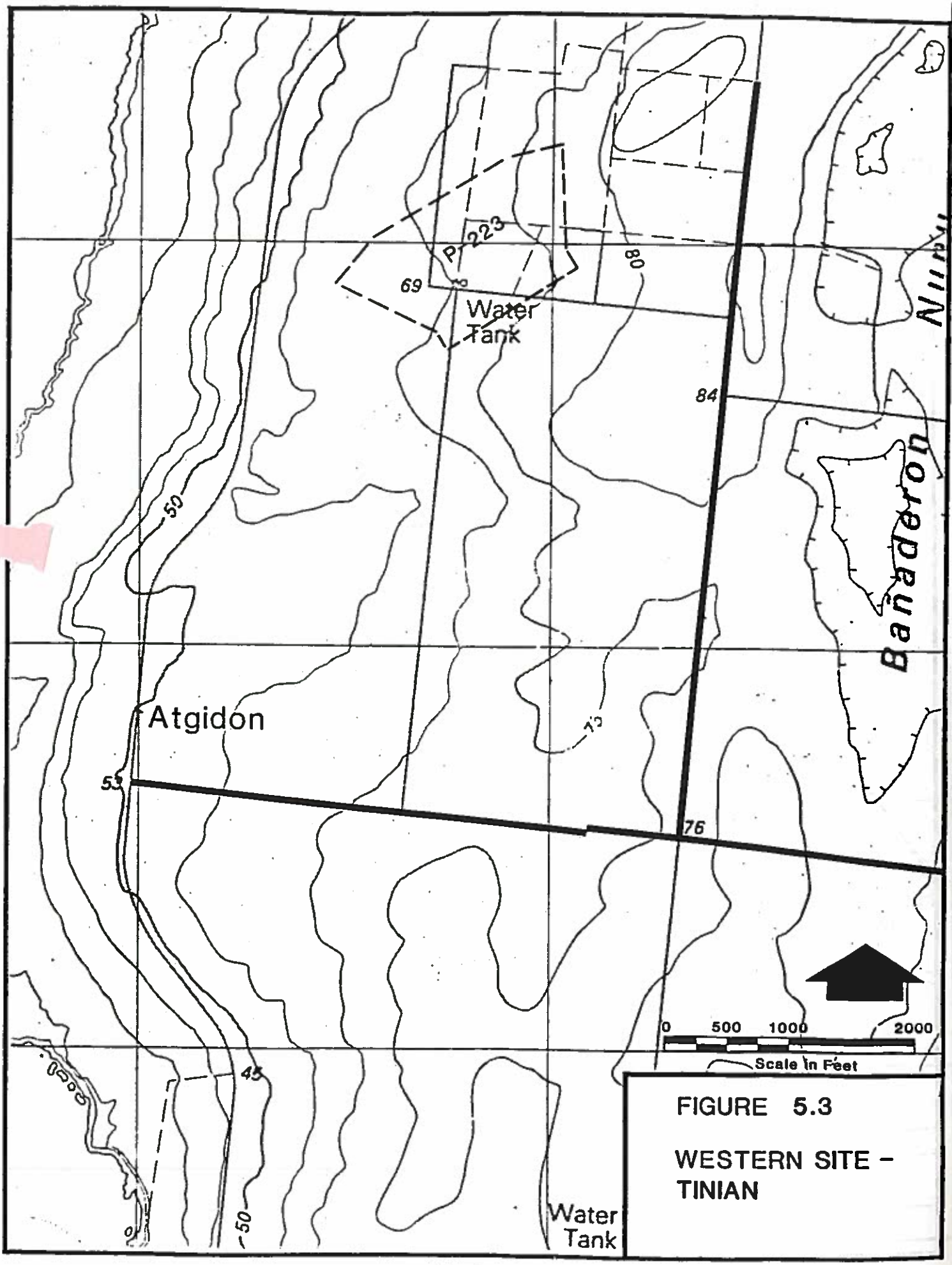


FIGURE 5.3

WESTERN SITE - TINIAN

possible construction of the receiver and support facilities. The first location (Northern sites) includes two sites, the northern site for Project P-223 located north of the Northwest Field runaways, and the Runway site, which includes the north runway and the land between the runway and taxiway. The second location for Project P-223 is on Andersen Air Force Base Harmon Annex. The last site is on privately owned land identified as Dandan Estates on southwestern Guam. Figures 5.4, 5.5, 5.6, and 5.7 show the receiver sites on Guam.

If either of the Northern sites are chosen for construction, the Operational Control Center will be located on NAVCAMS WESTPAC property in areas shown in Figure 8.2.4.

5.6 PREFERRED SITES

5.6.1 Transmitter Site (Tinian)

Sections 2.4 and 2.5 described the process used to select the sites for the transmitter. This process has been supplemented by further analysis in the FEIS shown in Appendix J. Section 5.7 compares the potential environmental consequences associated with the construction and operation of the receiver at each site.

Two sites are identified for the transmitter for Project P-223 on Tinian. The northern site is located north of the North Field runways on Tinian and lies totally outside of the North Field National Historic Landmark, a site listed on the National Register of Historic Places. The western site lies near the western coast of Tinian and a portion of the site is currently used for cattle grazing and for the raising of fruits and vegetables. Both sites lie within the military lease area. The northern site lies within a proposed exclusive use area for the military while the western site is within the proposed leaseback area.

Subsequent to publication of the DEIS, additional fauna, flora, and archaeological/historic field surveys were conducted on Tinian near the northern site for Project P-223. The surveys covered areas which would be used for construction of the support facilities for the transmitter. The results of the field surveys are included in the FEIS appendix.

As a result of carrying out its site selection and environmental analysis and its consultation with the USFWS, the U.S. Navy has identified the northern site on Tinian as the preferred site for the ROTHR transmitter. The conclusion for the preferred site is based on a combination of environmental, technical, and operational considerations. Section 5.6 compares the potential environmental consequences associated with the construction and operation of the transmitter at each site.

5.6.2 Receiver Site (Guam)

Sections 2.4 and 2.5 described the process used to select the sites for the receiver on Guam. This process has been supplemented by further analysis in the FEIS shown in Appendix J. Section 5.7 compares the potential environmental consequences associated with the construction an

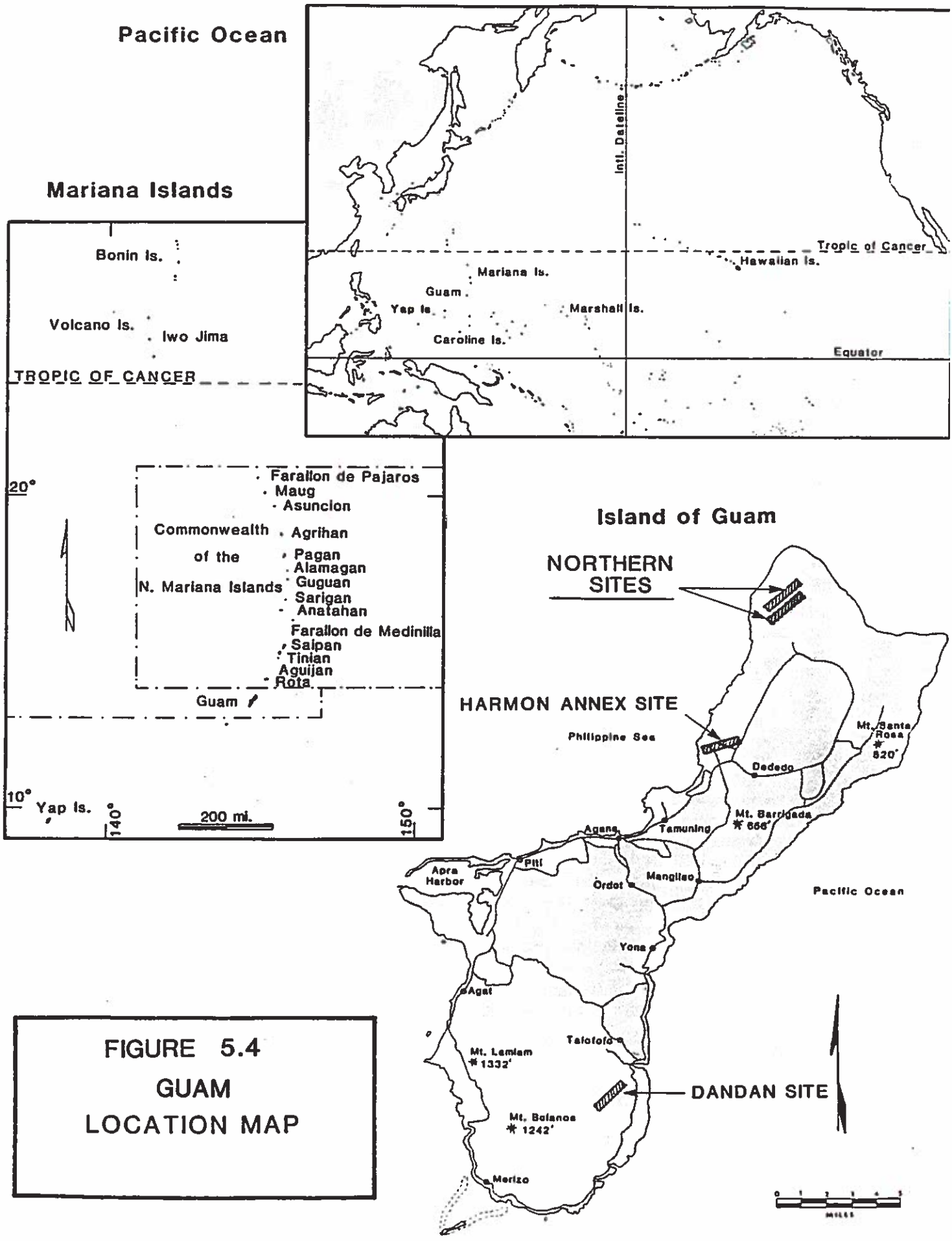


FIGURE 5.4
GUAM
LOCATION MAP

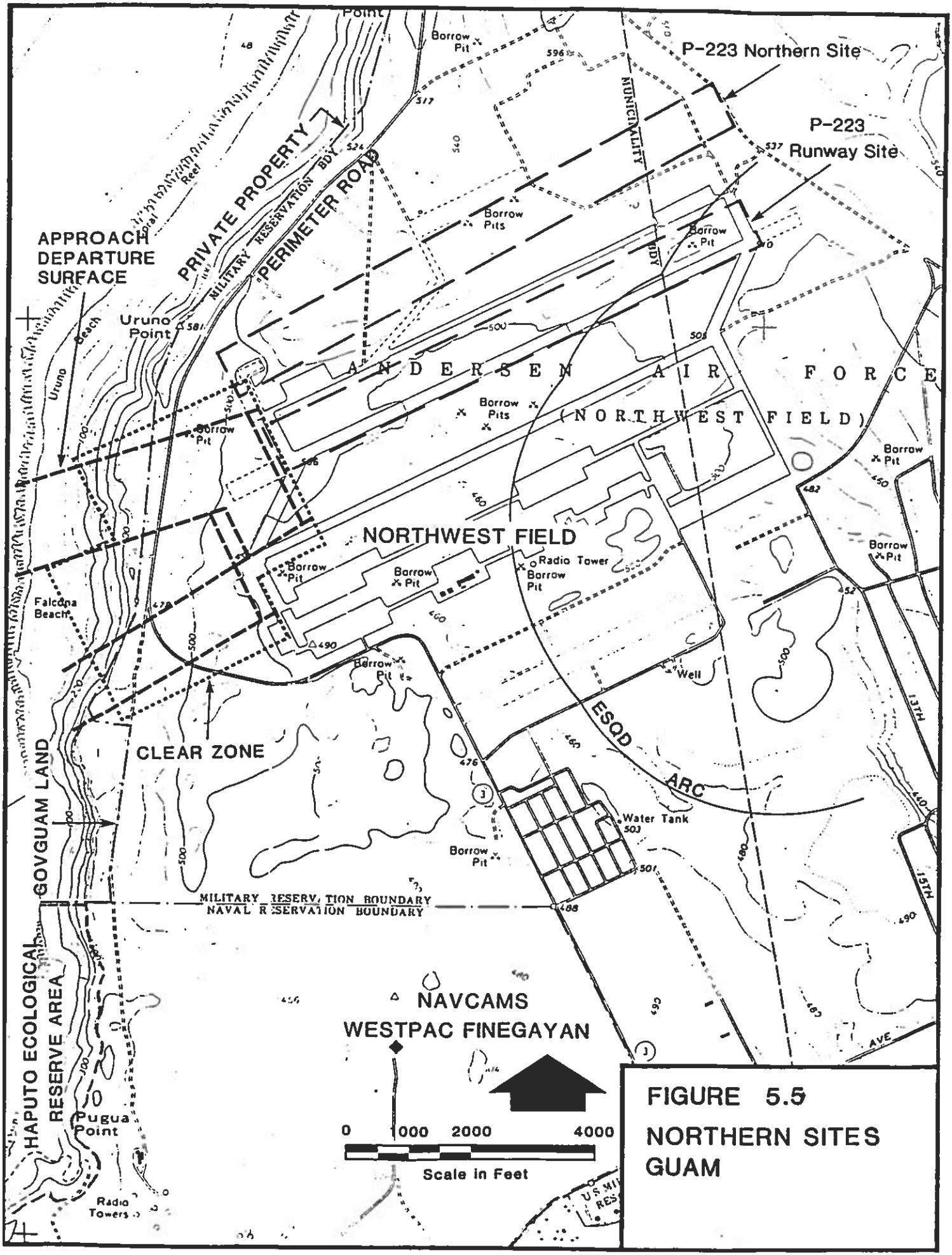


FIGURE 5.5
NORTHERN SITES
GUAM

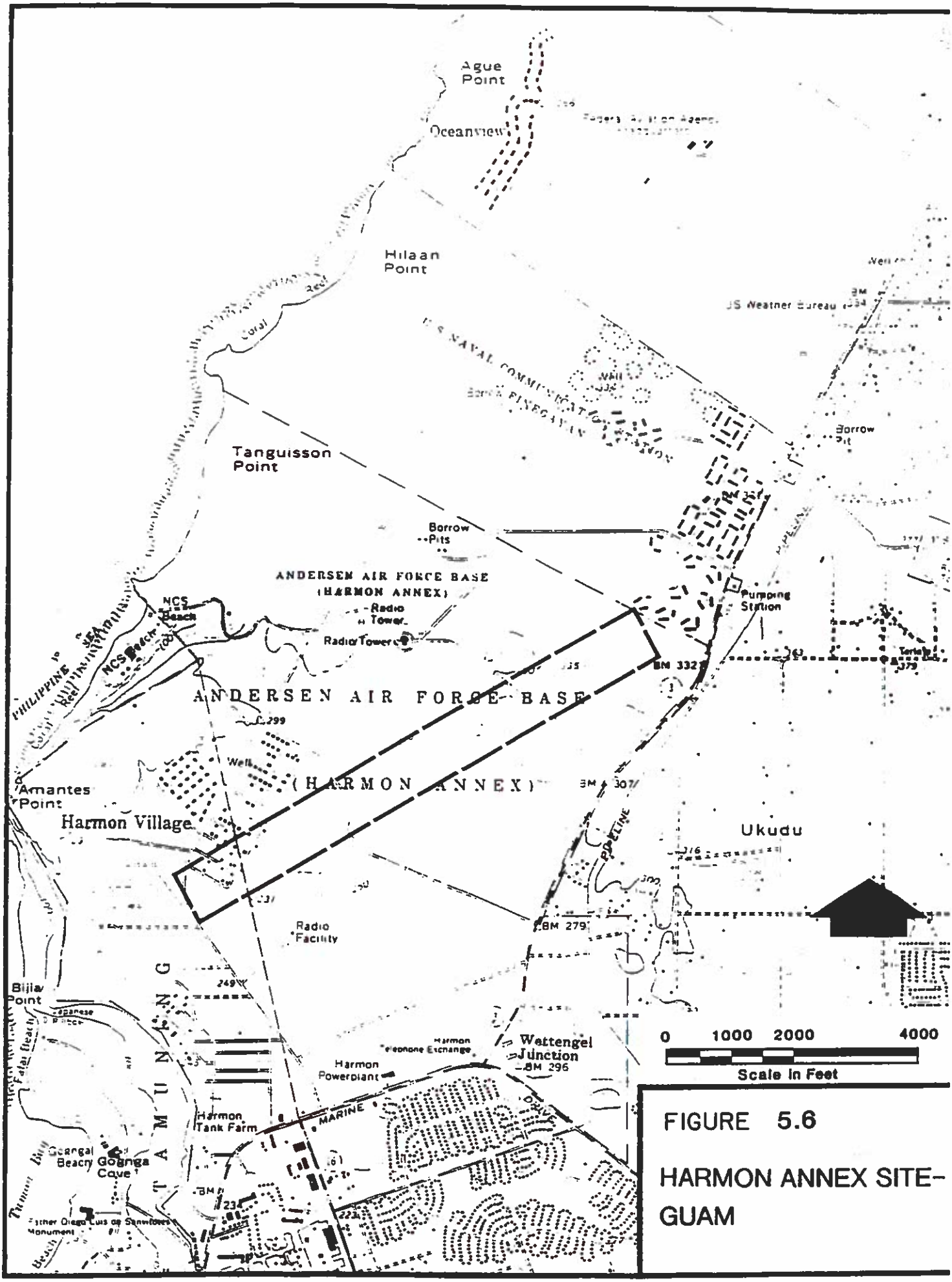


FIGURE 5.6

HARMON ANNEX SITE-GUAM

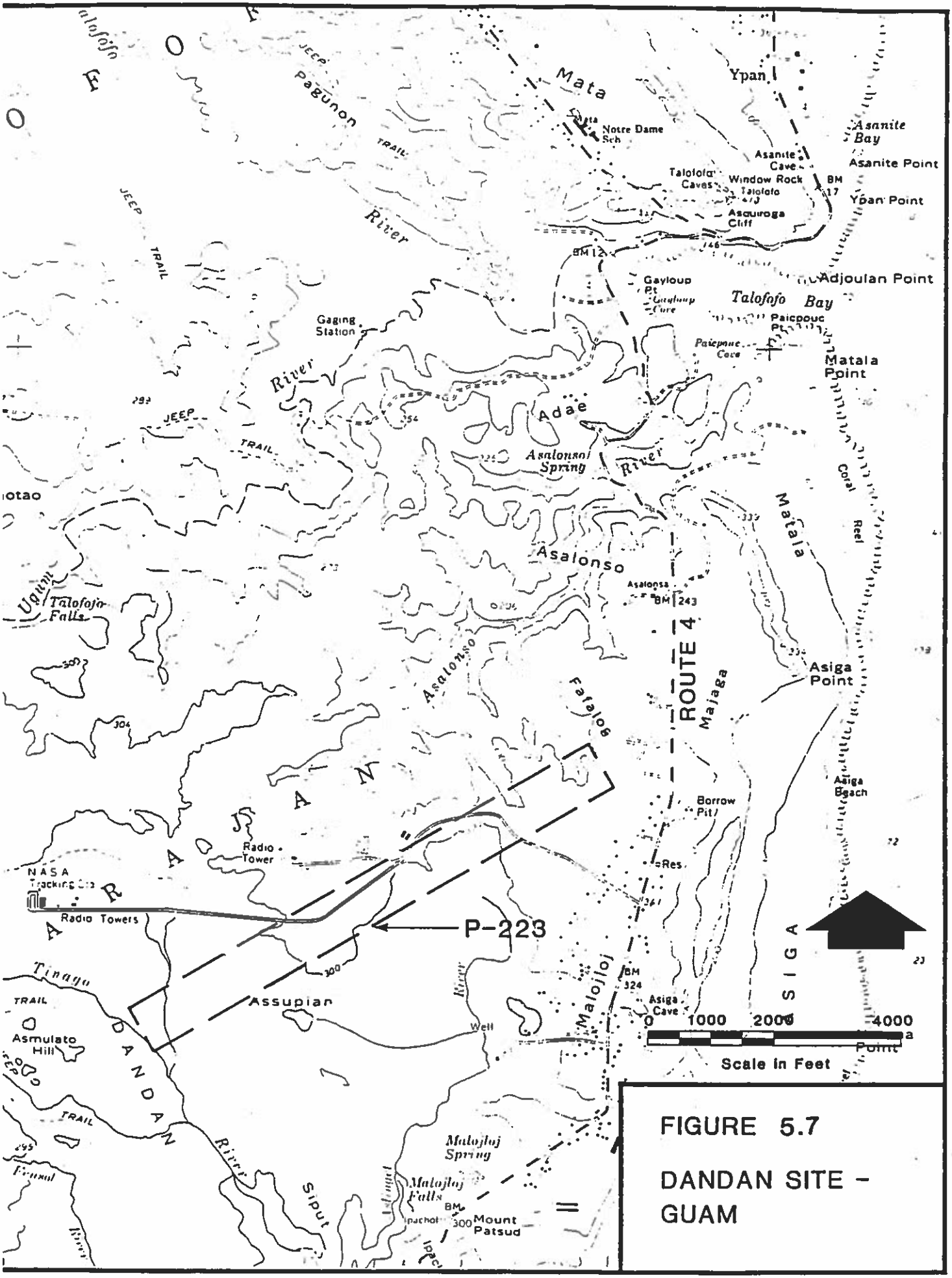


FIGURE 5.7

DANDAN SITE - GUAM

operation of the receiver at each site.

Four sites are identified for the receiver for Project P-223 on Guam. The northern site and Runway site are located within Andersen Air Force Base Northwest Field. The Harmon Annex site is located near the coast in central Guam and has been identified as excess by the DOD in the Guam Land Use Plan. The Dandan site is privately owned and lies near the southwestern coast of Guam in an area which does not currently include other DOD installations.

When the DEIS was published, fauna, flora, and archaeological/historic field surveys had not been performed at the Harmon Annex site for the Project P-223 alignment. Subsequent to publication of the DEIS, an electromagnetic interference study was conducted at the Harmon Annex site. The study showed the current EMI level at the Harmon Annex site was acceptable for a ROTHR receiver site. Thus, fauna, flora, and archaeological/historic field surveys were conducted in March 1990 at the Harmon Annex site. (See FEIS Appendices E-1, F-1, and G-1) The fauna and flora surveys did not show the presence of Federal or GOVGUAM listed or candidate threatened or endangered bird or plant species. Similarly, the archaeological and historic field survey did not show the presence of significant resources within the Harmon Annex site.

Based on the its site selection process, environmental analysis and the results of the Section 7 biological opinion from the USFWS, the U.S. Navy has selected the Runway site on Guam as the preferred site for the ROTHR receiver and the NAVCAMS WESTPAC site for the Operational Control Center for Project P-223. The preferred Runway site would use the existing north runway on Northwest Field as part of the receiver site. The Runway site would require clearing and area of about 110 acres as compared to approximately 172 acres for either of the other sites. The conclusion for the preferred site is based on a combination of environmental, technical, and operational considerations.

In the late 1970's, the Assistant Secretary of Defense requested the development of a mid-range plan for Guam lands under the control of the DOD. The resulting report, known as the Guam Land Use Plan or GLUP, identified a number of parcels as then being potentially releasable by DOD and as having value to the Government of Guam in meetings Guam's development needs. The U.S. Navy 1979 plan for implementing the GLUP recommended that 1,476 acres of Harmon Annex be reported to the General Services Administration (GSA) for disposal.

In view of changing military land requirements in the Pacific, in 1985, the Assistant Secretary of the Navy, Shipbuidling and Logistics, was requested to update the original GLUP. This report, known as the Arny report, continued to recommend disposal of the Harmon Annex property. The Arny report was subsequently approved by the Secretary of Defense in July 1986.

Since then, a number of legislative initiatives have been introduced in Congress dealing with disposition of excess DOD lands on Guam. Both H.R. 2601, introduced during the 100th U.S. Congress, 1st Session, and H.R.

1338 introduced during the 101st U.S. Congress, 1st Session, have specifically identified Harmon Annex as a parcel requested for return to local ownership. Disposal actions regarding most of the GLUP properties, including Harmon Annex, have been placed on hold pending resolution of the legislative initiatives regarding disposition and clarification of alternative uses of the land for military projects, such as ROTHR Project P-223.

If not retained for military purposes, Harmon Annex appears suitably located for residential development and Tangussion Beach along the coast for resort uses. Harmon Annex is partially bordered by Marine Drive, the primary roadway link to the developed areas of the island, and Route 3, the major access from central to northern Guam. Land to the immediate east and southwest of the Harmon Annex site has been designated for urban development. See Figure 6.2.2. The Mircroneasian Mall, the largest shopping complex on Guam, is to the south of Harmon Annex and Two Lovers' Point, a major tourist attraction and scenic overlook, is to the west. The proposed zoning for Harmon Annex, if the site is released, is shown in Figure 6.2.3. GOVGUAM Bureau of Planning in their letter of October 5, 1989 to the U.S. Navy has stated that it opposes locating Project P-223 at the Harmon Annex site.

5.7 COMPARISON OF ALTERNATIVES

5.7.1 Tinian

The following table presents a comparison of the environmental factors for each site on Tinian described in Section 5.5.1 and analyzed in Section 7.1, Environmental Consequences.

5.7.2 Guam

The following table presents a comparison of the environmental factors for each site on Guam described in Section 5.6.1 and analyzed in Section 7.2, Environmental Consequences.

TINIAN ALTERNATIVE SITES COMPARISON MATRIX

FACTOR	NORTHERN SITE Project P-223	WESTERN SITE Project P-223
Physiography/Topography	Site Altered	Site Altered
(Earthwork/cut/fill)	(200,000 cu yd)	(400,000 cu yd)
Soil Characteristics	No Adverse Impact	No Adverse Impact
Geologic Characteristics	No Adverse Impact	No Adverse Impact
Meteorology	No Adverse Impact	Major Stationary Source
Hydrology	No Adverse Impact	No Adverse Impact
Fauna	Potential Bird Collisions with Towers	Lower Potential Bird Collisions with Towers
Flora	No Adverse Impact	No Adverse Impact
Social/Economic Characteristics	No Adverse Impact	Reduce Leaseback Area
Infrastructure	No Adverse Impact	No Adverse Impact
Archaeological/ Historic	Adverse Impact to NH Landmark	No Adverse Impact
Aesthetics	No Adverse Impact to Tinian/Potential Effects to Views from Saipan	No Adverse Impact to Tinian or Saipan
Electromagnetic Radiation	No Adverse Impact to Humans/Animal/ Birds; No Impact to Aircraft Approaching Runway 7	No Adverse Impact to Humans/Animal/ Birds; No Impact to Aircraft

GUAM ALTERNATIVE SITES COMPARISON MATRIX

FACTOR	NORTHERN SITES		HARMON ANNEX	DANDAN
	Project P-223	Runway Site*	SITE	SITE
Physiography/Topography	Site Altered	Site Altered	Site Altered	Site Altered
(Earthwork/cut/fill)	(1.8 mil cu yd)	(1.3 mil cu yd)	(3.0 mil cu yd)	(3.2 mil cu yd)
Soil Characteristics	No Adverse Impact	No Adverse Impact	No Adverse Impact	Possible soil erosion
Geologic Characteristics	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact
Meteorology	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact
Hydrology	No Adverse Impact	No Adverse Impact	No Adverse Impact	Possible impact to nearby stream
Fauna	Reduce Proposed Essential Habitat	Reduce Proposed Essential Habitat	Reduce Proposed Essential Habitat (1)	No Adverse Impact
Habitat	172 acres cleared	110 acres cleared	172 acres cleared	172 acres cleared
Flora	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact
Social/Economic Characteristics	Some Impact to Artero Development	Some Impact to Artero Development	No Adverse Impact	Impact to Talofofo Falls
Infrastructure	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact
Archaeological/ Historic Resources	No Adverse Impact	Adverse Impact to Proposed Historic Landmark	No Adverse Impact	No Adverse Impact
Aesthetics	No Adverse Impact	No Adverse Impact	Adverse Impact to Nearby Views	Adverse Impact to Nearby Views
Conflicts with Land Use Plans	No Adverse Impact	No Adverse Impact	Remove from excess land	Remove Agricultural Lands (2)
Potential RFI	No Adverse Impact	No Adverse Impact	Potential Adverse Impact	Potential Adverse Impact

Notes: (1) Only portion proposed essential habitat. (2) Portion of site reusable.

6.0 AFFECTED ENVIRONMENT

6.1 TRANSMITTER SITES (TINIAN)

6.1.1 Introduction

This section describes the existing environmental conditions at the alternative transmitter sites being considered on Tinian for Project P-223. One of these sites is near the northern end of the island and the other on the western portion.

6.1.2 Physiography and Topography

6.1.2.1 Northern Site. The northern site lies on the northwest coastal area of the Northern Flatland, one of five physiographic units on Tinian. The Northern Flatland encompasses about seven square miles. The northern site lies primarily at an elevation of around 100 feet above Mean Sea Level (MSL). The site for Project P-223 has a gradual slope to the west of less than 1 percent.

6.1.2.2 Western Site. The western site lies at an elevation of about 210-215-FT. The site for Project P-223 shows little relief.

6.1.3 Soil Characteristics

6.1.3.1 Northern Site. Soils on the northern site are primarily of the Dandan-Chinen complex, a mixture of 50 percent Dandan clay loam and 40 percent Chinen clay loam. Dandan soil is moderately deep and well drained. It formed in sediment over porous coralline limestone. Chinen soil is shallow and well drained. Runoff is slow for both soil types and with only a slight hazard of water erosion. Other characteristics of these soils are: Shrink-swell potential: moderate; and plasticity index: 15-30. [Ref. 8]

6.1.3.2 Western Site. The western site almost completely overlies the Dandan Chinen Complex soils. Comprised of 50 percent Dandan clay loam and 40 percent Chinen clay loam, this complex is alternately deep and well drained or shallow and well drained and overlays coralline limestone. These soils form long and undulating slopes of 3-15 percent and are covered mainly by secondary forest and some pasture grasses. Other characteristics of these soils are: Shrink-swell potential: moderate; and plasticity index: 15-30. [Ref. 8]

6.1.4 Geological Characteristics

See Section 3.1.4 for general background information.

6.1.4.1 Northern Site. This site lies within the northern lowlands and is dominated by a 100-FT high limestone plateau comprised of alternately porous to compact fine-grained and elastic materials. The extreme southwestern margins of the site consist of fine grained and recrystallized limestones bordered by a high-angled fault running from

northwest to southeast. The site also lies on the uplifted block side of the fault which has been artificially emphasized by wave erosion during a past period of submergence. [Ref. 9]

6.1.4.2 Western Site. The area underlying the proposed western site is a relatively fault free collection of porous fossil bearing and recrystallized limestone conglomerate. A vertical fault running from the northwest to the southeast corresponds to an area of salt water intrusion of the island's Ghyben-Herzberg lens. [Ref. 9]

A rather large though narrow sinkhole extending in the same general north-south direction runs parallel and northeast of the vertical fault structure. This sinkhole also corresponds to another subterranean strike-slip fault. Although these faults and sinkhole structures fall outside the western sites, they run quite close to the sites and may extend beneath it at deeper levels. [Ref. 9]

6.1.5 Meteorology

See Section 3.1.5 for meteorological and air quality information.

6.1.6 Hydrology

See Section 3.1.6 for background information.

6.1.6.1 Northern Site. The northern project site overlies a portion of the northern fresh ground water resource of Tinian. The central ground water resource is the source for potable water. The northern and central aquifers are not connected. [Ref. 7]

The northern project site contains no surface water bodies, wetlands or potable water sources.

6.1.6.2 Western Site. The western project site lies above the central water resource of Tinian. The site overlies an area considered to have a well developed body of subsurface groundwater. Located below ground at depths close to sea level, the area is considered to offer some of the best potential well sites available. The extreme western area of the sites overlies a narrow channel of saltwater encroachment through a series of faults running from northeast to southwest. The groundwater in the immediate area surrounding this underground channel is considered too saline for potability. [Ref. 9]

The western project site contains no surface water bodies, wetlands or potable water sources.

6.1.7 Fauna

See Section 3.1.7 for background information.

6.1.7.1 Northern Site. A survey of the northern site for Project P-223 was conducted from August 13 to 16, 1986. The survey found a number individuals of the Tinian Monarch, a Federally listed threatened species,

and other bird species. None of the species observed during the survey is believed to be concentrated in the northern area of the island. [Ref. 10] The Tinian Monarch was one of the most common birds in the project site. No other Federally listed or candidate threatened or endangered species of birds or mammals were seen or heard on the site for Project P-223. The complete bird and mammal survey is in Appendix B.

These survey results are consistent with those of other recent surveys conducted on Tinian which also found the Tinian Monarch to be a common species. Based on these findings, the U.S. Fish and Wildlife Service down-listed the Tinian Monarch to threatened on 6 May 1987. (See Appendix B) With this exception, there have been no changes to the list of Federal endangered or threatened species of birds as it affects Tinian.

The Common moorhen and Mariana mallard were not observed during the August 1986 survey. This can be expected as the birds are both aquatic species and the northern site for Project P-223 does not contain wetlands. Similarly, the Island swiftlet was not seen on the northern site. This can also be expected as the Island swiftlet nests and roosts in caves and the site for Projects P-223 does not contain caves. (See Appendix B). Although the botanical survey showed trees used as food sources by the Mariana fruit bats were on the northern sites, fruit bats were not observed during the 1986 survey.

Other birds detected during the 1986 survey included the Bridled White-Eye (Zosterops conspicillata saypani), Rufous Fantail (Rhipidura rufifrons uraniae), Cardinal Honeyeater (Myzomela cardinalis saffordi), Collared Kingfisher (Halcyon chloris), Micronesian Starling (Aplonis opaca), Mariana Fruit-Dove (Ptilinopus roseicapilla), White-throated Ground-Dove (Gallicolumba kubaryi), and Philippine Turtle-Dove (Strpetopelia bitorquata). At least 10 individuals were detected of each species except for the Cardinal Honeyeater (3), Mariana Fruit-Dove (4), and White-throated Ground-Dove (1). (See Appendix B)

The only mammals seen were 2 rats (species unidentified). (See Appendix B)

An additional field survey of the areas for the support facilities was conducted in March 1990. This survey showed the same bird species were present in the support areas as were found in the northern site. (See Appendix B-1)

6.1.7.2 Western Site. The western site for Project P-223 was surveyed during February 1989. The Tinian Monarch was common throughout the site and was the only Federally-listed threatened species of bird detected on the project area. A number of other species of native birds were observed on the western site. (See Appendix B)

6.1.8 Flora

6.1.8.1 Northern Site. A botanical survey for the northern site was conducted from August 16 to 21, 1986. About one-half of the species found are indigenous to the northern Mariana Islands. No Federally listed or

candidate species of threatened or endangered plants were found on the project site during the survey. The complete botanical survey is in Appendix C.

According to the botanical survey, tangantangan was the primary canopy tree found. Other species of trees included Formosan koa and ironwood. The understory was composed of five species of vines; Mikania scandens (no common name), bitter melon, alalag, banago and love-in-a-mist. The herb layer, mostly introduced plants, was restricted to the edges of the roads, runways and aprons. (See Appendix C). Since all of the northern site was probably cleared during World War II, the vegetation on the site is regrowth over previously cleared land.

An additional field survey of the areas for the support facilities was conducted in March 1990. This survey showed the same plant species were present in the support areas as were found in the northern site. (See Appendix C-1)

6.1.8.2 Western Site. The western site was surveyed during February 1989. The western site contains ironwood and poinciana trees and extensive growth of tangantangan. About one-half of the western site for Project P-223 is used for cattle grazing and agricultural production. The remaining area is forested land covered with three types of tangentangen. No Federally listed or candidate threatened or endangered plant species were found on the western site for Project P-223. (See Appendix C)

6.1.9 Population

See Section 3.1.9 for discussion of the population on Tinian.

7.1.10 Land Use, Plans, Policies, and Controls

See Section 3.1.10 for discussion of land use plans, policies, and controls.

6.1.10.1 Northern Site. The northern site lies about eight miles north of the Village of San Jose via an asphalt covered divided two lane highway, Broadway Avenue, built during World War II. Four 8,500 foot runways and a series of connecting taxiways and aircraft parking aprons are located south of the project site. Except for portions of structures built by the Japanese during World War II, the project site does not contain any structures. The only nearby land uses are two historic markers which identify the sites where the atomic bombs dropped on Japan were loaded onto aircraft. The northern project site is regulated for harvesting of coconut crabs and land crabs by the general public consistent with the laws of the CNMI.

The northern site for Project P-223 is located north of the North Field National Historic Landmark, a site listed on the National Register of Historic Places. Support facilities for the northern site transmitter would be located outside of the Landmark, except for a water well.

A dirt road located east of the site for the Project P-223 transmitter

provides access to the northern tip of the island. It is used to visit a Memorial Cross dedicated to eight people who drowned when their boat capsized near Punton Tahong, the point at the northern tip of the island. The Cross has been accepted for listing on the Commonwealth Register of Historic Places. Memorial services are conducted in a small chapel near the Cross twice a year. [Ref. 12].

Military exercises are conducted within North Field two to four times per year. The northern most runway is primarily used to land aircraft and to bring personnel, fuel and ordnance to the area. Depending upon the type of exercise, anywhere from 25 to 500 personnel may be present for periods of one week to several weeks. Live firing usually occurs two or three days out of every exercise. During these exercises, the area north of the two traffic circles are closed to the civilian population on Tinian. [Ref. 16] The training exercises are coordinated with the U.S. Fish and Wildlife Service, as directed by the Endangered Species Act.

6.1.10.2 Western Site. The western site for Project P-223 also lies within the military lease area and includes leased land used for cattle grazing and for the production of papayas and bananas. The parcels are under lease from the Marianas Public Land Corporation.

The western site is within the area which would be leased back to CNMI under the current leaseback proposal.

Military exercises are currently not conducted on the western site.

6.1.11 Infrastructure

See Section 3.1.11 for discussion on the infrastructure on Tinian.

6.1.12 Economic Characteristics

See Section 3.1.12 for a discussion on the economic characteristics of Tinian.

6.1.13 Aeronautical Activities

See Section 3.1.13 for discussion of Saipan International Airport and West Tinian Field.

6.1.14 Archaeological/Historical Resources

6.1.14.1 Northern Sites. An archaeological/historic resources field reconnaissance of the northern site for Projects P-223 was conducted from September 6 to 11, 1986 and followed by detailed recording of sites from September 12 to 16, 1986. These field investigations identified 12 archaeological/historic sites within the transmitter site for Project P-223. The sites consisted of tin cans, earth/rubble berms, concrete piers and pads and one ceramic pottery scatter. None of these sites was considered significant. Appendix D contains the complete historic resources survey and inventory.

An archaeological/historic field survey of the support areas was conducted in March 1990. Two sites were found within the surveyed areas which included concrete pads, rubble building foundations, roads, privies, and evidence of occupation from World War II. The two sites were tentatively assessed as significant for information content, as they have yielded, and/or are likely to yield, information important for historical studies. Further documentary data collection is recommended for both sites. (See Appendix D-1)

6.1.14.2 Western Site. The western site was surveyed during February 1989. The survey of the western site for Project P-223 identified eight sites, including prehistoric pottery scatters and remnants of World War II American military occupation of Tinian. The largest prehistoric pottery scatter is located in the northwest central portion of the site. The scatter varies in density from dense to very sparse. Testing identified a subsurface deposit of up to 30 CM thick containing pottery. Further data collection would be appropriate prior to construction of the transmitter. (See Appendix D)

Another pottery scatter was located near the center of the western site for Project P-223. Testing revealed a subsurface deposit containing pottery. Further data collection would be necessary prior to construction.

Two prehistoric pottery scatters were found in the southwestern corner of the western site for Project P-223. The scatters were very sparse and confined to the ground surface. No further data collection is necessary at either site.

A cavity containing prehistoric pottery and Japanese artifacts was found in the south central portion of the project site. Further data collection is recommended for the site, after which preservation would not be necessary.

Three sites related to American military use of the area were identified in the western site for Project P-223. All of the sites consist of structural remains and foundations. None of the sites appear to require preservation or further data collection. However, if the CNMI Historic Preservation Officer deems them significant, further recording would be necessary prior to construction on the site.

6.2 RECEIVER SITES (GUAM)

6.2.1 Introduction

This section describes the existing environmental conditions at the alternative receiver sites being considered on Guam for Project P-223. Two receiver sites are located on Northwest Field (northern site and Runway site), and with one each on Harmon Annex, and Dandan.

6.2.2 Physiography and Topography

6.2.2.1 Northern Sites. The northern site for Project P-223 is on the

northwest corner of the northern plateau area of Guam, a single broad surface that slopes from north to south. Mount Santa Rosa lies to the south and east of the project site and rises to about 800 FT above Mean Sea Level (MSL).

The northern site for Project P-223 is relatively flat with approximate elevations of 440 FT above MSL on the west southwest end to an elevation of 560 FT above MSL at the east northeast end. Several large borrow pits used in construction of the runways are located within the project site.

The Runway site for Project P-223 lies primarily at about 500 FT above MSL. The northern portion of the site between the east end of the runway and the eastern cross taxiway includes a large borrow pit. This borrow pit extends from the runway to the north parallel taxiway and is about 15 to 20 FT deep in the deepest portions.

6.2.2.2 Harmon Annex Site. The Harmon Annex site slopes from east to west. The northeastern portion of the site lies at an elevation of about 340 FT above MSL and slopes to about 230 FT above MSL in the southwestern edge.

6.2.2.3 Dandan Site. The Dandan site lies in southeastern Guam which is characterized by foothills and grasslands. The site has a gradient from east to west with most of the site at an elevation of approximately 300 FT above MSL. The western portion of the site touches the Tinago River.

6.2.3 Soil Characteristics

6.2.3.1 Northern Sites. Soils on the northern site for Project P-223 are typical of those developed on limestone plateaus of northern Guam. The soils are generally reddish, granular, friable clays that are generally less than 12 inches thick. [Ref. 24] Permeability of these soils is good and erosion potential slight. [Ref. 25] Other characteristics of the soils are: Shrink-swell potential: low; and plasticity index: 10-20. [Ref. 26]

Soils on the Runway site for Project P-223 are classified Guam-Urban land complex. Permeability of the Guam cobbly clay loam is moderately rapid and runoff slow. The hazard of water erosion is slight. The soil is very shallow and well drained. The very shallow depth of the Guam soil makes excavation difficult. Other characteristics of the soils are: Shrink-swell potential: low; and plasticity index: 10-20. [Ref. 65]

6.2.3.2 Harmon Annex Site. The soil on the Harmon Annex site is primarily Guam cobbly clay loam. This soil type is similar to the soils on the northern site and the Runway site for Project P-223. Permeability and erosion characteristics are similar to the northern sites. Other characteristics of the soils are: Shrink-swell potential: low; and plasticity index: 10-20. [Ref. 26]

6.2.3.3 Dandan Site. The Dandan site is composed primarily of two types of soils, Togcha-Akina silty clays and Akina silty clay. Togcha-Akina silty clays have moderate to moderately slow permeability and moderate

hazard for water erosion. The Akina soil is well suited to commercial production of vegetables and moderately suited to commercial production of fruit trees. Commercial crops which can be grown include watermelon, Chinese and head cabbage, and fruit trees. The main limitations are the hazard of erosion, low soil fertility and lack of water during the dry season. In addition, this soil type is characterized by low strength. Other characteristics of the soils are: Shrink-swell potential: moderate; and plasticity index: 15-20. [Ref. 26]

6.2.4 Geologic Characteristics

6.2.4.1 Northern Sites. Guam is located in an active seismic zone and is currently classified in seismic probability Zone 3. It is subject to as much earthquake risk as southern California. The Pugua Fault, a major fault in northwestern Guam, lies south of the northern site and the Runway site for Project P-223 and extends offshore. [Ref. 24]

6.2.4.2 Harmon Annex Site. The Harmon Annex site lies about five miles south of the northern sites. Thus, the Pugua Fault lies about two miles north of the Harmon Annex site.

6.2.4.3 Dandan Site. The Talofofo Fault lies about five miles north of the Dandan site and extends from Talofofo Bay to the west end of Orote Peninsula. This fault is the closest major fault to the Dandan site.

6.2.5 Meteorology

See Section 3.2.5 for meteorology information.

6.2.6 Hydrology

6.2.6.1 Northern Sites. See Section 3.2.6 for background information.

There are no surface water bodies, wetlands or potable water sources on the northern sites.

6.2.6.2 Harmon Annex. The Harmon Annex site is also located over the northern basal water lens. The Harmon Annex site does not include any surface water bodies, wetlands or potable water sources.

6.2.6.3 Dandan Site. The Dandan site is located in southeastern Guam which contrasts to the northern plateau. The southern half of Guam is characterized by volcanic and mountainous areas drained by approximately 40 rivers. Significant ground water resources are not found on southeastern Guam. The Ugum River flows into Talofofo Bay about 1-1/2 miles north of the Dandan Site.

The Tinago River and small unnamed drainages are located on the southwestern border of the Dandan site. This area contains a small fresh water reed marsh, and although not included in the Department of the Army Corps of Engineers list of wetlands, it is typical of many reed marshes found in southern Guam. There are no potable water sources on the Dandan site.

6.2.7 Fauna

See Section 3.2.7 for background information.

6.2.7.1 Northern Sites. The northern site for Project P-223 was surveyed on a transect basis with 100 percent coverage of the area from April 16 to 27, 1988. The Runway site for Project P-223 was also surveyed on a transect basis during February 1989. The survey for the northern site (April 16 to 27, 1988) covered an area of approximately 500 acres, or about 3.3 times as large as the 172 acres required for the antenna array. That survey found approximately seven individuals of the Mariana Crow, a Federal and GOVGUAM listed endangered species, within the 172 acres required for Project P-223. In total, 32 audio of visual crow contacts were made during the 12-day survey of the 500 acres. In addition, a number of other species of birds were identified in the general area of the site for Project P-223 and in nearby areas. Besides the Mariana crow, no other Federal or GOVGUAM listed or candidate endangered or threatened species were seen in the site for Project P-223 or survey area. (See Appendix E)

A complete transect survey of the Runway site for Project P-223 was conducted during February 1989. The survey detected 12 individual Mariana crows on the Runway site. The Mariana Fruit Bat was not detected on the Runway site. No other Federal or GOVGUAM listed or candidate endangered or threatened species were observed during the survey.

These findings are consistent with other surveys conducted by the GOVGUAM Division of Aquatic and Wildlife Resources. Their work has detected the Mariana crow in Northwest Field in a number of locations. GOVGUAM has located active crow nests in Northwest Field and has "snake proofed" the trees in which the nests were located. Subsequently, observation has confirmed the hatching of three crows in the nests. This confirms Northwest Field as a habitat area for this endangered species.

The GOVGUAM surveys detected the Micronesian Kingfisher as late as 1988. The GOVGUAM 1985 survey found the crow and Kingfisher, the Cardinal Honeyeater and the Guam Rail (both Federal and GOVGUAM listed as endangered) on the northern site for Project P-223. (See Appendix E)

The surveys also sighted feral dogs, cats, pigs, and evidence of Guam deer on the northern site for Project P-223. These findings were expected as hunting for pigs and deer are allowed on portions of Northwest Field, including all of the northern site for Project P-223, under procedures established by AAFB.

Eight species of birds, in addition to Guam's endangered birds, inhabit or have been known to inhabit the areas on or near the proposed ROTHR project sites. These include the Philippine turtle dove, Streptopelia bitorquata: Eurasian tree sparrow, Passer montanus; black drongo, Dicrurus macrocerus; rock dove, Columba livia; black francolin, Francolinus francolinus; yellow bittern, Ixobrychus sinensis; lesser golden plover, Pluvialis dominica; and the white-tailed tropicbird, Phaethon lepturus.

Eight species of mammals, in addition to Guam's endangered bats, are known to occur on or near the proposed ROTHR project sites. These include the feral pig, Sus scrofa; Guam deer, Cervus unicolor mariannus; black rat, Rattus rattus; Polynesian rat, Rattus exulans; house mouse, Mus musculus; musk shrew, Suncus murinus; feral dog, Canis familiaris; and the feral cat Felis catus. Many of the aforementioned mammals are considered undesirable or pest species.

Reptiles such as the blue-tailed skink, Emoia werneri; brown skink, Carlia fuscata; house gecko, Hemidactylus frenatus; monitor lizard, Varanus indicus; and the neo-tropical toad, Bufo marinus are known to occur on or near the proposed project sites. Five species of lizards are in the Northwest Field area.

The decline of forest birds and the Mariana Fruit Bat have caused the GOVGUAM Division of Aquatic and Wildlife Resources in cooperation with the U.S. Fish and Wildlife Service to prepare recovery plans for these species. The primary purpose of these recovery plans is to restore Guam's population of these species. Although the plans have not been finalized by the U.S. Fish and Wildlife Service, a key part of these proposed plans is the designation of areas as "essential habitat" for these species. Both proposed plans have designated portions of northern Guam, including the northern sites, as essential habitat for the recovery of these species. Essential habitat is a designation used in the recovery plans to designate important habitat areas and to show areas where habitat should be preserved for reintroduction of endangered forest birds and bats. Essential habitat is not defined in the Endangered Species Act and not afforded the Federal protection established for critical habitat. (See Appendix E) Figure 3.2.1 shows the forest birds and bats proposed essential habitat.

In July of 1987, in accordance with the provisions of the Endangered Species Act, the U.S. Navy initiated consultations under Section 7 of the Act with the U.S. Department of Interior Fish and Wildlife Service (USFWS) regarding the northern site for Project P-223 in northern Guam. In August 1987, the Governor of Guam petitioned the USFWS to designate Northwest Field and other areas on Guam as critical habitat. In September 1987, the USFWS issued a biological opinion to the U.S. Navy that construction and operation of the northern site for Project P-223 would not jeopardize the continued existence of the endangered species. The opinion stated that the vegetation loss at Northwest Field would not be significant when compared to the available island-wide habitat (1 percent loss); and that the demise of the species was a result of poaching and predation by the Brown Tree Snake rather than the loss of habitat. (See Appendix K)

In December 1987, the U.S. Navy reinitiated Section 7 consultation to perform further ornithological surveys at Northwest Field. Also, in December 1987, the Sierra Club Legal Defense Fund, representing the National and Marianas Audubon Societies, petitioned the USFWS to designate, on an emergency basis, critical habitat on Guam.

In March 1988, the Governor of Guam similarly requested the Secretary of the Interior to commence emergency critical habitat designation procedures

as a result of the Navy's reported plans to construct up to three radar receiver installations on Guam. The Governor advised Interior that a total area of 1,600 acres of land would be adversely affected by one project (Project P-223). U.S. Navy projections indicated that for all three projects, if installed on their initial prospective sites, a maximum of 500 acres of assorted vegetation would be affected on Guam. Present (1990) calculations indicate that if Project P-223 is located on the preferred Runway site, no more than 110 acres of secondary forest would be removed while a total of 1,670 acres around the receiver would need to be access-restricted and free of most human structural interference. In that way, an area of 1,670 acres would be required to be preserved in its naturally vegetated state.

On July 1988, the Secretary of Interior replied to the Governor of Guam that the emergency rule-making process would not be used for considering critical habitat designation as the species' habitat was protected through the provisions of Section 7 of the Endangered Species Act and "the current plight of Guam's endangered species is largely the result of predation by the Brown Tree Snake, not loss of habitat, ..." The Secretary concluded that an emergency situation did not appear to exist. [Ref. 29]

Subsequently, on February 27, 1989 the USFWS responded to the original petition by the Governor of Guam to designate critical habitat for seven species on Guam, five species of birds, the Mariana fruit bat and the Little Mariana fruit bat. The USFWS agreed with the merits of the petition that a critical habitat designation may be beneficial for six of species (all except the Guam rail). The USFWS indicated that such designation would protect important habitat necessary to support the recovery of these six species. [Ref. 30]

Subsequent to publication of the DEIS, in July 1989, the U.S. Navy again reinitiated Section 7 consultation with the USFWS to evaluate the Runway site on northern Guam for the receiver for Project P-223.

In September 1989, the USFWS issued a draft biological opinion which concluded that construction and operation of the Project P-223 receiver on the Runway site on Guam will not be likely to jeopardize the continued existence of any listed species. In December 1989, the USFWS issued the final biological opinion for the Runway site for Project P-223 which reached the same conclusion. That opinion appears in Appendix K.

The opinion notes that at the time of its issuance no critical habitat has been designated or proposed, but that the Runway site is in an area under consideration for designation as critical habitat. (See Appendix K) If and when a proposal for designation of critical habitat is published, and if the U.S. Navy determines that the project may affect the proposed critical habitat, the Navy will confer with the USFWS. Should a final designation be made, the U.S. Navy will reinitiate consultation if the project may affect such designated critical habitat.

In the interim and in accordance with the advisory comments contained in the biological opinion, the U.S. Navy initiated a request to the USFWS to for technical assistance from the USFWS in developing conservation and

mitigation recommendations for the potential clearing of forest lands which may be included in the area under consideration for designation. The U.S. Navy expressed its interest in considering conservation recommendations in addition to those contained in the biological opinion which could be effective in minimizing the loss of habitat for endangered species. Recommendations for Project P-223 were specifically requested. See Appendix K.

6.2.7.2 Harmon Annex Site. Bird surveys conducted at the Harmon Annex site in March 1990 showed a number of species on the site. However, no Federal or GOVGUAM listed or candidate threatened or endangered species were found on the site. This findings are consistent with the disturbed nature of the habitat on the site. (See Appendix E-1)

Portions of the Harmon Annex site are designated as essential habitat in the Forest Bird, Swiftlets and Fruit Bat Recovery Plans.

6.2.7.3 Dandan Site. The Dandan site was surveyed during February 1989. According to this survey, the Yellow Bittern, a native species which is not listed as endangered or threatened, was widely distributed throughout the Dandan site. Since the Dandan site was predominantly grassland, this lack of native bird species could be expected. (See Appendix D)

Based on the results of the biological survey, no Federal or GOVGUAM listed or candidate endangered or threatened bird or mammal species were observed on the Dandan site. The Dandan site is not included as proposed essential habitat in the Forest Bird, Swiftlet, Fruit Bat or Common Moorhen Recovery Plans.

6.2.8 Flora

6.2.8.1 Northern Sites. A transect botanical survey of the northern site for Project P-223 was conducted in late June 1988. According to the findings of this survey, the northern site for Project P-223 does not contain a major vegetation type. However, based on local plant communities, the northern site for Project P-223 is mixed vegetation, composed of seedlings or young trees of native species and an equal number of weedy, introduced plants. Much of the northern site has a regrowth of native forest and a large number of introduced species. However, it did contain three pockets of Pisonia trees and a scattering of individual Pisonia trees. (See Appendix F).

These species have been documented to occur elsewhere on Guam, including the Naval Magazine and Naval Station in southern Guam, the Naval Air Station in central Guam, and on NAVCAMS WESTPAC. Based on the results of the survey, no Federal or GOVGUAM listed or candidate endangered or threatened plant species were found on the northern site for Project P-223. No such plants have been reported on this site and, based on the field work and previous studies, there is no evidence to indicate that endangered species may be present on the northern site for Project P-223.

A transect botanical survey of the Runway site for Project P-223 was conducted during February 1989. According to the findings of this survey,

the vegetation of the Runway site is low stature, second growth limestone scrub with a fringe of ironwood or gago trees and nanaso bushes. Gago trees are also found in the 20-25 FT deep borrow pit located on the eastern end of the Runway site. A small grove of coconut trees was found near the center of the Runway site near the eastern boundary.

6.2.8.2 Harmon Annex Site. A botanical survey of the Harmon Annex site was conducted in March 1990. The findings of the survey showed the vegatation to be composed mainly of grasses, herbs, shrubs, and trees. Two remnants of limestone forest were found on both ends of the Harmon Annex site. These limestone remnants contained native species of trees. No Federal or GOVGUAM listed or candidate threatened or endangered species were found during the botanical field survey. (See Appendix F-1)

6.2.8.3 Dandan Site. The Dandan site was surveyed during February 1989. According to this botanical survey, four vegetation types exist on the Dandan site; cultivated land used for agricultural production; open grassland; a mixed vegetation; and an area with vegetation typically found in wetlands. The cultivated land was not surveyed. However, based on observation, cucumbers and melons appear to be planted on the survey area. The grassland was used for grazing. This area contains a small fresh water reed marsh, although not listed on the Department of the Army Corps of Engineers List of wetlands, it is typical of many reed marches found on southern Guam. (See Appendix F)

The mixed vegetation, found mostly in the deep gulches at the eastern end of the site, consisted of a mixture of coconut, guava, Pandanus, Pago, and Ahago trees, tangantangan, red hibiscus and a collection of weeds and grasses.

The western edge of the site lies just east of the Tinago River and several small drainages which drain into the River. Vegetation found near this area included Phragmites karka Tin ex. Steud., Thelypterius opulenta (Kaulf) Forsk., Lygodium scandens (L.) Swartz, and many sedges, including two types of leocharis. This area contains a small fresh water reed marsh, although not listed on the Department of the Army Corps of Engineers list of wetlands, it is typical of many reed marshes found on southern Guam. (See Appendix F)

Based on the results of the botanical survey, no Federal or GOVGUAM listed or candidate endangered species of plants were found on the Dandan site.

6.2.9 Population

See Section 3.2.9 for discussion of population.

6.2.10 Land Use Plans, Policies, and Controls.

See Section 3.2.10 for discussion of land use plans, policies, and controls.

6.2.10.1 Northern Sites. All of the northern site for Project P-223 is on Northwest Field, a facility under the control of Andersen Air Force

Base (AAFB). Although under the control of AAFB, Northwest Field is treated as a separate facility. AAFB does not have current plans for development in the area designated for Project P-223. Site approval for any project in Northwest Field will be processed by the Environmental and Engineering Office of AAFB. Final site approval will be made by Headquarters, Pacific Air Forces (PACAF).

The major land uses of Northwest Field are the two parallel runways (North Runway, 6L-24R, 180 feet by 8,500 feet; and South Runway, 6R-24L, 150 feet by 8,500 feet), connecting taxiway system and parking aprons. Other land uses include the Northwest Field Perimeter Road, two Air Force classified installations, one Navy classified installation, and an automated lighthouse at Ritidian Point.

In addition, recreational hunting is allowed in specified areas of Northwest Field under a permit procedure administered by the Air Force. All of the northern site and the Runway site for Project P-223 are located in the area designated by the Air Force for hunting.

Recorded hunting data collected by GOVGUAM shows Northwest Field to be a popular recreational hunting area. For the period between October 1, 1987 and September 30, 1988, GOVGUAM data show that 26 deer and 151 pigs were reported as taken from Northwest Field. Information as to the location of the hunting within Northwest Field is not available. Regardless, the data show recreational hunting is important in the Northwest Field.

Portions of Northwest Field are periodically used for training exercises, including at times jungle warfare training. When certain training exercises occur, the South Runway is primarily used for aircraft operations. The North Runway is occasionally used for training exercises. The parking pad north of the North Runway was used monthly until September 1989 for hand grenade training.

Use of land within Northwest Field by the U.S. Navy will be authorized by means of a Host Tenant Real Estate Agreement or by transfer of needed areas directly to the U.S. Navy. Either approach would authorize construction and operation of the approved ROTHR facilities and the required documents would contain terms to ensure compatibility with existing U.S. Air Force operations in the area.

For the most part, the northwestern portion of Guam is under DOD control. However, the area below the cliffline near the Perimeter Road is privately owned. [Ref. 41] The Perimeter Road is used for access by the Artero family under a permit procedure established by AAFB. The Perimeter Road is the only land access currently available to the Artero family property, a portion of which lies above the cliff lines and the remainder on the slopes and below the cliffline.

The Department of the Air Force has initiated a project to remove debris from two sites on the Artero family land west of the Northwest Field Perimeter Road. (A third site on Air Force property may also be included in this debris removal program.) The two debris sites are located on the Aretero land entirely below the cliffs and south and west of the northern

site and Runway site for Project P-223. The debris is primarily material from World War II and may include unexploded ordnance. Four alternatives were examined by the Department of the Air Force, including: (1) complete removal of debris by a crane and cable system; (2) surface clearance only; (3) no action; and (4) purchase of the contaminated areas. The Air Force analyzed the alternatives and prepared an Environmental Impact Statement on the project. The EIS stated that the preferred alternative is to leave the material in place, contingent on obtaining suitable interest in the land. [Ref. 43] Solutions to resolve this matter are currently under evlauation by the U.S. Air Force and the private property owner.

The Artero family has proposed development of their land below the cliffline, an area of about 430 acres. The conceptual development plan for this land shows construction of a mixed use development including hotels, conference center, commercial/retail, restaurants, museum, an 18-hole golf course, and a small craft marina.

The existing land uses in northern Guam are shown in Figure 6.2.1. The proposed land uses in Guam are set forth in the Territory of Guam Master Plan adopted in 1966. Subsequently, the Guam Comprehensive Development Plan (GDP) was prepared in 1978 to update the Master Plan. Although portions of the GDP have been adopted, the entire plan has not been. Notwithstanding this situation, many of the concepts in the GDP have been followed for planning purposes. Figure 6.2.2 shows the land use districts for northern Guam.

6.2.10.2 Harmon Annex Site. The Harmon Annex site is located north of Marine Drive (Route 1) and west of Route 3 in the northern portion of Guam. The proposed siting would use lands under the control of Andersen Air Force Base (Harmon Annex). The Harmon Annex site is one of the parcels declared excess by DOD pursuant to a 1977 Guam Land Use Plan (GLUP) study. The proposed zoning, if the land is released, is shown in Figure 6.2.3.

The Harmon Annex site contains two occupied residential structures near the southwestern corner. In addition, three existing paved roads cross the site from east to west. One of these is near the northern portion of the project site and leads to a building used for printing Navy publications located beyond the western edge of the project site. This road may require a minor change in its present alignment to accommodate the antenna array. The other road is located near the center portion of the site and leads to the Navy Public Works Center Tanguisson Power Plant and the GOVGUAM northern area sewage treatment plant. The third road is located on the southern end of the Harmon Annex site and provides access from Marine Drive to Two Lovers Point, a popular tourist and sight seeing location.

Other nearby land uses include the GOVGUAM sewage treatment plant, communication facilities, including a tower and the Navy Public Works Center Tanguisson Power Plant.

The Harmon Annex site is closed to recreational hunting.

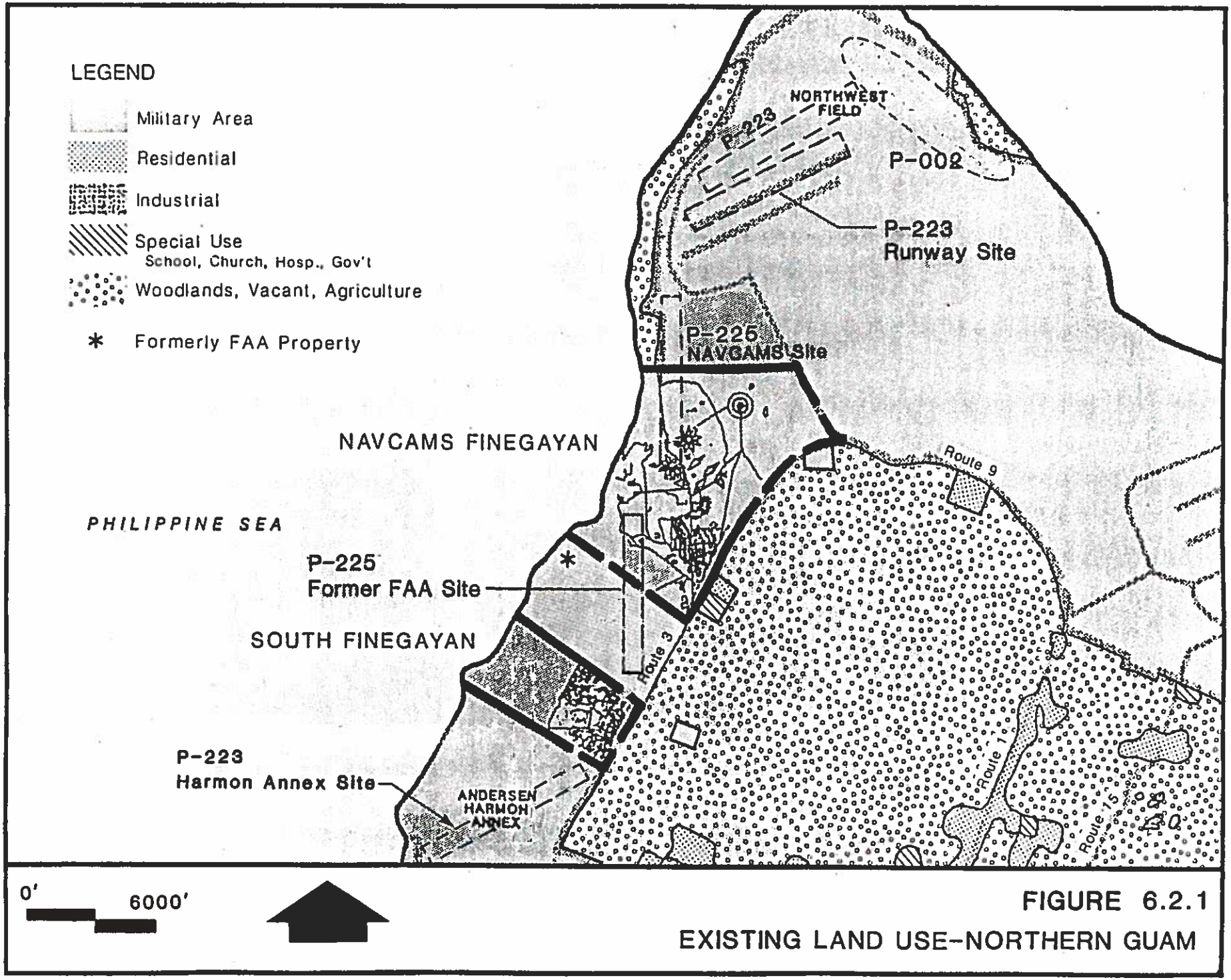


FIGURE 6.2.1

EXISTING LAND USE-NORTHERN GUAM

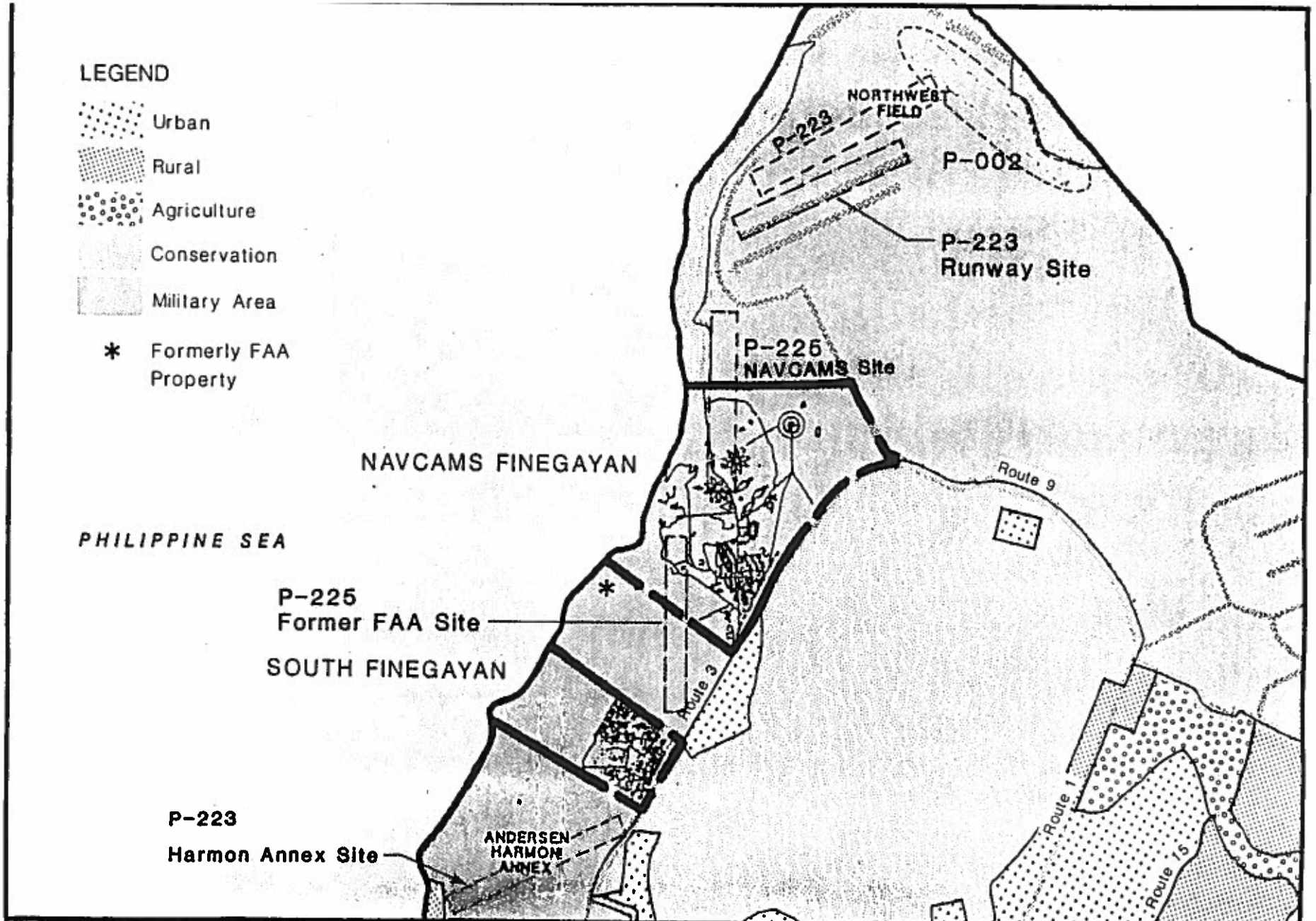


FIGURE 6.2.2
LAND USE DISTRICTS-NORTHERN GUAM

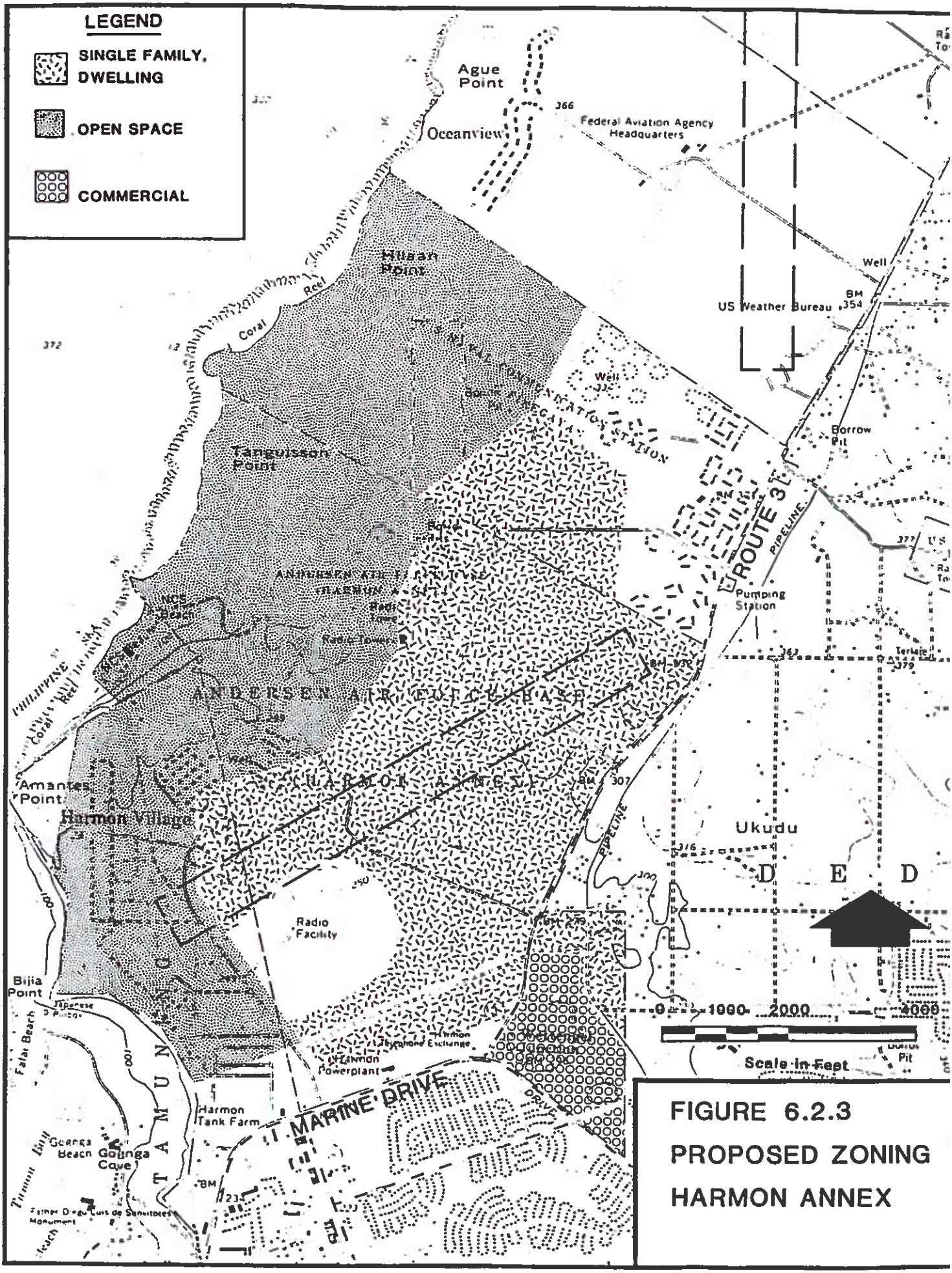


FIGURE 6.2.3
PROPOSED ZONING
HARMON ANNEX

6.2.10.3 Dandan Site. The Dandan site is located west of Route 4 in the Inarajan area in southeastern Guam. The proposed site does not contain any structures. However, portions of the proposed site are used for farming, primarily the growing of melons. Nearby land uses include the NASA Dandan tracking station, located about 4,000 LF north of the western edge of the proposed project site and a number of nearby residents to the east and south along Route 4.

A paved access road on U.S. Government right-of-way provides access to the NASA tracking station. NASA has ceased operations and the tracking station is held in caretaker status. The lease of the tracking station has been extended until June 1991.

The NASA access road is open to the public and used by visitors to Talofofo Falls Park, a privately-owned and operated park located on the Ugum River. The access road will have to be relocated, if the site is selected. Talofofo Falls Park is open seven days per week to the public for picnicking and swimming. Visitors must pay an entrance fee to enter the Park. Military personnel and Guamanians are the primary visitors of the Park.

The proposed Dandan site is privately owned and rights to use the property (either lease or purchase) would have to be acquired prior to development of the receiver. An area of 1,500 acres would be required for facilities and RFI-free zone (in fee); and 2,600 acres for RFI-free zone (restrictive easement).

The Guam Territorial Planning Commission has approved a proposed project called the Dandan Estates & Country Club near the Dandan site. The development would encompass about 500 acres and includes a 200-room hotel, 122 townhouses, 200 condominiums, and two golf courses.

6.2.11 Radio Frequency Interference (RFI)

See Section 3.2.11 for discussion of RFI-free zones. Figure 6.2.4 shows the existing RFI-free zones in northern Guam.

6.2.12 Explosive Safety

Storage facilities for explosives and ordnance have a designated safety radius, or Explosive Safety Quantity Distance (ESQD), based upon the Net Explosive Weight (NEW) handled in the facility. The types of buildings and structures, and activities within the ESQD arc are limited. An ESQD arc generated by the weapons storage area in Northwest Field is located near the northeast corner of the Runway site for Project P-223. Inhabited buildings will not be sited within the ESQD arc. Antenna poles, service road, communication and electrical cables will be within the ESQD arc. [Ref. 45]

6.2.13 Aesthetic Considerations

6.2.13.1 Northern Sites. The northern site and the Runway site are located within established DOD installations. As such, antennas and other

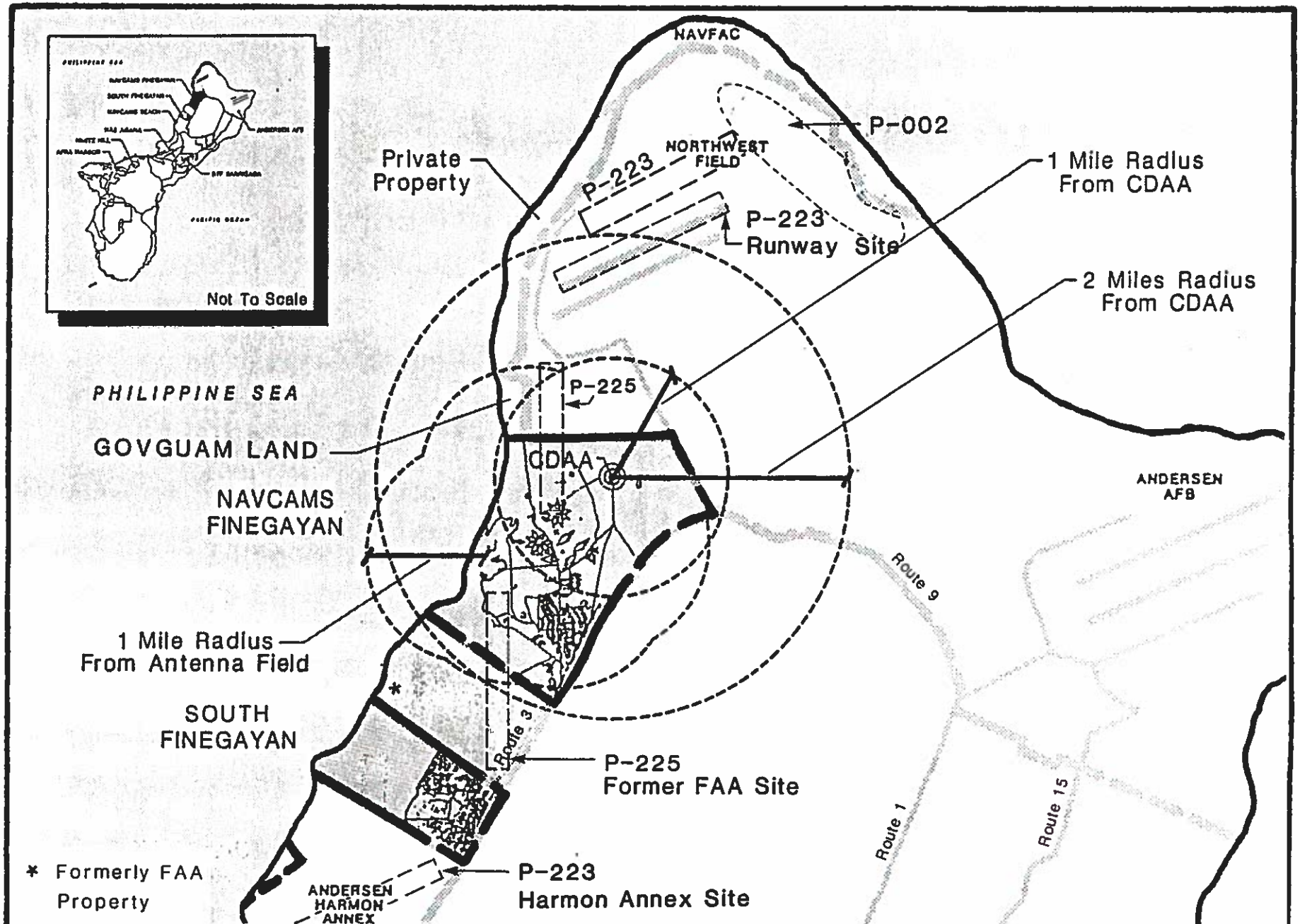


FIGURE 6.2.4
EXISTING RFI-FREE ZONES

electronic installations are located within the vicinity of the northern site and the Runway site. However, both sites are not visible from public roads which serve this area of Guam.

6.2.13.2 Harmon Annex Site. The Harmon Annex site is located east of Route 3 and north of Route 1, the main roadway in this area of Guam. Most recently, population growth and urban development have been occurring to the northern end of the island, which must be accessed by Route 1. The project site would be visible from both Routes 1 and 3.

6.2.13.3 Dandan Site. The Dandan site is located west of Route 4 on southeastern Guam. The Dandan area is primarily rolling foothills as contrasted to the northern flat areas. The Dandan project site would be visible from the south along Route 4 as the road is at a higher elevation.

6.2.14 Archaeological/Historical Resources

6.2.14.1 Northern Sites. An archaeological/historic resources survey was conducted on the northern site for Project P-223 between September and December, 1986. The survey found two isolated archaeological localities, one near the southeastern corner and the other on the northern edge near the center of the project. The complete archaeological resources survey is contained in Appendix G.

The Runway site for Project P-223 was surveyed during February 1989. A series of hardstands and building foundations were found between the runway and north parallel taxiway. As discussed below, the two parallel runways and connecting taxiways on Northwest Field have been nominated as a National Historic Landmark.

On June 9, 1986, the U.S. Department of Interior, National Park Service, Western Regional Office, nominated the two parallel runways and connecting taxiways on Northwest Field as a National Historic Landmark. [Ref. 46] See Figure 6.2.5 The nominated area is about 1,500 feet south of the northern site for Project P-223 and does not encompass any of it. However, the Runway site for Project P-223 would use the north runway for the receiver antennas.

The Northwest Field runways became operational in 1945 (the southern runway on June 1 and the northern one on July 1) and were the last of five to be completed in Guam and the Northern Mariana Islands. The 315th Bombardment Wing was based at Northwest Field and flew the only true variant of the B-29 to be manufactured, the B-29B. The 315th Bombardment Wing was assigned the specialized campaign mission of destroying the oil production facilities at the Utsube Refinery in Yokkaichi, Japan. [Ref. 46]

6.2.14.2 Harmon Annex Site. An archaeological/historic resources survey was conducted in March 1990. The survey found two sites, one related to the U.S. military presence on Guam and the other related to the Japanese presence. Further documentary data collection is recommened for the U.S. military site. No further data collection is necessary at the Japanese site. (See Appendix G-1)

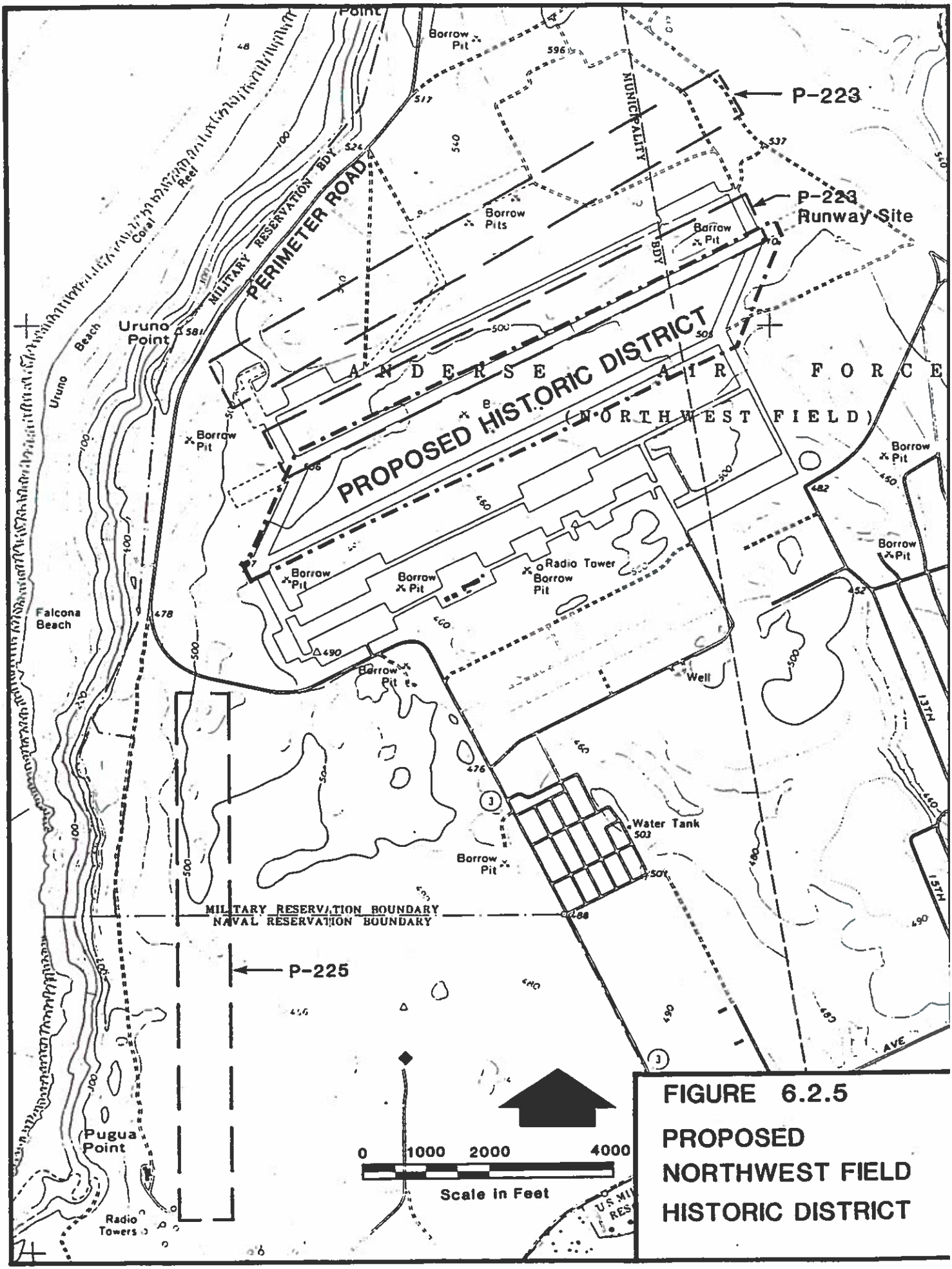


FIGURE 6.2.5

PROPOSED NORTHWEST FIELD HISTORIC DISTRICT

6.2.14.3 Dandan Site. The Dandan site was surveyed in February 1989. According to the results of the survey, two prehistoric pottery scatters were found on the eastern end of the site. No further data collection will be necessary on the Dandan site as the sites were not considered significant. (See Appendix G)

7.0 ENVIRONMENTAL CONSEQUENCES

7.1 TRANSMITTER SITES (TINIAN)

7.1.1 Introduction

This chapter describes the environmental consequences of constructing and operating the ROTHR system transmitter for Project P-223. The effects are organized according to the information presented in Section 6.0. Site specific direct effects are discussed for each of the alternative sites shown in Section 5.0. Impacts not associated with a site are discussed in Section 4.0.

7.1.2 Physiography and Topography

7.1.2.1 Northern Site. The northern site for Project P-223 is relatively flat with less than 1 percent slope. Cut material from the site will be reused for fill, to the extent feasible. Preliminary estimates show that total earthwork of approximately 200,000 CY of cut and fill will be required for Project P-223. Cutting, filling and grading the northern site will permanently alter the topographic conditions at the project site.

7.1.2.2 Western Site. The western site for Project P-223 lies at a contour elevation of about 210-215 FT. Preliminary estimates show that total earthwork of approximately 400,00 CY of cut and fill will be required at the western site for Project 223. Cutting, filling and grading the western site will permanently alter the topographic conditions at the project site.

7.1.3 Soils Characteristics

7.1.3.1 Northern Site. The Dandan and Chinen soils on the northern site are well drained as they were formed over porous coralline limestone. Runoff under these conditions is slow with only a slight hazard of water erosion or siltation to adjacent shoreline areas.

7.1.3.2 Western Site. Soils on the western site for Project P-223 are almost all of the Dandan-Chinen Complex. Since these soils are well-drained, they present only a slight erosion hazard. The western site is located well back from the shorelines and does not present a potential for siltation to shoreline areas.

7.1.4 Geologic Characteristics

See also discussion in Section 4.1.4.

7.1.4.1 Northern Site. The base of the antenna towers and the guy wire anchorage systems will require excavations below the existing ground during construction activities. The excavations will not alter the geologic conditions of the northern site.

Tinian is located in a region of seismic instability. Thus, the antennas will be subject to hazards from earthquakes. In the event of a severe earthquake and antenna failures, they would buckle at the point of failure. This design will confine any hazard from a severe earthquake to the project site.

7.1.4.2 Western Site. The area underlying the western site is relatively fault free, although nearby faults may extend beneath it at deeper levels. As previously discussed, any failure of the antenna towers will be confined to the project site.

7.1.5 Meteorology

See also discussion in Section 4.1.5.

Once construction of the transmitter is complete, impacts on air quality would occur from operation of the power plant and from losses associated with one 200,000 gallon fuel storage tank. Currently, three 1,200 KW generators are being planned for installation under Project P-223. Only one will be used to generate the necessary power for operation of the installations and support facilities. The remaining two will be used as an online standby and the other as an offline maintenance spare.

These generators would be housed in power plants and were assumed to operate at different load factor capacities to determine air quality impacts. The Defense Supply Center is conducting a marketing survey to determine contract fuel support for the fuel requirements for the transmitter. No additional fueling facilities are contemplated as part of any of the projects.

The U.S. Environmental Protection Agency (EPA) has published emission factors for stationary point sources of emissions such as engines used for generators. [Ref. 47] Based on the published EPA emission factors, the Nitrogen Oxides (NO_x) emission factor for the Waukesha generators [Note, the Waukesha generator is used as an example of the type of large bore diesel generator which might be used for power generation in Tinian.], and the demand power requirements for the system and support facilities, pollutant emissions from the power plant can be estimated. Analysis indicates the annual uncontrolled pollutant emissions from operation of the generator installed to operate the ROTHR system would be as shown below:

Uncontrolled Pollutant Emissions
Project P-223

	Tons/Year*
Particulates	16.6
Nitrogen Oxides (NO_x)**	180.6
Carbon Monoxide (CO)	43.7
Volatile Organic Compound (VOC)	4.9
Methane (0.5)	
Non-Methane (4.4)	
Sulfur Dioxide (SO_2)	19.6

* Based on: Operation of one 1,200 KW generator at .9722 load factor.
** Measured as NO_2

This analysis shows the primary pollutant of concern from the diesel engine generators is NO_x, which readily forms in the high temperature, pressure, and excess air environment found in these engines. Lesser amounts of carbon monoxide and hydrocarbons are also emitted. Sulfur dioxide emissions will usually be quite low because of the negligible sulfur content of diesel fuels. [Ref. 47].

The major variables affecting NO_x emissions from diesel engines are injection timing, manifold air temperature, engine speed, engine load and ambient humidity. In general, NO_x emissions decrease with increasing humidity. [Ref. 47]

Because NO_x is the primary pollutant from diesel fuel engines, control measures to date have been directed mainly at limiting NO_x emissions. The most effective NO_x control technique for diesel engines is fuel injection retard, achieving reductions (at eight degrees of retard) of up to 40 percent. Additional NO_x reductions are possible with combined retard and air/fuel ratio change. [Ref. 47]. The controlled pollutant emissions to operate each ROTHR System are shown below:

Controlled Pollutant Emissions
Project P-223

	Tons/Year*
Particulates	16.6
Nitrogen Oxides (NO_x)**	108.3
Carbon Monoxide (CO)	43.7
Volatile Organic Compound (VOC)	4.9
Methane (0.5)	
Non-Methane (4.4)	
Sulfur Dioxide (SO_2)	19.6

* Based on: Operation of one 1,200 KW generator at .9722 load factor.
** Measured as NO_2

Other NO_x control techniques exist but are not considered feasible because of excessive fuel penalties, capital cost, or maintenance or operational

problems. These techniques include exhaust gas recirculation (EGR), combustion chamber modification, water injection and catalytic reduction. [Ref. 47]

Air emissions from fixed roof fuel tanks occur under two conditions, breathing loss and working loss. Breathing loss is the expulsion of vapor from a tank through vapor expansion and contraction, which result from changes in temperature and barometric pressure. Working loss is a result of filling and emptying the tank. [Ref. 47]

The EPA has also published factors to estimate these emissions from fuel tanks. Based on these factors and the estimated fuel usage, the annual volatile organic compound (VOC) emissions from breathing losses and working losses for one tank would be about 9.4 tons per year. The tank would not be considered a major stationary source.

Construction and operation of the installations and support facilities will not alter the meteorology of the project sites or region.

The antenna array will be subject to typhoons. The antennas will have a wind design of 140 knots. The design of the antennas will confine adverse impacts from antenna failures to the project site.

7.1.6 Solid and Hazardous Waste

An incinerator will be constructed to dispose of solid and non-hazardous waste from the installations and support facilities. Based on a staff of 52 personnel (two military, 16 (O and M) and 34 base operations support (BOS) personnel) to operate Project P-223 and U.S. Navy design criteria, an average of 510 pounds/day of solid waste will be generated. Incineration of this solid waste would not create a significant adverse impact to air quality.

See also discusssion in Section 4.1.6.

7.1.7 Noise

Clearing and grading the project site and constructing the antenna array and support facilities will be done by a contractor. Noise in the area will increase during this period. Operation of the installation and the power plant will create long-term impacts in an area currently not subjected to this type of noise. However, since the project site is located within the military lease area and away from existing residential areas or public uses, these impacts will not be a public nuisance.

The generators, cooling radiator fans, and exhaust systems will be the primary sources of noise. As previously discussed, three 1,200 KW generators are being planned for installation under project P-223. Only one generator will be used to generate the necessary power for operation of the transmitter and support facilities. The generator will be housed within the power plant building, which will not be acoustically treated. Based on these factors, the generator would produce a sound level of about 58 dBA at 2,000 FT (the approximate distance between the power plant

building and the quarters, dining, and recreation building) from the power plant building. This noise level is similar to a urban neighborhood area.

7.1.8 Hydrology

7.1.8.1 Northern Site. Construction and operation of the transmitter and support facilities will not affect percolation of rainfall, as there will only be a minor increase in impervious surfaces over existing conditions. Thus, no adverse effects to groundwater resources are anticipated due to decreased percolation.

There are no existing potable water sources on the northern site. Potable water will be supplied from new sources in the general vicinity of the project area. The total withdrawal of water is not expected to be significant.

Groundwater resources and other nearby surface areas will be protected from fuel stored for the power plant. An impervious containment area will be constructed around and beneath the storage tanks to contain accidental spills or leaks. The containment area for Project P-223 will be sufficient to contain the contents of one fuel storage tank or 200,000 gallons. The impervious containment area will protect groundwater resources of Tinian against accidental spills or leaks. Thus, the ROTHR system should not have significant adverse effect to the groundwater resources of Tinian.

7.1.8.2 Western Site. The western site is located over the central ground water resource aquifer of Tinian. The water quality of the aquifer will be protected by the impervious containment area constructed around and beneath the fuel storage tanks.

There are no existing potable water sources on the western site. Potable water will be supplied for new sources constructed in the general vicinity of the project area. The total withdrawal of water is not expected to be significant.

7.1.9 Fauna.

See also discussion in Section 4.1.9.

7.1.9.1 Northern Site. Construction of the antenna array and ground screen, and support facilities will remove all vegetation from the northern site. Removal of vegetation will result in loss of wildlife habitat and ultimately loss of the fauna dependent on that habitat. However, replacement of grassy areas will provide some measure of habitat for migratory shore birds.

The bird survey found that the northern site provides habitat for a number of species including the Tinian Monarch, a Federally listed threatened species. No other Federally listed or candidate threatened or endangered species of mammals were located on the northern site. (See Appendix B and Appendix B-1)

The 1984 survey of the military lease area showed most species of birds found on the northern sites, including the Tinian Monarch, to be widespread on the island. Thus, although resident birds will be lost from the area to be cleared, the species present on the site, including the Tinian Monarch, are found in great enough densities elsewhere on the island that the loss will not significantly impact the island wide populations. See Appendix K.

The Island swiftlet, a Federally listed endangered species, was not observed in the 1984 survey of the military lease area nor was it observed during the survey of the northern site. Although this species was reported in southern Saipan in 1987, it has not been seen on Tinian since 1976. Based on the lack of sitings, these species may not be moving between Tinian and Saipan. Until the species are detected on Tinian and their habitat identified, the effect of removal of habitat on the Island swiftlet cannot be assessed.

The Common moorhen, a Federally listed endangered species, was not observed during the 1984 survey of the military lease area [Ref. 7] nor was it observed during the survey of the northern site. Since the Common moorhen is an aquatic species, it would not be expected on the northern site, as no freshwater wetland or other surface water occurs within the designated area. However, the Common moorhen is believed to exist in the wetland areas of Lake Hagoi located about 1-1/2 miles south of the northern site. Thus, removal of the vegetation on the northern site should not have a significant adverse effect on the Common moorhen.

Based upon a request from the U.S. Navy, the USFWS has issued a final biological opinion regarding construction and operation of the transmitter for Project P-223 at the northern site on Tinian. The biological opinion concluded there was no designated or proposed critical habitat on Tinian and that construction and operation of the transmitter at the northern site will not be likely to jeopardize the continued existence of the Mariana common moorhen or Tinian monarch. The U.S. Navy request to the USFWS for a biological opinion covered only the northern site, and not the western site. See Appendix K.

7.1.9.2 Western Site. The potential adverse effects to birds on the western site would be similar to the northern site. Removal of vegetation will result in loss of habitat and ultimately loss of fauna dependent on that habitat. Since the western site is surrounded by forested areas with a number of tall tress, shielding the antenna towers may be effective an effective mitigation on this site.

The western site is located south of Lake Hagoi, the Common moorhen habitat area. This site would not be in the presumed flight path between Tinian and Saipan.

7.1.10 Flora

7.1.10.1 Northern Site. Construction of the antenna arrays and ground screen, and support facilities would require removal of all vegetation on the northern site. After grading the antenna and ground screen sites,

grass or other suitable ground cover will be planted.

According to the botanical survey, vegetation of the northern site and support areas is primarily large trees and a jungle composed of vines. Since all of the northern site was probably previously cleared during World War II, the vegetation is secondary growth. None of the species found during the botanical survey are Federally listed or candidate threatened or endangered plants. Construction of the installation will not have a significant adverse effect to the flora of Tinian. (See Appendix C and Appendix C-1)

The total cleared area would be about 79 acres or about 0.5 percent of the total vegetated land within the military lease area.

7.1.10.2 Western Site. The western site currently contains extensive growth of tangantangan and large numbers of ironwood and poinciana trees. Based on the botanical survey, no Federally listed or candidate endangered or threatened plant species were found on the western site. (See Appendix C)

Construction of the transmitter antennas would require removal of all vegetation from the designated area. Cattle grazing occurs on about 20 acres of the western site. In addition, agricultural production of bananas and papayas occurs on (about 5 acres) the western site for Project P-223.

Although the botanical characteristics of the western site is not unique, construction of a transmitter on this site would remove the current agricultural use of the lands. The personnel exclusion fence would preclude cattle grazing and agricultural production within fenced areas. Current lessees of the land would have to relocate to other sites on the island or cease production.

7.1.11 Social and Economic Characteristics

See also discussion in Section 4.1.11.

Once construction is completed, the transmitter will be operated by a civilian contractor. These personnel positions will not be civil service. Two military personnel would be assigned to the transmitter on Tinian. Approximately 52 workers (two military, 16 operations and maintenance (O & M) and 34 base operations and support (BOS)) would be employed for Project P-223. Thirty-four (34) personnel would be housed in quarters near the transmitter and 18 personnel are expected to use housing in the town of San Jose.

Although not yet a major economic activity, tourism provides employment and income to the residents of Tinian. Currently, tourists arrive from Saipan via commuter flights to West Tinian Airport or via boat and then normally spend the day visiting sites on the island, including the North Field National Historic Landmark and the Memorial Cross at the northern tip of the island. The northern site for Project P-223 has been sited to ensure that the road to the Memorial Cross will remain open for

unrestricted use for motor vehicles or tour buses. Thus, the ROTHR systems should not have a significant adverse effect on tourist activities in this area of Tinian.

The western site is in an area normally not visited by tourists. Thus, siting the ROTHR projects on this site should not have a significant adverse effect on tourist activities on Tinian.

Hunting and other food gathering activities near the ROTHR transmitter will be restricted to areas outside of the personnel exclusion fence and the areas occupied by the personnel support facilities. No hunting or other food gathering activities will be permitted within the personnel exclusion fence. Hunting activities near any of the ROTHR systems which involve the use of firearms, bows, traps, or any other types of weapon will have to be restricted to areas established by a joint agreement by CNMI and Tinian authorities who control hunting and the ROTHR Facilities Commander. The extent of hunting and food gathering within the either project site is not known.

CNMI has raised strong objections to siting the ROTHR transmitter at the western site. Use of this site would mean that the military would retain the western site and the land area would be excluded from the leaseback area. CNMI prefers locating the transmitter in proposed exclusive use area at the northern end of Tinian. The Mayor of Tinian expressed this position in correspondence to the Navy and the Tinian Council passed a resolution supporting this same position. (See Appendix A) This position was restated in the public testimony during the public hearing held on Tinian.

7.1.12 Infrastructure

See discussion in Section 4.1.12.

7.1.13 Archaeological and Historic Sites

7.1.13.1 Northern Site. The archaeological and historic field survey and literature search indicated the site for Project P-223 is located north of the North Field National Historic Landmark, a property listed in the National Register of Historic Places. Construction of the antenna arrays and ground screens for Project P-223 site and the support facilities would not affect the historic value of the North Field National Historic Landmark, including in terms of visual impact. However, the mitigative measures to be discussed below will offset some of this impact.

Section 106 of the National Historic Preservation Act of 1966, as amended, requires a Federal agency with jurisdiction over a Federal project to take into account the effects of the agency's undertaking on properties included in or eligible for the National Register of Historic Places and, prior to the undertaking, to afford the Advisory Council on Historic Preservation a reasonable opportunity to comment on the undertaking. In addition, 36 CFR Part 800, Protection of Historic Properties, sets forth the procedures the Federal agency must follow to ensure that historic preservation concerns are accommodated with its proposed undertaking.

[Ref. 60] Furthermore, Section 110 (f) of the National Historic Preservation Act specifically notes that:

> Prior to the approval of any Federal undertaking which may directly and adversely affect any National Historic Landmark, the head of the responsible Federal agency shall, to the maximum extent possible, undertake such planning and actions as may be necessary to minimize harm to such landmark, and shall afford the Advisory Council on Historic Preservation a reasonable opportunity to comment on the undertaking. [Ref. 60]

The CNMI Historic Preservation Officer and the Tinian Historic Preservation Representative have been consulted by the U.S. Navy to develop appropriate mitigation measures for Project P-223 which are responsive to the historic values of the North Field National Historic Landmark. These mitigation measures will include: (1) additional archival data gathering especially focusing on the identifications and locations of facilities and activities associated with the two atomic bomb pits located in North Field; (2) photographic documentation of significant historic resources likely to be impacted by Project P-223 construction including a representative sample of those runways, hardstands, taxiways, building foundations and other such features that are most amenable to photography; and (3) disposition with the CNMI Historic Preservation Office of a complete set of collected archival documents, negatives, and prints of all photographs. (The photographs will follow the guidelines for photography established by the National Park Service.)

A Memorandum of Agreement (MOA) is currently being prepared by the U.S. Navy to ensure that the proposed mitigation measures will be satisfactorily implemented, and also to ensure that the public will have continued access to the significant historic resources located in the North Field National Historic Landmark. Signatory parties to the MOA will include the CNMI Historic Preservation Officer, the U.S. Navy, and the Advisory Council on Historic Preservation.

Project P-225 will involve construction of transmitter antennas on approximately 69 acres located entirely within the National Historic Landmark. Construction will involve alteration (construction will alter existing conditions) of part of the property within the National Historic Landmark and will introduce visual elements that are out of character with the other areas of the Landmark. Thus, based on these criteria, Project P-225 will have an adverse effect on the North Field National Historic Landmark. However, the visual effects will not be permanent in that the antenna arrays will be removed at the end of the operational life of the system. Also, the World War II historic features in the Project P-225 site that were encountered during the 1986 field survey will be reassessed for significance based on the findings of the archival study noted above.

The site for Project P-002 is located north of the North Field Historic Landmark District. The half-day walk-through archaeological and historic survey identified sites which will require further field and literature research to determine the significance of the sites.

7.1.13.2 Eastern Site. The archaeological survey of the eastern site revealed three sites, all remnants of World War II era Japanese structures. All three of these remnants were heavily damaged by bombing. Although the sites do not warrant preservation, if the CNMI Historic Preservation Office deems it necessary, additional limited data recovery would be performed prior to construction on the site.

7.1.13.3 Western Sites. The survey of the western sites revealed a number of small pottery scatters and remnants from U.S. military use of the sites. The western site for Project P-223 contained eight sites, four prehistoric pottery scatters and four former U.S. military sites. Construction of the transmitter would require removal of all of these sites. Two of the prehistoric sites contained surface and subsurface pottery scatters. Additional data collection would be necessary prior to construction on the site. The other two prehistoric pottery scatters would not require additional data collection prior to construction.

The four former U.S. military sites within the western site for Project P-223 included structural remains, foundations, roads, and walkways. Further data collection for these sites would be performed prior to construction, if deemed necessary by the CNMI Historic Preservation Officer.

7.1.14 Aesthetics

7.1.14.1 Northern Site. The northern site is located on the tip of Tinian in an uninhabited area. The relatively flat terrain of the North Field area and nearby existing dense vegetation should limit visibility of the antenna towers to short distances on Tinian. Notwithstanding this condition, the transmitter and support facilities will be an intrusion into the visual environment of this area of Tinian.

The northern site is located to the west of the trail which leads to the Memorial Cross on the northern tip of Tinian. The antenna towers, ground screen support facilities and personnel exclusion fencing for the northern site transmitter will be clearly seen by visitors to the Memorial Cross.

The northern tip of Tinian is about 2.75 miles south-southwest from the southern end of Saipan. Although the antenna towers will be constructed from lattice work and cable, they will be visible from portions of southern Saipan and from higher elevations in the central area of Saipan. As seen from Saipan, the antenna towers will be a contrast to the existing vegetation covered and undeveloped visual environment of this area of Tinian.

7.1.14.2 Western Site. The western site is located in an area used for cattle ranching and other farming activities. The western site has relatively flat terrain, tall trees, and other dense vegetation which should limit the visibility of the antenna towers to short distances. The antenna towers will be an intrusion into only a limited area of the visual environment of this area of Tinian.

The western site is located approximately 10 miles south - southwest of

Tinian and should not be visible from Saipan.

7.1.15 Electromagnetic Radiation

7.1.15.1 Radio Frequency (RF) Radiation. RF radiation is part of the electromagnetic radiation spectrum which applies to frequencies between 3 kilohertz (kHz) and 300 gigahertz (GHz). A variety of commercial communications and data systems are made possible by transmitting information via electromagnetic waves. For example, most amplitude modulated (AM) radio stations transmit signals in the frequency range of 550 kHz to 1,600 kHz, while most frequency modulated (FM) radio stations transmit in the frequency range of 88 MHz to 108 MHz. The ROTHR system transmits an frequency modulated continuous wave (FMCW) signal in the frequency range of 5 to 28 MHz.

As with all large radio transmitters, the RFEMR emitted by the ROTHR system can be harmful to humans, animals, combustible fuels and electronic equipment unless proper distances are maintained from the transmitting antennas. The factors which determine these proper distances are widely varied and complex when considering, for instance, what power levels become harmful to humans versus electronic equipment. To address these factors and to establish safe separation distances specific to ROTHR, the Space and Naval Warfare Command has prepared a publication titled "Electromagnetic Effects Associated with the Relocatable Over-the-Horizon Radar, short titled "ROTHR E^3 Study". [Ref. 3] The basis of the ROTHR E^3 Study is explained by the two objectives used to develop the document:

1. To present the U.S. nationally recognized standard and DOD policies concerning the safe exposure levels of personnel, volatile fuels, ordnance, and electronically controlled aircraft to non-ionizing electromagnetic fields.

2. To present calculations, studies and technical papers which determine safe separation distances from the ROTHR transmitting antennas in compliance with recognized standard and policies.

The ROTHR E^3 Study is available for public review. The following discussions are to present a summary of the topics addressed in the ROTHR E^3 Study as they apply to the alternative transmitter sites on Tinian.

7.1.15.2 Biological Exposure. Time varying electromagnetic fields, such as those previously discussed, have the characteristic of motion or propagation and are most often referred to as Electromagnetic Radiation (EMR). Unfortunately, RFEMR is often linked, erroneously, to the known biological hazards of ionizing radiation (X-rays, Gamma rays, and particle beam energies). Even moderate levels of ionizing radiation are dangerous because they have sufficient quantum energy to expel an electron from a molecule. This expulsion leaves the molecule positively charged and thereby affecting its interactions with neighboring molecules. In biological systems this ionization can alter their functions fundamentally and often irreversibly. [Ref. 61]

By contrast, the quantum energies from RFEMR are so much smaller that,

even at very high intensities, their primary effect is to agitate or vibrate molecular structure rather than to ionize them. The effect of this agitation is to produce heat. Beyond this distinction lies the primary concern; at what threshold do the biological entities begin to experience the effect of heat or hyperthermia caused by prolonged exposure to RFEMR?

To begin, at most population centers, ambient levels of RFEMR are from sources such as radio and television broadcasts and from naturally occurring electromagnetic radiation such as thunderstorms. In humans, the heat produced by such exposure is undetectable above the heat produced by the normal metabolic rate and physical activity. Even at moderate levels of intentional RFEMR exposure the thermoregulatory capability of mammals and birds can adequately accommodate dissipation of the added heat load. However, under sufficiently high levels of RFEMR exposure the thermoregulatory capacity becomes inadequate and the continuation of exposure will begin to distress or possibly damage the organism.

The knowledge that adverse effects to humans were sometimes associated with exposure to high powered radio signals has existed since the earliest times of radio communications. Over the last several decades research has emerged which describes the thresholds at which adverse effects will begin to occur. In identifying these thresholds and seeking to compare results of various experimental data, researchers developed specific methodology to quantify the "dose" of electromagnetic energy that an exposed subject had received. This methodology is called specific absorption ratio (SAR) and describes a dose of electromagnetic energy in terms of the amount of energy absorbed per unit time per unit mass or per unit volume.

The U.S. Air Force School of Aerospace Medicine has performed some of the most comprehensive analysis available concerning the mechanism by which energies from RFEMR are coupled to whole body biological entities. Their work is published and titled "Radiofrequency Radiation Dosimetry Handbook" report SAM-TR-78-22 (second edition) and SAM-TR-80-32 (third edition), copies may be obtained from the U.S. Air Force School of Aerospace Medicine, Aerospace Medical Division, Brooks Air Force Base, Texas.

On the basis of dosimetry and decades of experimental data, a consensus standard was developed by the American National Standards Institute (ANSI) to limit human exposure to RFEMR. [Ref. 75] The most recent release of the ANSI standard is the 1982, C95.1. The ROTHR system only operates between 5 and 28 MHz, known as high frequencies (HF), the ANSI standard specific for HF are given as follows: the free space plane-wave power density should not exceed a value greater than 900/F2 in units of milliwatts per centimeter squared (Mw/cm2) (where F denotes frequency in megahertz) for a period greater than six minutes. Since 1982, the ANSI subcommittee responsible for C95.1 has met at least once a year to review the new experimental data and to continually assess the validity of the standard. Recently, the subcommittee has considered the results of 321 of the most recent reports concerning the potential health effects of RFEMR. They have again concluded that the current recommendations presented in ANSI C95.1 remain applicable.

Using the recommendations published in the ANSI standard and an analysis of the ROTHR transmitter antenna patterns, the ROTHR E^3 Study has developed a personnel exclusion zone shown in Figure 7.1.1. The area will be enclosed by a continuous fence and will be conspicuously marked with appropriate warning signs. All power levels of electromagnetic fields which exceed the recommendations of ANSI C95.1 will remain well within the boundaries identified by the fence. The analysis which determined the fence location is presented in section 5.2.1 of the ROTHR E^3 study. This analysis considers all modes and aspects of the ROTHR transmitter operations and has been confirmed by direct measurement of the electromagnetic fields surrounding the ROTHR transmitter in New Kent, Virginia. [Ref. 3]

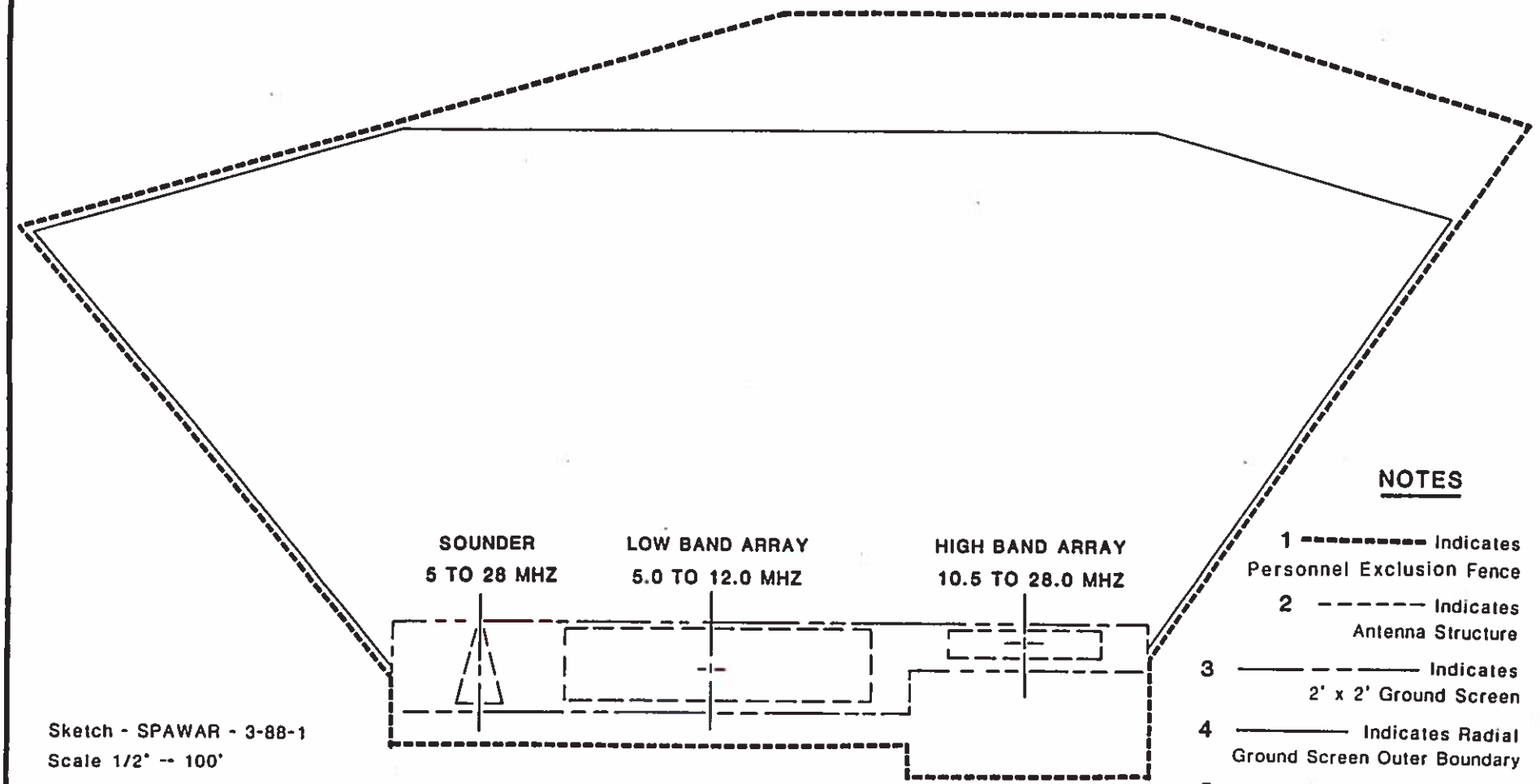
Animal species able to penetrate the fenced boundary were also considered in the ROTHR E 3 Study. Analysis presented in section 5.2.2 of the ROTHR E^3 Study shows that smaller animals are very inefficient absorbers of energy carried by HF electromagnetic fields. Using specific absorption rates developed by the School of Aerospace Medicine and calculating the maximum field strengths around the ROTHR antennas, the analysis shows that the ROTHR transmitter does not emit a powerful enough HF field to create an adverse rise in the body temperature of animals smaller than that of a beagle-sized dog. [Ref. 3]

Furthermore, as discussed in the ROTHR E^3 Study, no hazard exists to passengers of airborne vehicles in the vicinity of the transmitters at any range except for helicopters hovering within the zone.

7.1.15.3 Hazards to Fuel and Flammable Atmospheres (HERF). If a strong enough electromagnetic field is present when two metal objects contact one another, a small spark may be generated. If combustible liquids or vapors are present, an explosion may occur. For example, when the two metal objects are a fueling nozzle and an aircraft fuselage fuel fitting, there is potential for explosive detonation of fuel vapors or liquid depending upon factors such as volatility of the fuel, fuel/air ratio and strength of the spark. The ROTHR E^3 Study discusses the application of existing standards to ROTHR RF transmission characteristics in detail and provides guidance for the establishment of a restricted zone for combustible atmospheres. [Ref. 3]

No operations involving transfer of volatile fuels or flammable gases such as natural gas and propane will be permitted in the vicinity of the ROTHR transmitters on Tinian within the limits of the ROTHR HERF Restricted Zone depicted in Figure 7.1.2. Figure 7.1.3 presents a composite scaled overlay of the ROTHR HERF Restricted Zone for all three sites at North Field. Fueling operations outside of the given zone will not be at risk. Signs will be posted in areas with public access warning visitors about fueling activities. None of the proposed transmitter sites on Tinian will have any adverse effect on aircraft fueling operations at any of the surrounding airports.

7.1.15.4 Hazards to Ordnance (HERO). The ROTHR E^3 Study discusses in detail the hazards posed by electromagnetic radiation to various types of ordnance. Particular reference is made to standards developed by the U.S.



Sketch - SPAWAR - 3-88-1
Scale 1/2" -- 100'

Navy Space and Naval Warfare
Systems Command PMW-144
Washington D.C. 20363-5100

NOTES

1 ---------- Indicates Personnel Exclusion Fence

2 ------ Indicates Antenna Structure

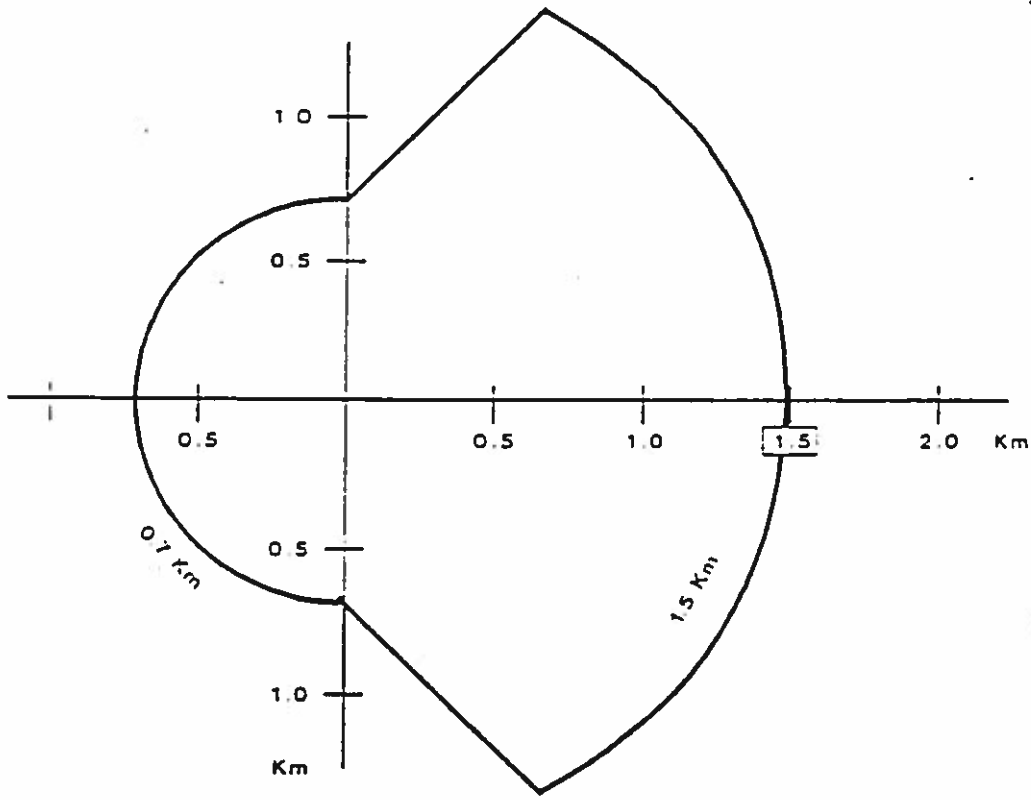
3 —— – – – – Indicates 2' x 2' Ground Screen

4 —— Indicates Radial Ground Screen Outer Boundary

5 Radiation is Measured as Power Density ($900/F^2$) Not to Exceed 1.15 MW/CH^2 at 6 Ft. Above Ground

PERSONNEL EXCLUSION AREA (ROTHR HERP ZONE)

FIGURE 7.1.1

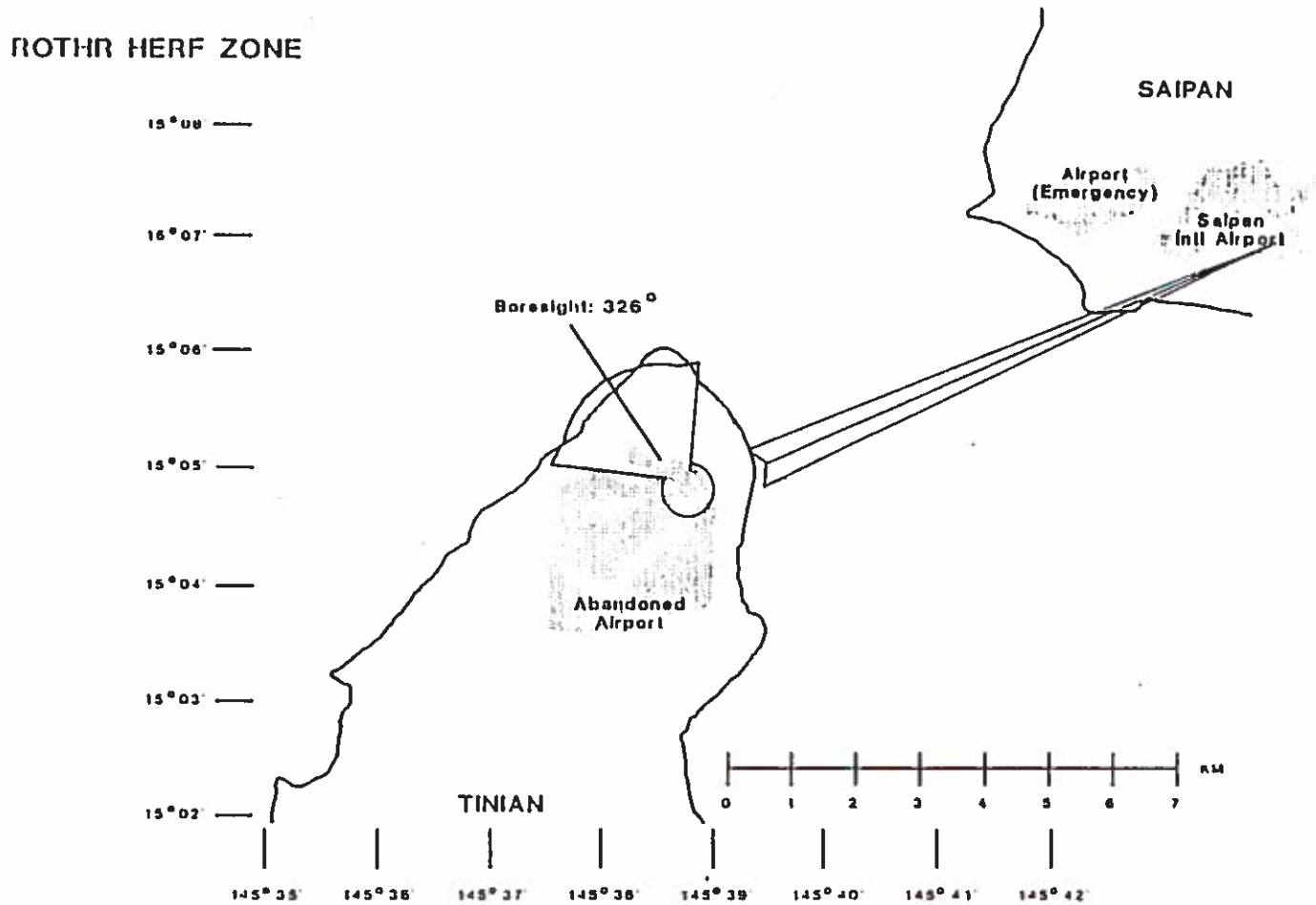


ROTHR HERF ZONE
28.0 MHz
0.0884 W/M^2

FIGURE 7.1.2

ROTHR HERF

RESTRICTED ZONE



COMPOSITE ROTHR HERF RESTRICTED ZONE

FIGURE 7.1.3

Navy, the leading agency currently involved in testing and certifying its ordnance systems to RF environments. Several restricted zones in the vicinity of the ROTHR transmitters have been identified outside of which various types of ordnance may be safely carried, handled, loaded, tested and disassembled.

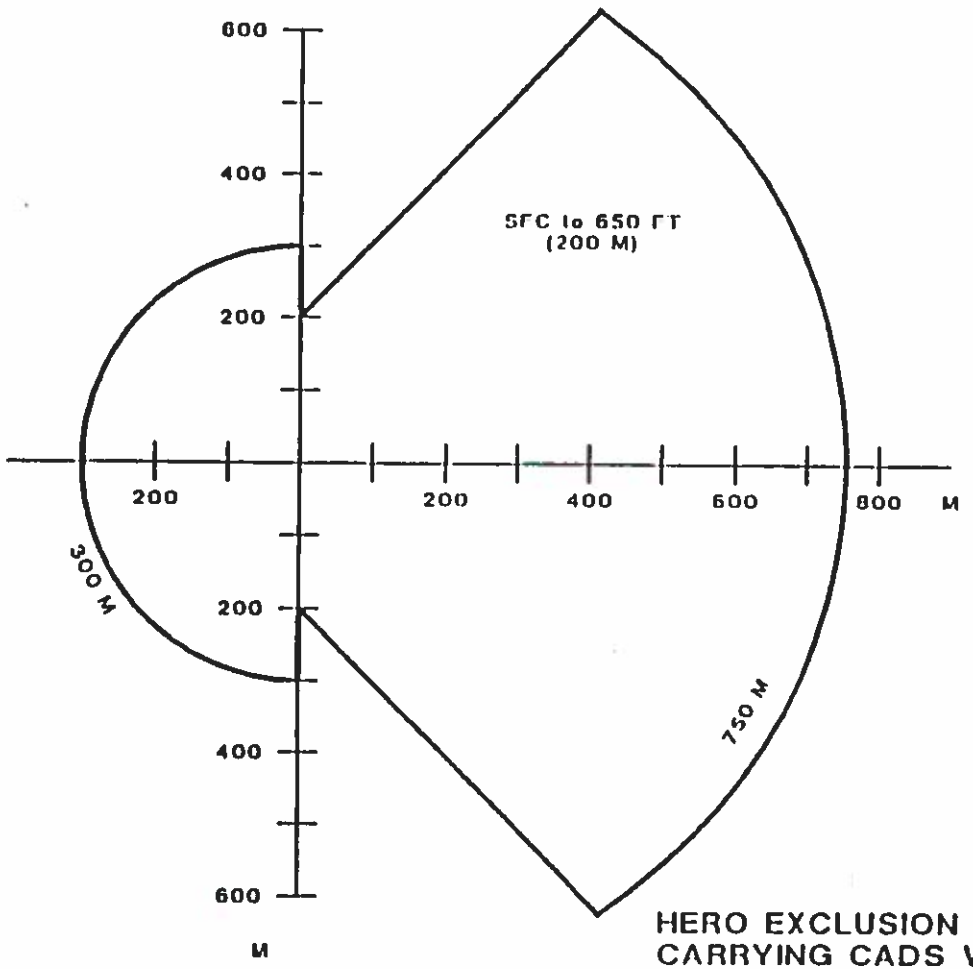
HERO Susceptible Ordnance. Civil or military aircraft containing only HERO SUSCEPTIBLE cartridge actuated devices (CADs) such as fire extinguisher actuators may normally be safely flown anywhere in the vicinity of the ROTHR transmitters. However, since some CADs have demonstrated susceptibility to RF emissions in the HF spectrum, restricted zone has been established extending 700 meters in front of the antenna and up to an altitude of 650 feet. All aircraft carrying CADs may safely operate outside of the limits of this zone. The boundaries of the HERO Restricted Zone for CADs is depicted in Figure 7.1.4. Figure 7.1.5 is a composite scale overlay of Figure 7.1.4 for the three proposed sites at North Field. Figure 7.1.6 shows the relationship of the Saipan International Airport instrument approach to the limits of Figure 7.1.4.

Flights of aircraft carrying other, more potent forms of ordnance (mostly military aircraft) will be restricted according to their degree of susceptibility to electromagnetic radiation. Ordnance or explosives certified HERO SUSCEPTIBLE in the presence of HF radiation greater than 10 or 20 volts per meter may be safely carried outside the limits of Figure 7.1.7. Figure 7.1.8 is a composite scaled overlay of Figure 7.1.7 for the proposed site at North Field. The largest restriction zone applies to 10 volt per meter susceptibility. The 20 volt per meter susceptibility zone is bounded by the smaller area.

For HERO SUSCEPTIBLE ordnance which has not been tested, operations must remain clear of the limits of Figure 7.1.9 until actual susceptibility limits of the ordnance are determined by test. Figure 7.1.10 is the composite scaled overlay of Figure 7.1.9 for the proposed site at North Field. Operations with HERO SAFE ordnance are unrestricted.

HERO Unsafe Ordnance. Ground operations involving the handling of ordnance as HERO UNSAFE should not be conducted within the boundaries of Figure 7.1.11. Activities which meet this criterion include munitions factories, ordnance depots and military airfields were ordnance is loaded, tested or otherwise handled in an unsafe configuration. When the ROTHR transmitter is located very close to the shoreline as with Tinian, the boundary shown in Figure 7.1.11 may be extended due to the more favorable propagation characteristics of seawater compared to land. The degree to which this will actually occur will be determined by the electromagnetic field strength survey which will be conducted as the system is activated. For analysis, Figure 7.1.12 presents a composite scale overlay of Figure 7.1.11 for the proposed site at North Field. No existing HERO UNSAFE activities have been identified within these restricted zones.

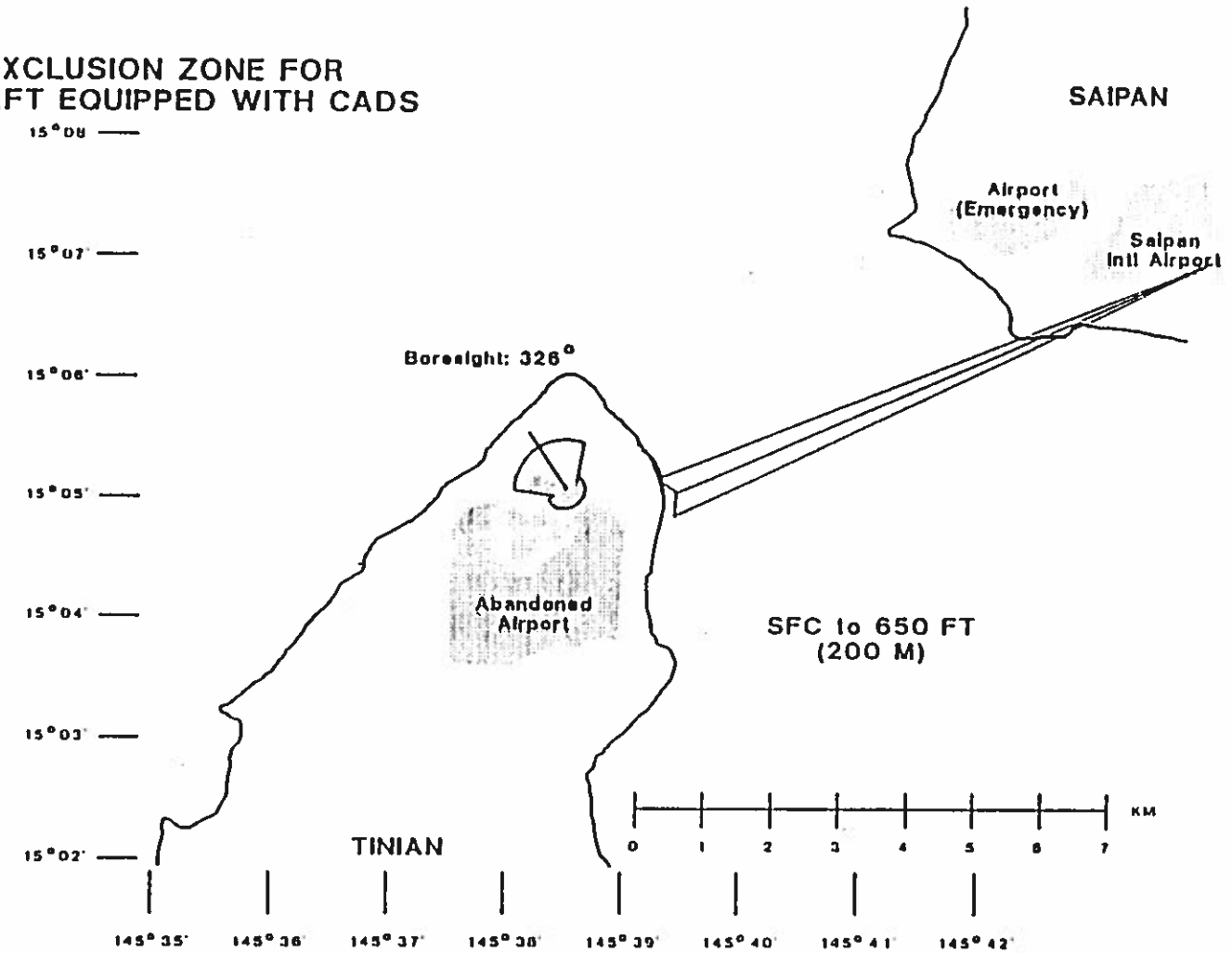
7.1.15.5 Radio Frequency Interference (RFI). RFI involves interference with one's use of the airwaves caused by another's use of the same medium. Examples are: Two Ham Operators talking on the same frequency or distortion of a local TV stations' signal caused by harmonics from someone



HERO EXCLUSION ZONE FOR AIRCRAFT CARRYING CADS WHICH ARE SUSCEPTIBLE AT 20 V/M OR GREATER WITH FUSELAGE ISOLATION OF 10 dB

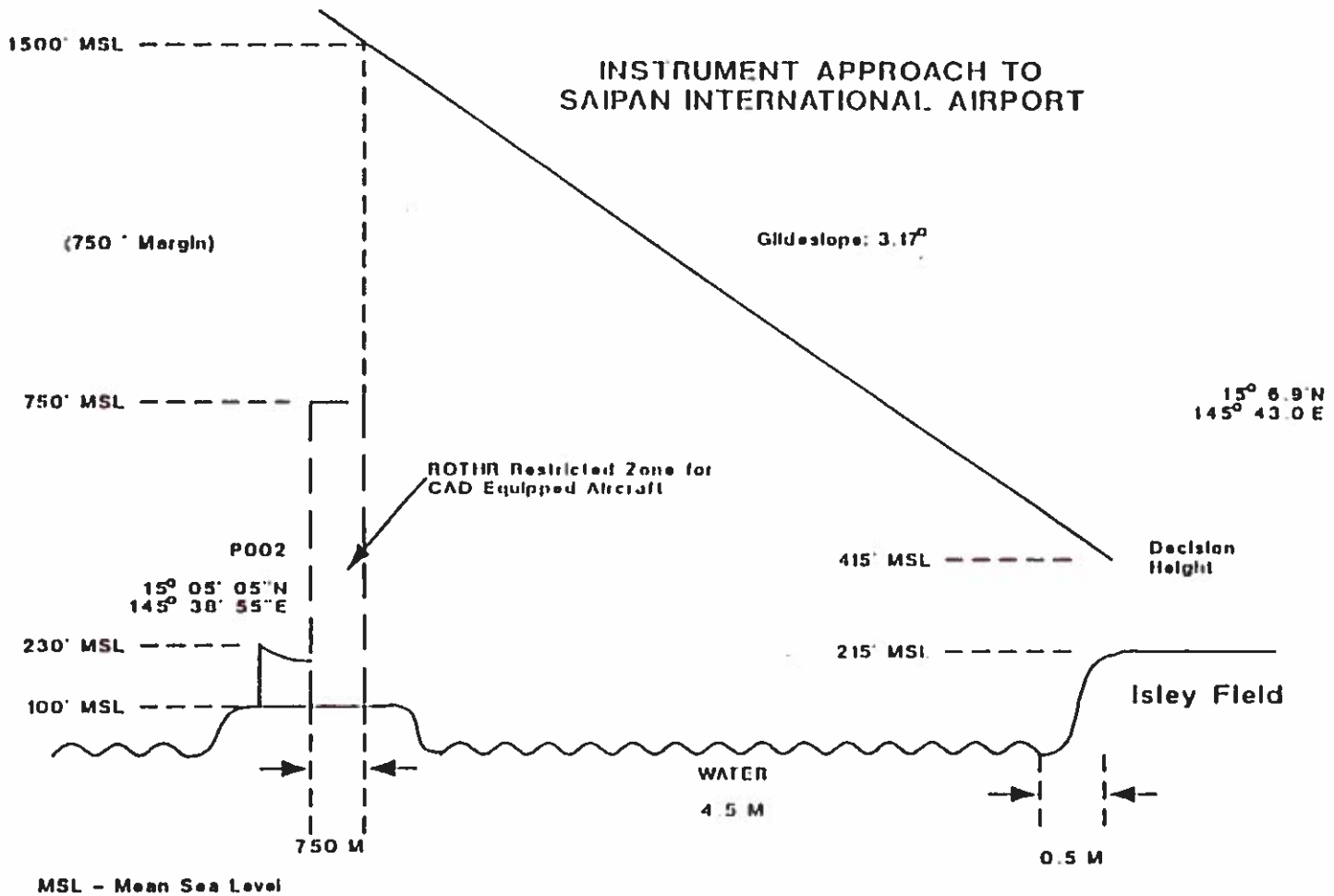
ROTHR HERO RESTRICTED ZONE

FIGURE 7.1.4



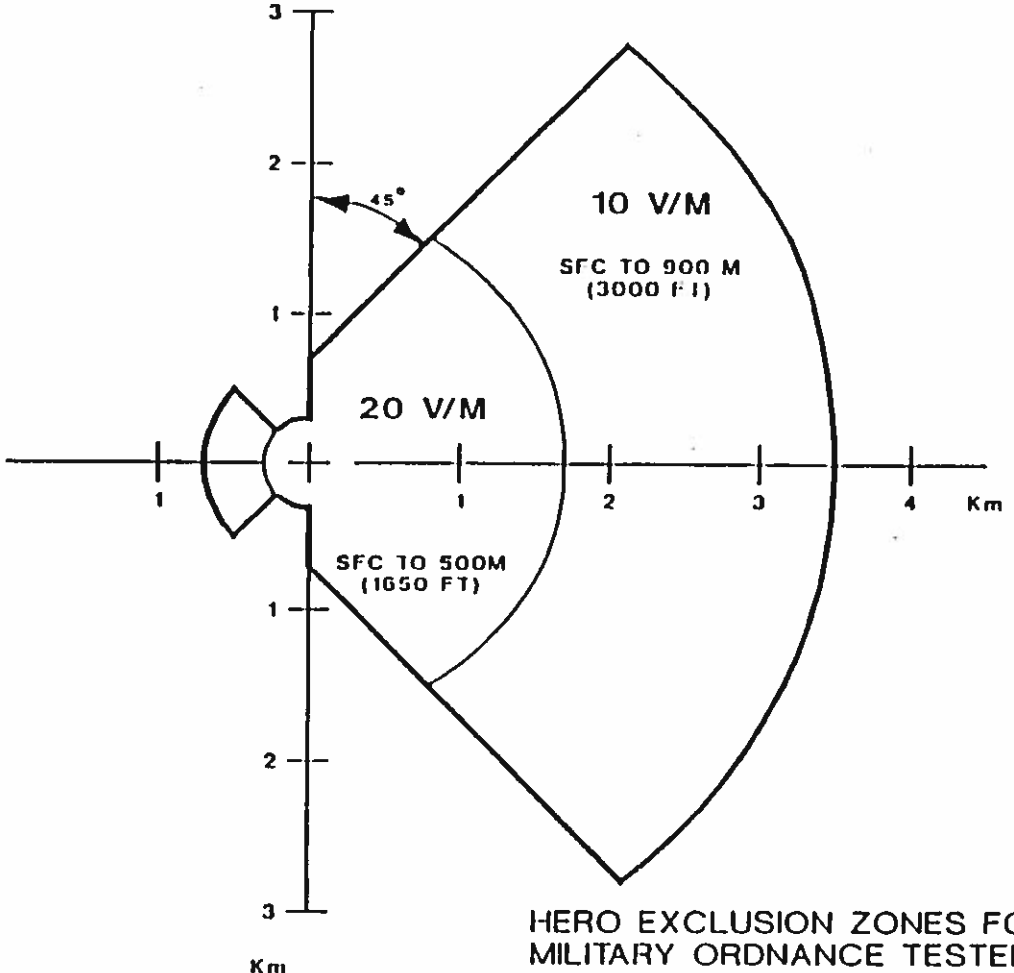
COMPOSITE ROTHR HERO RESTRICTED ZONE

FIGURE 7.1.5



INSTRUMENT APPROACH TO
SAIPAN INTERNATIONAL AIRPORT

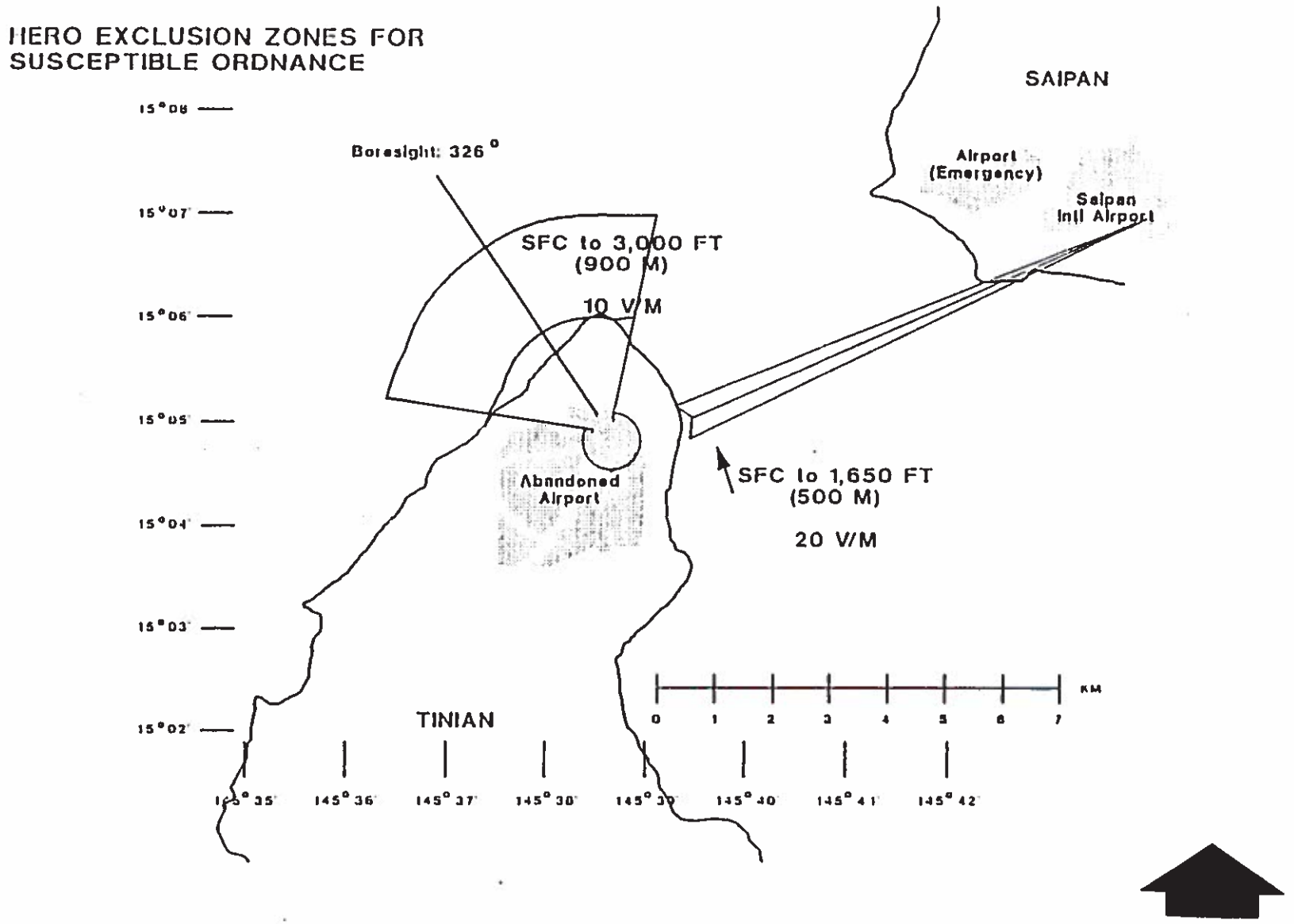
FIGURE 7.1.6



HERO EXCLUSION ZONES FOR MILITARY ORDNANCE TESTED AND CLASSIFIED AS HERO SUSCEPTIBLE AT FIELD STRENGTHS GREATER THAN 10 AND 20 V/M

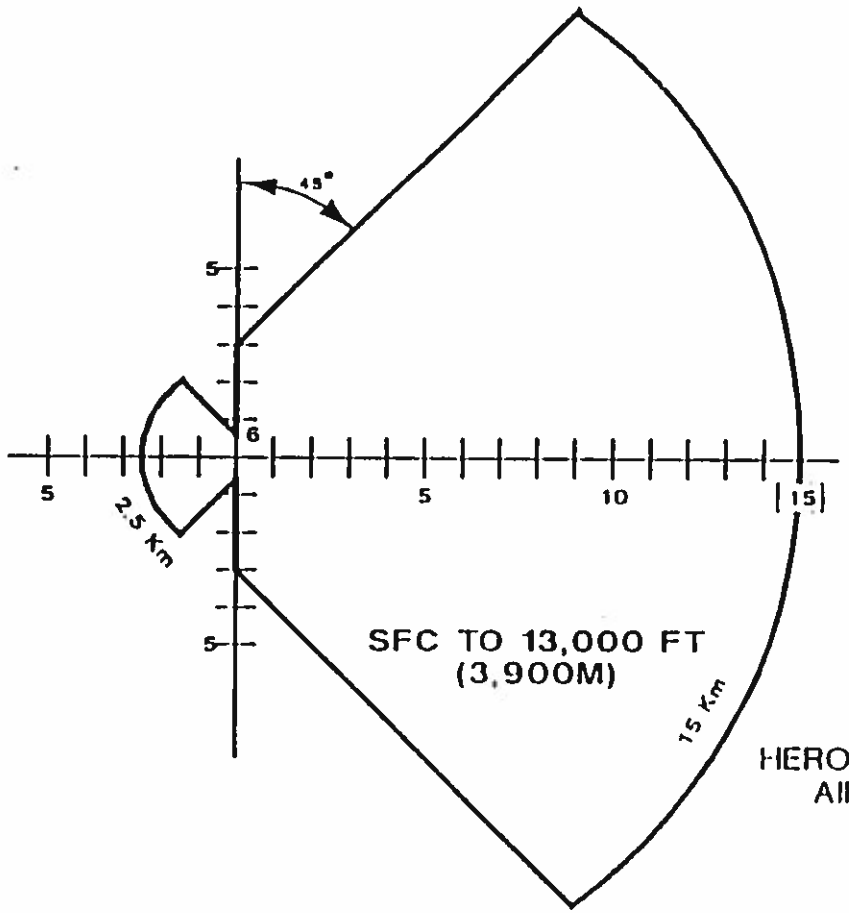
ROTHR SPECIFIC HERO SUSCEPTIBLE RESTRICTED ZONE

FIGURE 7.1.7



COMPOSITE ROTHR SPECIFIC HERO SUSCEPTIBLE RESTRICTED ZONE

FIGURE 7.1.8



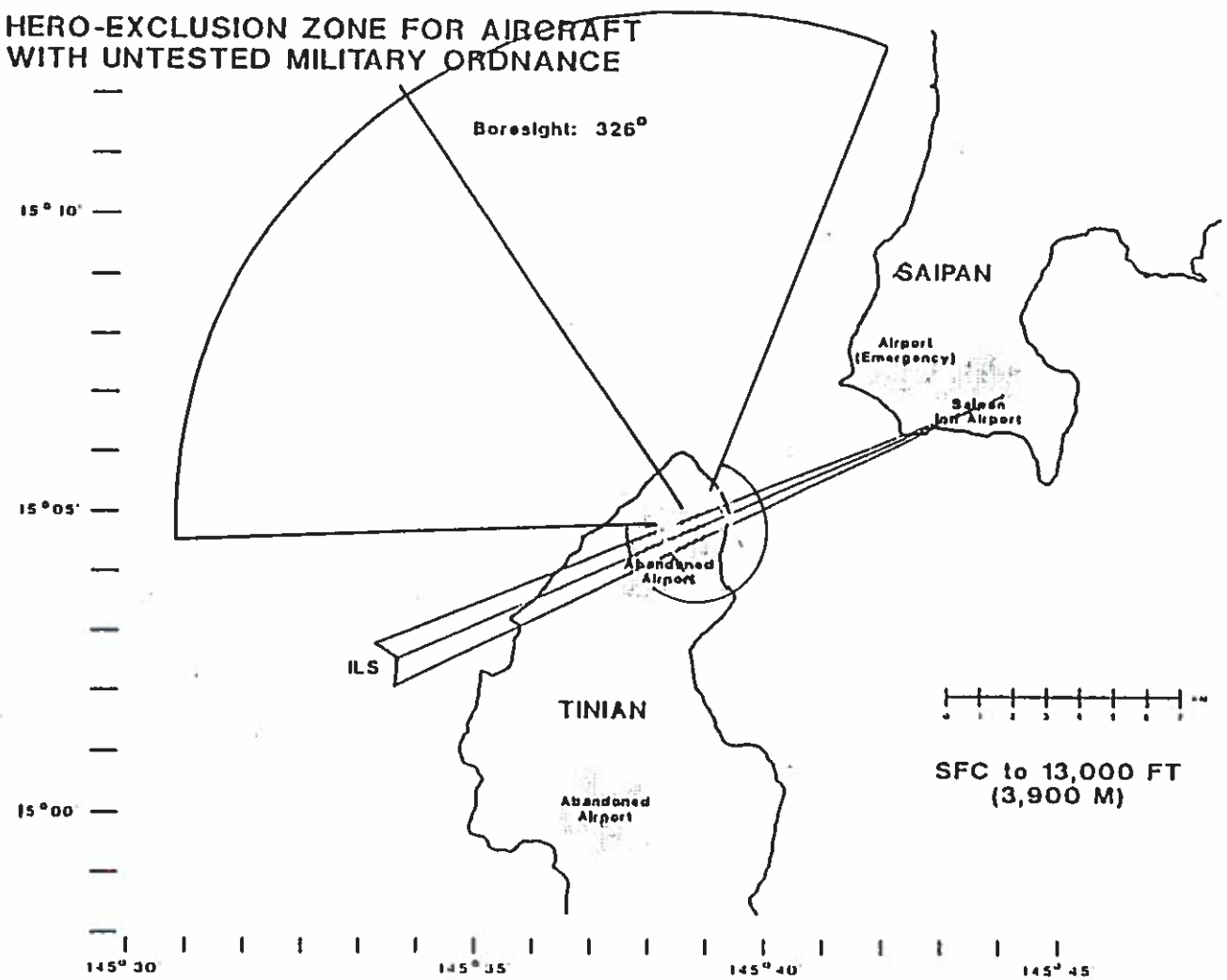
HERO EXCLUSION ZONE FOR MILITARY AIRCRAFT CARRYING UNTESTED ORDNANCE CLASSIFIED AS HERO SUSCEPTIBLE

(2.0 V/M)

ROTHR HERO SUSCEPTIBLE

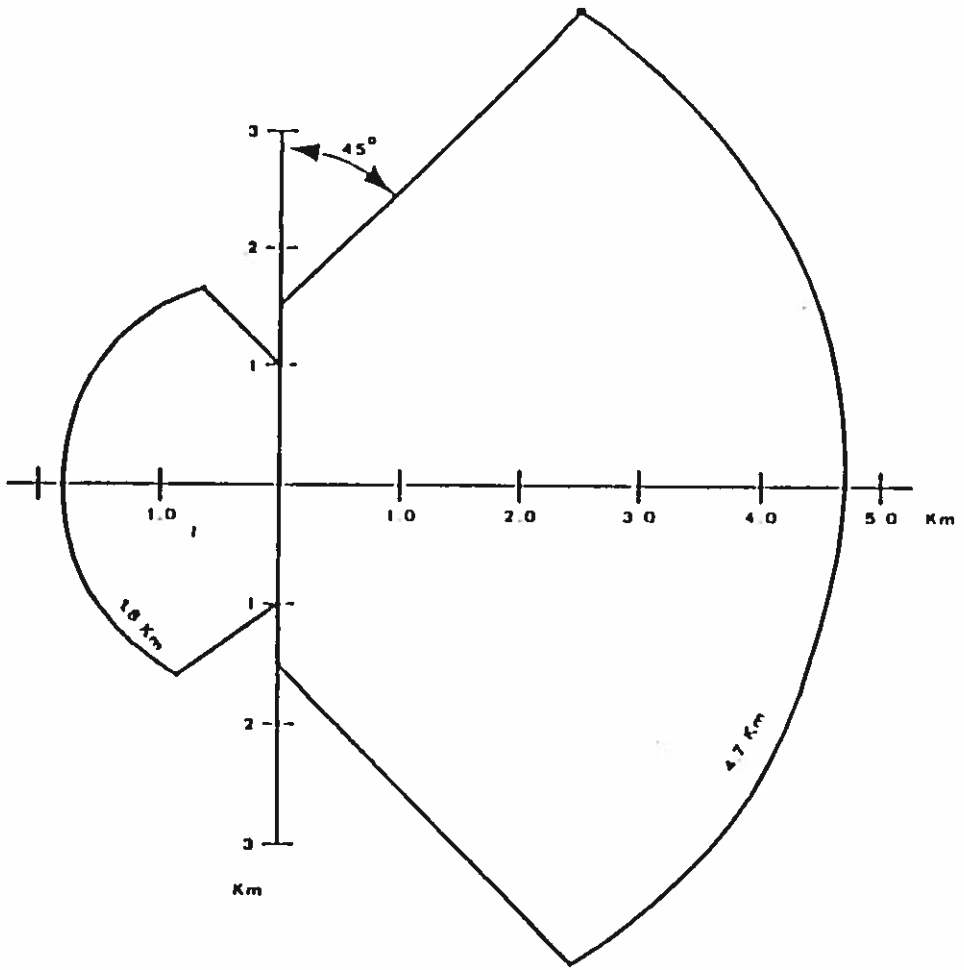
RESTRICTED ZONE

FIGURE 7.1.9



COMPOSITE ROTHR HERO
SUSCEPTIBLE RESTRICTED ZONE

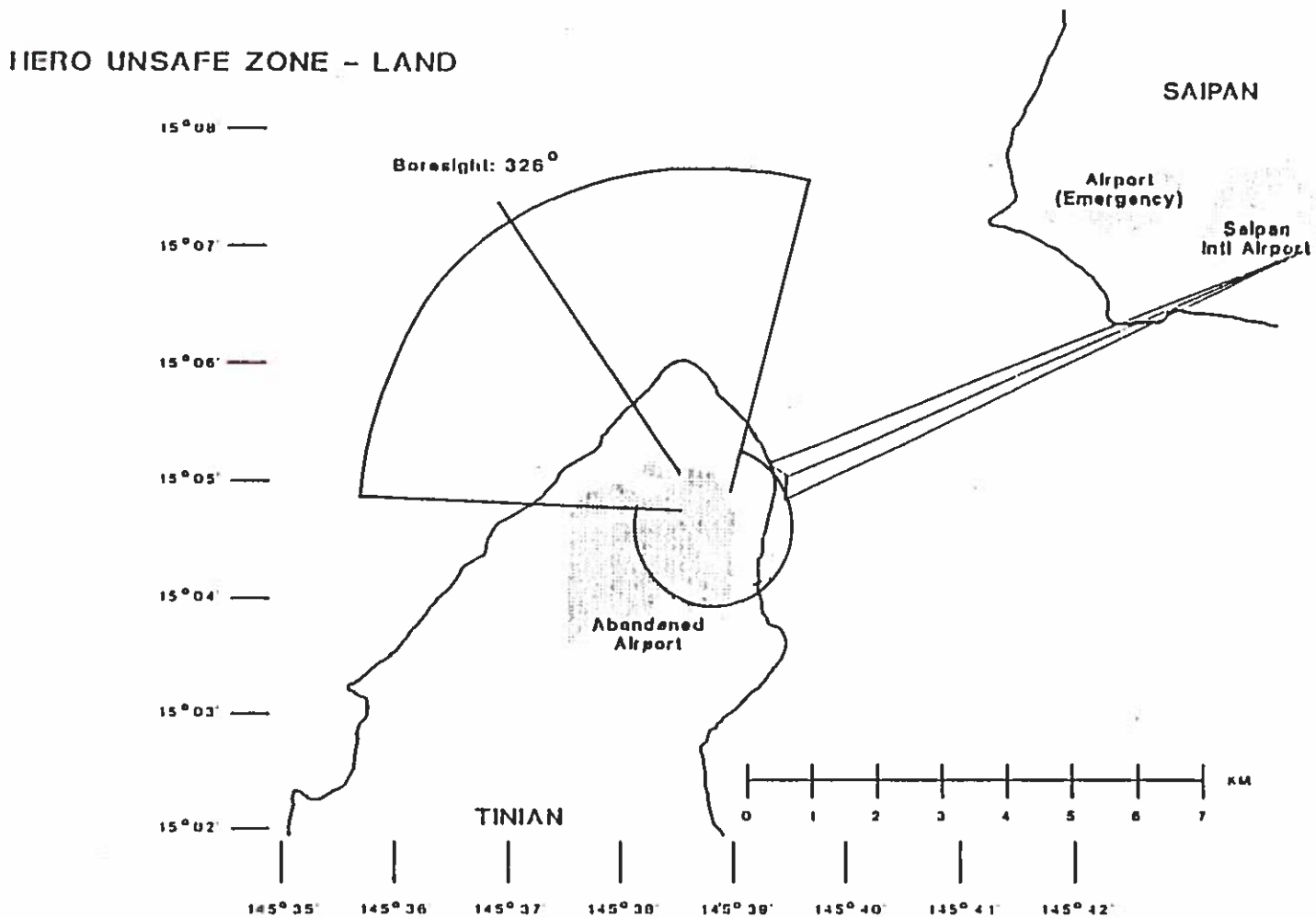
FIGURE 7.1.10



ROTHR HERO UNSAFE ZONE
GROUNDWAVE PROPAGATION - LAND

ROTHR HERO UNSAFE RESTRICTED ZONE

FIGURE 7.1.11



COMPOSITE ROTHR HERO UNSAFE RESTRICTED ZONE

FIGURE 7.1.12

else's transmission on a lower frequency. This type of interference is manifested in three basic forms:

1. Frequency Crowding - This is caused by two or more users all attempting to use the same frequency simultaneously.

2. Harmonic Interference - This occurs when a transmission at one frequency injects enough RF energy into higher frequencies that are harmonic multiples of the fundamental to interfere with users on those frequencies. Although all radio transmissions produce harmonics, most of the harmonics are too small to interfere with other users.

3. Front End overload - Because of limited dynamic range in the "front end" of many radio receivers, automatic gain control (AGC) circuits are often used to adjust this range up and down depending upon the strongest frequency present within this frequency coverage. The effect is analogous to turning the volume down on your radio when the music gets too loud for your ears (or your speakers) and then being unable to hear the music when it gets real soft. In the same way, the AGC in a radio receiver's front end might turn down the volume due to a strong signal at one frequency far enough to lose weak signals at all the other frequencies, including the frequency to which the receiver is turned. [Ref. 3]

The ROTHR transmitter will not transmit on any frequencies in the 5-28 MHz band that are reserved for dedicated use by others (e.g., Ham radio bands, search and rescue, land and sea mobile, etc.). The frequencies are blocked by the computer software according to a data base of prohibited frequencies programmed for each site.

Furthermore, when preparing to transmit the ROTHR transmitter selects its frequency by monitoring the band of interest for unused channels. This ensures that the system will not interfere with other users and also ensures that the radar will achieve its optimum performance. The ROTHR transmitter transmits on available channels on a "non-to-interfere" basis.

Harmonic content of the ROTHR signal is specified to be more than 80 dB (a factor of 100,000,000) lower in power than the primary signal. This fact will preclude harmonic interference with TV and radio stations, navigation aids, etc., that operate in the frequency bands above ROTHR. However, in the unlikely event that any harmonic interference is experienced, the fundamental ROTHR frequency that generates the interference can be added to the ROTHR's list of prohibited frequencies to correct the problem.

Experience with the prototype system operating in New Kent, VA, has produced no documented radio or television interference over the last two years although two towns exist within ten miles of the site and several houses stand within a few hundred yards of the transmitter.

7.1.16 Aeronautical Activities

7.1.16.1 Saipan International Airport. The northern sites are located on a bearing of S 71°W about 5.6 miles (approximately 29,600 LF) from the end of Runway 7 on Saipan International Airport. Analysis of Federal Air Regulations (FAR) Part 77, Objects Affecting Navigable Airspace, indicates the northern project site would be located under the approach surface for Runway 7. (The approach surface for a civilian airfield is defined as an imaginary surface longitudinally centered on the extended runway centerline and extending outward and upward from each end of the primary surface). The approach surface starts 200 FT from the end of Runway 7 and extends for 10,000 FT at a slope of 50 to 1 with an additional 40,000 feet at a slope of 40 to 1. Objects or structures protruding into this imaginary surface are considered an obstruction to air navigation. [Ref. 62] See Figures 7.1.6 and 7.1.13.

Based on wind conditions at the Airport, about 90% of the departures are to the east, or from Runway 7. Similarly, about 90% of the approaches would be on Runway 7 from the west. Based on a normal 3% glide slope approach, aircraft would be 900 to 1,000 FT above the North Field area when approaching Runway 7. [Ref. 63] Some of the transmit antennas will be 125 FT high. Thus, the northern project site will not adversely affect aircraft approach patterns to Runway 7 at Saipan International Airport.

The effects of ROTHR RF emissions upon aircraft operations at Saipan International Airport have been the subject of experiments conducted by the Naval Research Laboratories (NRL) and the Electromagnetic Compatibility Analysis Center (ECAC). These experiments were performed to specifically measure the coupling of the ROTHR transmitted signal to the instrument landing system (ILS) onboard aircraft. The FAA is currently reviewing the results of these experiments to determine the impact on ILS operations. No degradation of the ground-based or airborne radio-navigation systems is expected from operation of the ROTHR transmitter at the northern site on Tinian.

No restrictions must be applied to aeronautical activities at Saipan Airport which are incompatible with present or anticipated future operations. The FAA will make the final decisions as to the compatibility of the transmitters with the navigational aids at Saipan Airport. Although not anticipated, adjustments will be made to operation of the system to ensure compatibility with operations at Saipan Airport.

7.1.16.2 West Tinian Field. West Tinian Field is located about 1.5 miles south of the western site and two miles west of the eastern site. The Field is not equipped with navigational aids and primarily accommodates single engine air taxi operations to and from Saipan International Airport. Aircraft normally approach and depart to the east on Runway 8. Aircraft approaching Runway 8 from Saipan would circle in east of the western sites before landing at West Tinian Field. Aircraft departing for Saipan on Runway 8 would turn north before the eastern site. No adverse impacts are expected to aircraft operations at West Tinian Field.

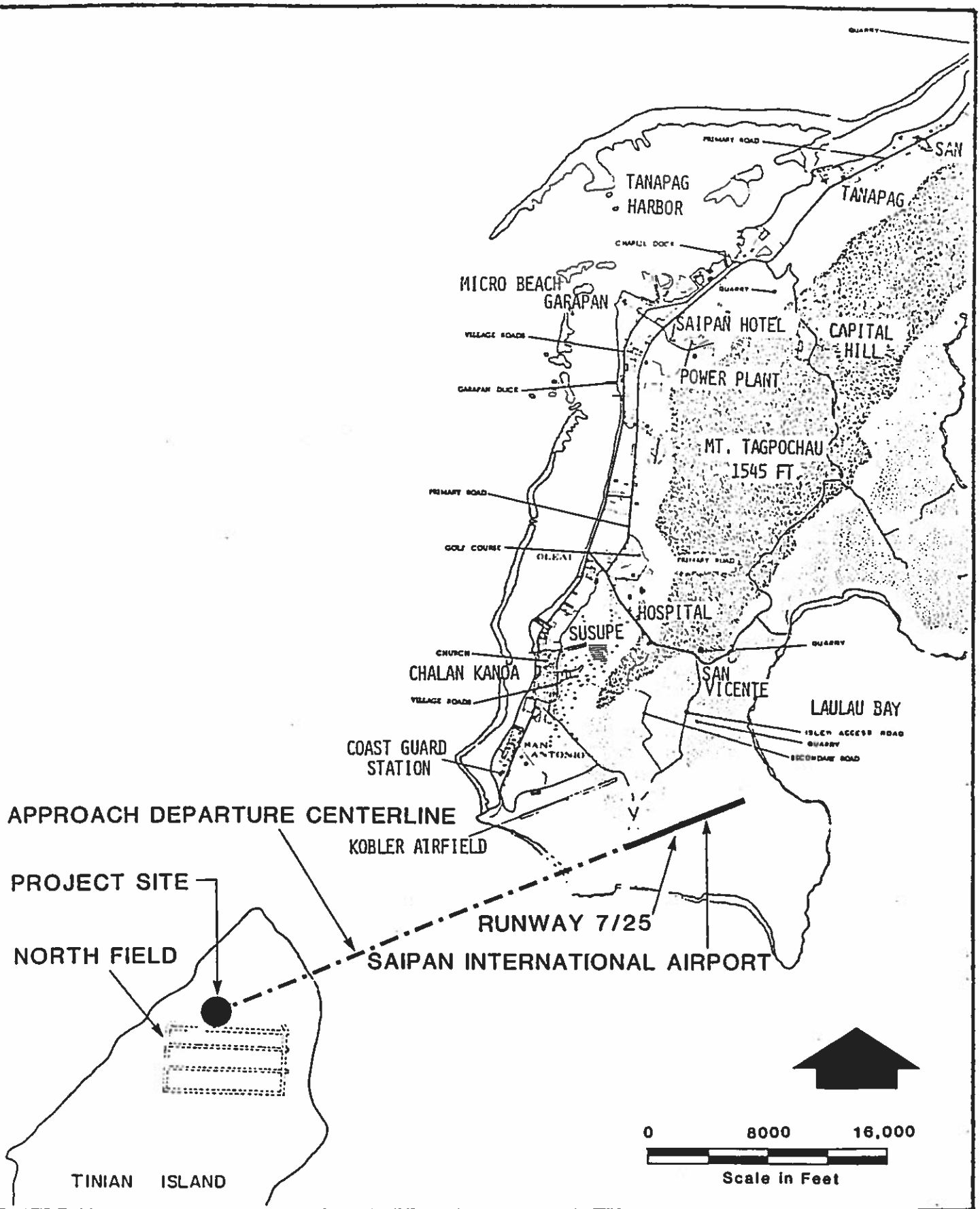


FIGURE 7.1.13

SAIPAN AIRPORT

7.1.17 Possible Conflicts Between the Proposed Action and the Objectives of Federal, State, and Local Land Use Policies and Controls

See Section 4.1.17 for discussion of the land use policies and controls.

The northern site is located within lands leased by the U.S. Government for defense purposes. However, notwithstanding the exclusion of Federal government lands, as previously discussed, the CNMI Coastal Resources Management (CRM) program provides that proposed projects on Federally excluded lands which have a direct and significant impact on areas subject to the CRM program shall be consistent with the CRM Rules and Regulations and applicable Federal and CNMI laws. The applicable CNMI policies set forth in Public Law 3-47 (CNMI Coastal Resources Management Act) are discussed below:

> Section 3. (3)(D) Improvement of Coordination Between Commonwealth and Federal Agencies

The Department of Navy, U.S. Pacific Fleet, Commander Naval Forces Marianas, Commander Naval Base Guam announced the ROTHR projects by letter, dated 26 January 1987 to Governor Tenorio. Subsequently, newspaper and newsletter articles were written describing the proposed project. (See Appendix A).

In addition, on 23 March 1987, representatives of the Department of the Navy, Commander Naval Forces Marianas, Guam and Department of the Navy Pacific Division, Naval Facilities Engineering Command Pearl Harbor, Hawaii met with CNMI agencies to discuss the proposed project and to solicit comments and concerns.

Subsequently, on December 24, 1987, the Department of the Navy, Pacific Division Naval Facilities Engineering Command published a Notice of Intent (NOI) in the Federal Register to prepare an EIS for the Construction of Electronics Installations on Tinian, CNMI, and on Guam, MI. The NOI solicited comments to be addressed in the EIS.

Scoping meetings to identify and narrow the issues to be addressed in the EIS were held on Saipan on February 3, 1988 in the Governor's conference room and in Garapan Elementary School. A scoping meeting was also held in the Tinian Social Hall, Village of San Jose, on February 4, 1988. A total of approximately 20 members of the public and CNMI agency personnel attended the meetings on Saipan. Approximately 80 members of the public, CNMI agency personnel, and Tinian officials attended the scoping meeting on Tinian.

Subsequent to publication of the DEIS in July 1989, the Department of the Navy held public hearing to solicit comments on the DEIS. Public hearings were held on Saipan in the afternoon and evening on August 16, 1989, and in the afternoon on August 17, 1989 on Tinian. The list of questions and comments from the public hearings are shown in Section 10.0.

> Section 3. (4) Plan for and manage any use or activity with the potential for causing a direct and significant impact on coastal

resources. Significant adverse impacts shall be mitigated to the extent practicable.

Bird strikes and collisions with the transmitter antennas and guy wires could be a significant adverse effect on the birds near the project site. Previous research has shown that bird strikes and collisions may be mitigated by using trees and other visible obstacles. The U.S. Navy will institute the specific mitigation measures set forth in Sections 4.4 and 8.5, Means of Mitigating Potentially Adverse Effects.

Accidental introduction of the Brown Tree Snake could cause a direct and significant adverse effect to the forest birds on Tinian, if it is introduced and becomes established. Cargo and equipment for construction and operation arriving on Tinian and originating in Guam or being transhipped through Guam have the potential for accidental introduction of the Brown Tree Snake. The U.S. Navy will institute the specific mitigation measures for Guam and Tinian discussed in Sections 4.4 and 8.5, Means of Mitigating Potentially Adverse Effects.

Section 3.(6) Provide for adequate consideration of the national interest, including that involved in planning for, and in the siting of, facilities which are necessary to meet requirements which are other than local in nature.

The transmitter sites for the proposed ROTHR project are sited in optimal locations considering technical and operational factors, accessibility and land ownership. In addition, the sites have also been located to minimize potential adverse effects to presumed bird flight paths and the North Field National Historic Landmark. The ROTHR projects are to provide for the strategic defense of the U.S. by providing wide area surveillance for at-sea battle groups.

Section 3.(9) Require any development to strictly comply with erosion, sedimentation, and related land and water use districting guidelines, as well as other related land and water use policies for such areas.

The northern site is located on the Northern Flatland of Tinian at an elevation of about 100 feet MSL. It is relatively flat with slope less than 1 percent with a gradual up slope to the west. The Dandan-Chinen complex soil is well drained with only a slight hazard of water erosion.

The western site is also well drained with only a slight hazard of water erosion.

Section 3.(10) Maintain or improve coastal water quality through control of erosion, sedimentation, runoff, siltation, sewage and other discharges.

Soils on the northern project site are well drained such that there will only be a slight hazard of erosion, sedimentation, runoff or siltation to nearby coastal waters. Septic tanks and leach lines will be used for sewage disposal. There will be no discharge of sewage. Other liquid

wastes will be disposed according to existing Navy regulations for handling such materials.

The western site will only have a slight hazard of erosion. No discharge of sewage or other liquid wastes will occur on the western site.

> Section 3.(11) Recognize and respect locations and properties of historical significance throughout the Commonwealth, and ensure that development which would disrupt, alter or destroy these, is subject to Commonwealth and any applicable federal and regulations.

According to the archaeological and historic field survey, the northern site for Project P-223 contained 12 archaeological and historic sites, none which were considered significant. The northern site for Project P-223 would not affect the historic value of the North Field National Historic Landmark. The support facilities for the ROTHR systems are also located outside the North Field National Historic Landmark.

As required by 36 CFR Section 800, Protection of Historic Properties, the U.S. Navy will initiate a Memorandum of Agreement (MOA) with the CNMI Historic Preservation Officer.

The archaeological and historic field survey found no significant resources within the western site. However, further data collection may be required at the site, if deemed necessary by the CNMI Historic Preservation Officer. Once the data collection is complete, construction of transmitters and support facilities could proceed.

> Section 3.(12) Recognize areas of cultural significance. Development which would disrupt the cultural practices associated with such areas shall be subject to a consultation process with concerned ethnic groups and any applicable laws and regulations.

A Memorial Cross dedicated to persons who drowned in a boating accident is located near the northern tip of Tinian. A dirt road located east of the northern site for Project P-223 provides access to the Cross. This road will remain open to visitors of the Memorial Cross. Other nearby roads leading to the Cross will remain open for unrestricted use.

> Section 3. (13) Require compliance with all local air and water quality laws and regulations and any Federal air and water quality standards.

Analysis of the pollutant emissions indicate the emissions from power plant required for Project P-223 would not be a "major stationary source", as defined by the CNMI Air Pollution Control Regulations. The Chief of the Division of Environmental Quality shall approve an application for a Permit to Construct and Operate, if the applicant can show to the satisfaction of the Chief that:

- The new source is designed, built, and equipped in accordance with reasonably available control technology, and

- The new source is designed and will be constructed or modified to operate without causing a violation of applicable rules and regulations.

The Permit to Construct and Operate shall be issued for any term not to exceed five years.

Sewage at either site will be disposed of through a septic tank and leach field. There will be no off-site disposal of sewage. Thus, water quality standards will be maintained. Similarly, the fuel storage tanks will be located within an area designed to contain any spill or leaks.

> Section 3. (14) Not permit, to the extent practicable, development with the potential for causing significant adverse impact in fragile areas such as designated and potential historic and archaeological sites, critical wildlife habitats, beaches, designated and potential pristine marine and terrestrial communities, limestone and volcanic forests, designated and potential mangrove stands and other wetlands.

The northern and western sites do not contain critical wildlife habitats, beaches, designated and potential terrestrial communities, limestone and volcanic forests, designated and potential mangrove stands and other wetlands.

The northern and western sites do not contain designated and potential historic and archaeological sites. The support facilities are located outside of the North Field National Historic Landmark.

> Section 3. (19) Discourage, to the maximum extent practicable, visually objectionable uses so as not to significantly degrade scenic views.

The northern site is located within the military lease area on the northern tip of Tinian. The relatively flat terrain of the North Field area and the existing dense vegetation should limit visibility of the antennas. However, the antenna towers may be visible from off-shore areas when looking toward the shoreline. Visibility should not extend more than a mile off shore. Considering the lattice and cable construction and the dense vegetation, the antennas should not be intrusive.

> Section 3. (21) encourage the preservation of traditional rights of public access to and along the shoreline consistent with the rights to private property owners.

The northern site is located on the Northern Flatland above the cliffline. Access to the shoreline areas will be consistent with existing policies for access within the military lease area.

The western site is located at a contour elevation of about 210-215 FT and not near the shoreline. Access to the shoreline areas will not be affected by this project.

7.1.18 Energy Requirements and Conservation Potential of Various Alternatives and Mitigation Measures

Energy will be required to construct and operate the electronic installations. The amount of energy used during construction will depend upon the type and number of pieces of equipment used by the construction contractor. This information is not known at this time.

The electrical system for the transmitter will use a secondary 120/208 volt, three-phase, four wire 60 hertz service. The total connected load for the electronic installations, with equipment and support facilities will be 4.2 MW, the demand load will be less. [Ref. 4] The ROTHR systems will not use the municipal utility system for power.

7.1.19 Irretrievable and Irreversible Resource Commitments

Site preparation and related construction activities would employ a wide variety of trades and skills, and machinery to ensure rapid completion of the transmitter and related support facilities. Most of the skills required are expected to be imported from other labor markets, though local workers and equipment will be used to the extent feasible.

Materials used for construction of the transmitter and related support facilities would be irretrievably committed during the period of operations. Once committed to the project site, use of the materials at other locations is not considered practicable.

Construction of the transmitter will require removal of vegetation currently used by certain bird species and other wildlife on Tinian. Once the vegetation has been removed, the transmitter areas will be maintained with low-growth vegetation or covered with crushed aggregate to control weeds. Forests and trees similar to those currently on the project site would not be allowed to grow back. The forests and resources on the project site will be irretrievably lost.

Previous surveys of native birds on Tinian indicate their ability to adapt to changes in land uses on the island. Thus, this commitment of resources is not a significant adverse effect.

7.1.20 Short-Term Use Versus Long-Term Productivity

Use of the either the northern or western site for the transmitter would preclude other uses, as the ground screen and reflecting area must be kept clear of structures and facilities to ensure efficient operation of the system. Once the transmitter and support facilities are dis-established, the project site could be used for other purposes as the surface disturbance will be minimal. Thus, the short-term use of the project site would not foreclose long-term productivity.

The electronic installation has a strategic defense mission that is in the interest of the national security of the United States. Thus, the long-term productivity from the use of the project site for the transmitter would outweigh any short-term losses from other uses of the

site.

7.1.21 Urban Quality, Historic and Cultural Resources

The transmitter and support facilities will be located within lands leased to the U.S. Government for defense purposes. There are no other structures or antennas located near the transmitter site. The relatively flat terrain near the northern and western sites, and the nearby existing dense vegetation should limit visibility of the XMTRs.

The transmitter on the northern site would be visible from off-shore areas, including Saipan, when looking toward the shoreline. The western site would not be visible from off-shore areas or from Saipan.
The transmitter and support facilities will be a contrast to the undeveloped character of most areas of the military lease area.

7.1.22 Means of Mitigating Potentially Adverse Effects

See Sections 4.4 and 8.5 for discussion of mitigation measures.

7.2 RECEIVER SITES (GUAM)

7.2.1 Introduction

This chapter describes the environmental consequences of constructing and operating the ROTHR system receivers. The effects are organized according to the information presented in Section 6.2. The site specific-direct effects are discussed for each of the alternative sites considered. If the consequences are similar regardless of the alternative sites, the impacts are discussed in general.

7.2.2 Physiography and Topography

7.2.2.1 Northern Sites. The northern sites and the area for support facilities will be cleared by mechanical means of all vegetation and other features and graded to specified requirements of the receiver. This clearing will be confined to the 850 LF wide by 8,700 long area (approximately 172 acres) for the northern site and about 110 acres for the Runway site. There will be no removal of vegetation or cutting of trees outside of the specified clear area. Once preparation of the site has been completed, the antennas will be erected and the anchoring systems and ground screen will be completed.

Cut material will be re-used for fill, to the extent feasible. Based on aerial photographs of the northern sites, preliminary estimates show that there will be a balance of cut and fill material. Total earthwork of approximately, 1,800,000 CY of cut and fill will be necessary for the northern site and about 1,300,00 CY for the Runway site. Cutting, filling and grading the project site will permanently alter the topographic conditions of the northern sites.

7.2.2.3 Harmon Annex Site. The Harmon Annex site slopes from east to west. Preliminary estimates on the cut and fill required for the Harmon

Annex site is about 1,300,000 CY.

7.2.2.4 Dandan Site. The Dandan site has a gradient from east to west and includes a ravine on the eastern tip. Preliminary estimates on the cut and fill required for the Dandan site is about 3,200,000 CY for the Project P-223 alignment.

7.2.3 Soil Characteristics

The construction contractor will be responsible to devise a plan for review and acceptance by the U.S. Navy and coordination with GOVGUAM agencies, that will address grading plans and erosion control measures.

7.2.3.1 Northern Sites. Soils on the northern site for Project P-223 and the Runway site are permeable and well drained. Erosion and runoff should not be significant upon completion of construction as the northern sites are relatively flat. Portions of the cleared site will be covered with low-growth vegetation and portions with crushed aggregate. Runoff will percolate through the either portion and should not create erosion problems to nearby areas.

7.2.3.2 Harmon Annex Site. Soils on the Harmon Annex site are similar to the northern sites. Erosion and runoff should not be significant upon completion of construction, as there is only a minor slope.

7.2.3.3 Dandan Site. Soils on the Dandan site are primarily silty clays which have moderate to moderately slow permeability. The cut and fill required to create a site for construction of the RCVR could be described as a "level table plateau." The raised area could result in runoff of material to nearby areas, including the Tinago River, during rainy periods. The silty clay soils have a moderate hazard for water erosion.

7.2.4 Geologic Characteristics

7.2.4.1 Northern Sites. The bases of the antenna and anchoring systems will require excavations below the existing ground surface. These excavations will be compacted during the construction activities. They will not alter the geologic conditions of the northern sites.

Guam is a seismically active area. Thus, the antennas will be subject to hazards from earthquakes. In the event of a severe earthquake and antenna failures, they would collapse to the base or buckle at the point of failure.

This design will confine any hazard from a severe earthquake to the project site.

7.2.4.2 Harmon Annex Site. Construction of the RCVR should not alter the geologic conditions of the Harmon Annex site. The antennas would be subjected to the same earthquake hazard as the northern sites.

7.2.4.3 Dandan Site. The Talofofo Fault lies about 5 miles north of the Dandan site and extends from Talofofo Bay to the west end of Orote

Peninsula. This fault is the closest major fault to the Dandan site. Based on the fault locations, the antennas at the Dandan site should be subjected to less geologic hazard than the northern sites.

7.2.5 Meteorology

Clearing and grading of any of the project sites could create dust, if conducted during the seven month dry season, from December to June. This impact would occur during the clearing period. Water spraying of the area being cleared will be used to mitigate adverse impacts from dust. Upon completion of construction, the major portion of the project site will be covered with low-growth vegetation or crushed aggregate. Thus, significant adverse impacts to air quality from dust should not occur.

Vegetation on the project site will be disposed of by on-site burning within a secure area surrounded by exposed bare mineral soil. Necessary permits would be obtained by the contractor prior to burning operations. The construction contractor will be notified by the U.S. Navy of the requirement to allow the removed vegetation to be sufficiently cured prior to burning to prevent excessive smoke during burning operations. This requirement will minimize adverse effects from smoke during burning of vegetation.

Once construction is complete, impacts on air quality would occur only during periods of emergency generator use. One 400 KW emergency generator would be needed to support each OCC and one 400 KW emergency generator for each receiver. These periods of generator use are not predictable. However, if the generators were to be operated for 30 days per year, about 2.5 days per month, for 24 hours per day, the nitrogen oxides emissions, with control measures, would be 0.25 tons/year. As a comparison, the Clean Air Act define a "major stationary source": as any stationary source which emits, or has the potential to emit, 250 tons per year or more of any air pollutant regulated under the Clean Air Act. Thus operation of the stand-by emergency generators should not cause significant adverse impacts to the air quality on Guam.

Construction and operation of the RCVRs at any project site will not alter the meteorology of the project site or region.

The antennas will be subject to typhoons. The antennas will have wind design of 140 knots. The design of the antennas will confine adverse impacts from antenna failures to the project site.

7.2.6 Solid and Hazardous Waste

The antennas and ancillary equipment used by the receivers will not contain any hazardous substances. Thus, the environmental resources of the project site and other nearby areas will not be affected by hazardous substances.

Solid and non-hazardous waste from the operation of the receivers and ancillary facilities will be collected and be disposed according to standard Navy procedures. The operations contractor will be notified of

this requirement.

7.2.7 Noise

Clearing the project site and constructing the antennas will be done by a contractor. Noise in the area of the project site will increase during this period. Since the northern site and the Runway site are not located near residential areas or public roads, these impacts will not be a nuisance. Similarly, long-term noise impacts from operation of the installation at either the northern site or the Runway site will not be a public nuisance.

Each emergency generator will be housed within a power plant building located near the receiver or OCC. Each of the receivers would require one 400 KW generator and one OCC will require one 400 KW generator for use in emergency situations. The periods of generator use are not predictable. However, if the generator were to be operated in an emergency situation, the noise be about 63 dBA at 500 LF during operation of the 400 KW generator. This noise level is typical of urban areas.

The Harmon Annex site is located near Navy family housing and other residences located along Route 3. There will be an increase in noise during the construction period which may create some annoyance. Long-term noise should not be a public nuisance at the Harmon Annex site as the receivers do not create significant noise.

The Dandan site is located near residential housing near Route 4. Noise from construction activities could present a public nuisance to these residents. Once construction is complete, long-term noise impacts will not be a public nuisance.

7.2.8 Hydrology

7.2.8.1 Northern Sites. Construction and operation of the receivers and support facilities will not adversely affect percolation of rainfall, as only a minor portion of the required area will be covered with impervious surfaces.

Both the northern site and Runway site are located within the groundwater resource area of northern Guam. Groundwater resources and other nearby surface areas will be protected from accidental spills or leaks from the emergency generator above-ground diesel fuel storage tank. An impervious containment area will be constructed around and beneath the tank to contain spills or leaks. Thus, ground water or other nearby surface areas will not be adversely affected by the installation.

There are no existing potable water sources on the northern site or the Runway site. Required potable water will be obtained by connecting to existing water supply lines.

7.2.8.2 Harmon Annex Site. The Harmon Annex site is also located over the ground water resource area of northern Guam. The ground water and other nearby areas will not be adversely affected by the RCVRs.

There are no existing potable water sources on the former Harmon Annex site. Required potable water will be obtained by connecting to existing water supply lines.

7.2.8.3 Dandan Site. Southeastern Guam, the location of the Dandan site, does not contain significant ground water resources. Since the Ugum River flows about 1-1/2 miles north of the Dandan site, there will no significant adverse effects to this surface water resource.

The Tinago River and tributary drainage are located on the western edge of the Dandan site. A drainage system to permit water flow through the receiver site will be required to permit un-interrupted flow of the River.

There are no existing potable water sources on the Dandan site. Required potable water will be obtained by connecting the existing water supply lines.

7.2.9 Fauna

The general decline of the bird population is a great concern on Guam. Loss of habitat from vegetation clearing for the receivers or other adverse impacts could be a serious threat to the declining bird population of the island. The USFWS has listed ten bird species and two bats as endangered species on Guam. GOVGUAM has listed 15 bird species and three bats as endangered species. At the time the USFWS listed these species, August 27, 1984, designation of areas of critical habitat was not considered prudent. The USFWS indicated that a determination of critical habitat would result in no known benefit to the species involved. [Ref. 66]

7.2.9.1 Northern Sites. As previously discussed, much of northern Guam has been proposed as essential habitat, a designation used in recovery plans to identify important habitat areas and to show areas where habitat should be preserved for reintroduction of endangered forest birds and bats. Essential habitat is not defined in the Endangered Species Act and not afforded the Federal protection established for critical habitat. Notwithstanding this distinction, extensive loss of habitat could adversely affect the ability of any of the endangered species to continue to exist in the wild or to be re-introduced at a later date, should the Brown Tree Snake be controlled.

Construction of the RCVRs would require removal of vegetation and grading the sites to meet operational requirements. This clearing would be confined to the approximate area of the receiver. No clearing of vegetation or cutting of trees outside of the designated area would be required. The staging area for the construction contractor will be outside of the designated project site on existing paved areas of the former airfield. Topographic data is still required to establish finish array elevations and to confirm existing terrain elevations at any of the northern sites. However, based on preliminary topographic data available for Project P-223 on Northwest Field, excavation or removal of trees and other vegetation in front of the reflecting area will not be required. Similarly, the other northern sites would not require excavation or

removal of vegetation in front of their reflecting areas.

Based on these clearing requirements and the information collected from the botanical survey, the approximate amount of forested area to be cleared is shown below:

Project	Forested Area to be Cleared
P-223 (Northern site)	172 acres
P-223 (Runway site)	110 acres*

* Includes use of the North runway for the receiver antennas.

Clearing the forested areas for construction of the antenna arrays will cause the remaining Mariana crows and kingfishers in the these areas to seek other habitat. Estimates vary on the amount of habitat available on Guam for the endangered bird species. These estimates range from approximately 17,300 acres to 24,700 acres on northern Guam and from 42,000 to 49,400 acres on all of Guam. (The lower estimate of habitat was developed by GOVGUAM Division of Aquatic and Wildlife Resources based on 1986 aerial photographs and includes adjustments for recently developed lands. The higher estimate was developed by the Fish and Wildlife Service based on 1983 mapping data which used 1975 aerial photographs.) [Ref. 67] The estimates for northern Guam include undisturbed limestone forest, broken forest of mixed vegetation types, and scrub forest. The botanical surveys on the northern sites confirm this general description of the vegetation types.

Based on the clearing for the northern site and the Runway site and estimates of available habitat, the range of possible loss of habitat from construction of each project is shown below:

Project	Cleared Area	Range of Habitat Loss N. Guam*	Range of Habitat Loss All Guam**
P-223 (Northern site)	172 acres	0.7 - 1.0%	0.3 - 0.4%
P-223 (Runway site)	110 acres	0.5 - 0.6%	0.2 - 0.3%

* Based on area of 17,300 to 24,700 acres.
** Based on area of 42,400 to 49,400 acres.

As shown, depending upon the assumption of available habitat and the selected site for Project P-223, the range of habitat loss for northern Guam will be about 0.6 percent for the Runway site to about 1.0 percent for the northern site. The botanical surveys show the northern site and Runway site are second growth limestone forest. Thus, these areas are similar to habitat available in northern Guam for the remaining native forest birds.

Although information about the habitat requirements of birds in Guam is not well established, limited information suggests that the kingfisher and Mariana Crow occur at their highest densities in undisturbed mature

forest. This is the type of forest was not identified in either the northern site or the Runway site.

There are a number of reasons for the decline of the various species of native forest birds, including decreases in undisturbed native forest and predation by the Brown Tree Snake. Of these two reasons, predation by the Brown Tree Snake has been shown by GOVGUAM to be the overriding cause of the decreased populations of native forest birds. The expanding range of the Brown Tree Snake has matched the pattern of decline of many of the native forest birds.

Available information suggests that the northern plateau and coastline of Guam were last areas to expereince the spread of the Brown Tree Snake population on the island. Snakes are now found in Northwest Field and AAFB. Predation by the snake on the eggs and young is believed to be the significant reason for the endangered status of the crow and kingfisher.

The decline in population of the Mariana Fruit Bat is thought to be from a combination of snake predation and illegal hunting. Most recent surveys (1988) indicate a population of less than 500 to 600 individuals are on Guam. Poaching of this species remains a significant reason for their decline. Bats are prized as a fiesta food, and illegal hunting is lucrative.

Upon completion of construction, the area occupied by the antenna arrays and ground screen will be closed to all types of hunting. An agreement between the Air Force and the Navy will be completed to determine the exact boundaries in which hunting will be restricted. The Navy will have the responsibility for maintaining security for each antenna area. This security would be in addition to the current measures maintained by Andersen Air Force Base personnel. The increased security should help to decrease instances of illegal hunting of fruit bats in the areas of the antenna arrays.

Clearing, filling and grading would remove the project site as habitat for the endangered bird species. Most likely, the remaining forest birds would no longer be seen within the cleared areas under current population conditions and with snake predation. However, under normal resident bird population conditions, one would expect to see, on occasion, species such as starlings and migratory shorebirds using the cleared area for foraging.

Similarly, although no fruit bats were seen within the northern site or the Runway site, (the individual noted in the bird survey was outside of the designated sites) the area which includes the northern site and the Runway site has been included as the proposed essential habitat for reintroduction of these species. Habitat within DOD controlled areas would provide some protection to fruit bats as access into these lands is normally restricted.

Birds striking the antenna arrays or anchoring systems during normal movement or migration could have an adverse affect to the bird population. However, the single pole antennas without guy wires would minimize the chance of collisions or bird strikes. Moreover, the GOVGUAM Department

of Aquatic and Wildlife Resources has indicated no knowledge of bird strikes to the numerous antennas on the island. [Ref. 56] Research on the island of Yap has indicated no reported cases of bird strikes to a 1,000 foot LORAN-C tower and anchoring system located there. [Ref. 68] Thus, it is highly unlikely that bird strikes or collisions with the receiver antenna arrays will have any adverse impact on the bird population of the island.

Eight species of birds, in addition to Guam's endangered forest birds, inhabit or have been known to inhabit the areas on or near the northern and Runway sites. These include the Philippine turtle dove, Streptopelia bitorquata; Eurasian tree sparrow, Passer montanus; black drongo, Dicrurus macrocerus; rock dove, Columba livia; black francolin, Francolinus francolinus; yellow bittern, Ixobrychus sinensis; lesser golden plover, Pluvialis dominica; and the white-tailed tropicbird, Phaethon lepturus. Construction of the ROTHR projects are expected to displace several bird species, however, the open areas created by the project are likely to increase the habitat available for the lesser golden plover, Eurasian tree sparrow, black francolin, black drongo, and yellow bittern. The White-tailed tropicbird nests in coastal cliffs and is not expected to be adversely affected by the proposed project.

Eight species of mammals, in addition to Guam's endangered bats, are known to occur on or near the proposed ROTHR project sites. These include the feral pig, Sus scrofa; Guam deer, Cervus unicolor mariannus; black rat, Rattus rattus; Polynesian rat, Rattus exulans; house mouse, Mus musculus; musk shrew, Suncus murinus; feral dog, Canis familiaris; and the feral cat Felis catus. Many of the aforementioned mammals are considered undesirable or pest species. Although the proposed projects are likely to displace many of these mammals, the overall populations of these animals on Guam will not be significantly affected. The proposed projects will increase the amount of open areas or "edge" habitats available for Guam deer and feral pigs which are likely to find these areas desirable for foraging.

In September 1989, the USFWS issued a draft biological opinion which concluded that no critical habitat has been designated or proposed on Guam and the construction and operation of receiver at the Runway site on Guam will not be likely to jeopardize the continued existence of the Guam Micronesian kingfisher, Mariana crow, or Mariana fruit bat.

In December 1989, the USFWS issued the final biological opinion with the same conclusions set forth in the September 1989 draft document.

The opinion noted that the Runway site for Project P-223 is under consideration for designation as critical habitat and that if a rule proposing to designate critical habitat is published, the U.S. Navy will be required to confer with the USFWS. In view of this, the U.S. Navy initiated a request to the USFWS to provide assistance in developing conservation recommendations in addition to those already provided in the biological opinion. The additional conservation recommendations sought are ones which could reduce or eliminate the impact to habitat which may be proposed as critical habitat.

Reptiles such as the blue-tailed skink, Emoia werreri; brown skink, Carlia fuscata; house gecko, Hemidactylus frenatus; monitor lizard, Varanus indicus; and the neotropical toad, Bufo marinus are known to occur on or near the northern and Runway sites. Although the construction of the receiver can be expected to displace these reptiles, the overall populations of these animals will not be significantly affected.

7.2.9.2 Harmon Annex Site. A bird survey was conducted on the Harmon Annex site in March 1990. Although a number of species were found on the site, none of the species was a Federal or GOVGUAM endangered. The lack of endangered bird species is expected as the Harmon Annex site did not contain a significant area of habitat used by these species.

Portions of the Harmon Annex site are designated as essential habitat in the USFWS forest bird recovery plans.

7.2.9.3 Dandan Site. The survey of the Dandan site found the Yellow Bittern, a native species which is not listed as endangered, to be widely distributed throughout the site. No other native forest birds were detected on the Dandan site, which is not listed in any of the USFWS recovery plans.

7.2.10 Flora

Construction of the receivers at any of the sites would require removal of all vegetation within the 850 LF wide by 8,700 LF long area. No vegetation or trees will be removed outside of this designated area.

An area of about 19 acres will be in the Clear Zone of Runway 24R, an inactive runway. This portion lies beyond the area which must be graded and free of above ground structures. Runway 24R would be closed, if the Runway site for Project P-223 is used.

7.2.10.1 Northern Sites. Transect botanical survey covering the entire northern site for Project P-223 was conducted in late June 1988. According to the findings of these surveys, the northern site for Project P-223 does not contain a major vegetation type. However, based on local plant communities, the northern site is covered with vegetation, consisting of mixed locally abundant types of vegetation. (See Appendix F)

None of the species found on the northern site are Federal or GOVGUAM listed or candidate endangered or threatened species. Thus, although construction of Project P-223 would remove the existing vegetation from the designated area, there would be no significant adverse effects to the vegetation of Guam.

The Runway site for Project P-223 was surveyed during February 1989. According to the findings of this survey, the vegetation of the Runway site is low stature, second growth scrub with a tinge of ironwood trees. None of the plant species on the Runway site is a Federal or GOVGUAM listed or candidate threatened or endangered species.

7.2.10.2 Harmon Annex Site. A botanical survey of the Harmon Annex site

was conducted during March 1990. Based on the results of the survey, there only two areas containing small portions of native tree species, one on the northern end and one on the southern end. Most of the other portions of the Harmon Annex site was composed of a variety of weedy species. None of the plant species found during the botanical survey is a Federal or GOVGUAM listed or candidate threatened or endangers species. Thus, construction of the receiver on the Harmon Annex site would not create a significant adverse affect to the flora of this area of Guam.

7.2.10.3 Dandan Site. The botanical survey found most of the Dandan site had been cleared for farming purposes. About 10 acres were being farmed within the project site. A portion of the western edge of the site contained a small fresh water reed marsh, and although not included in the Department of Army Corps of Engineers list of wetlands, this vegetation is typical of those found in wetland areas. None of the species found on the Dandan site was a Federal or GOVGUAM listed or candidate endangered or threatened species. Thus, there would be no significant adverse effect to the vegetation of Guam from the construction of a RCVR on the Dandan site.

7.2.11 Social and Economic Characteristics

Construction of the RCVRs will be done by a contractor. If a contractor from Guam is used, most of the beneficial effects of spending of wage and salary payments would accrue to the local economy. Purchases of goods and services by the contractor would also generate beneficial secondary economic effects throughout Guam.

Once construction is complete, each ROTHR system will require about 72 military personnel to operate the receiver and OCC and to perform other necessary functions. Since the ROTHR systems will be under the control of the Fleet Surveillance Support Command, a command currently not stationed on Guam, the military personnel will be new to the island.

In addition to the military personnel, the ROTHR systems will use a civilian contractor for operation and maintenance of the installations. The civilian contractor is expected to use a total of 44 civilian personnel to operate Project P-223. Some of the technical personnel in positions requiring extensive training may be brought to Guam by the operation and maintenance contractor, while other personnel may be hired from Guam. Eventually, the technical positions could be filled by personnel from Guam.

Some of the new military and civilian personnel can be expected to bring dependents, including school age children, when they move to Guam. The population impact of these military and civilian personnel can be estimated using established U.S. Navy planning factors and data derived from the characteristics of existing Naval personnel on Guam. Based on these factors, the distribution of married and unaccompanied personnel are shown on the following table:

	Military		Civilian	
Project	Married	Unaccompanied	Married	Unaccompanied
P-223	41	31	25	19

Project P-223 could involve approximately 116 military and civilian personnel. The estimated total population impacts for Project P-223 included married military and civilian personnel and their dependents can be seen on the following table:

	Military		Civilian	
Project	Personnel	Dependents*	Personnel	Dependents
P-223	41	103	25	63

* Based on 2.5 dependents for each married personnel. [Ref. 69]

One of the primary concerns related to the addition of a new population to an area such as Guam is the housing requirements for personnel and their dependents. Previous analysis has been performed by the Navy to address the housing concern for bachelors and accompanied personnel. According to this information, the unaccompanied or bachelor military personnel will be housed in available existing military quarters throughout the island. No new military quarters will be constructed as part of this project. [Ref. 69]

Similarly, no additional family housing is expected to be constructed on Guam as part of Project P-223. The latest family housing data for Guam shows that the available housing stock on the island is sufficient to house the military personnel and their dependents without the construction of additional family housing units. [Ref. 69]

In addition to the total population impacts, it is possible to estimate the school age dependents associated with the ROTHR system using established Naval planning factors. [Ref.70] Based on this information, a total of 140 school age children will be associated with the three ROTHR systems. The estimated school age population by grade in school is shown in the following table:

	Military			Civilian		
Project	K (a)	1-6 (b)	7-12 (c)	K (a)	1-6 (b)	7-12 (c)
P-223	3	21	11	2	13	7

(a) Based on .08 pupils per family. [Ref. 70]
(b) Based on .52 pupils per family. [Ref. 70]
(c) Based on .26 pupils per family. [Ref. 70]

The school age dependents of the ROTHR personnel are expected to use the public school system on Guam. Currently, the military does not operate Department of Defense Dependent Schools (DODDS) for eligible dependents on Guam. Thus, all school age dependent children will have to use the Guam public school system. [Ref. 71]

Although there have been previous declines in enrollment, some of the schools on Guam are currently operating near design capacity. The impact of additional students would especially be severe on schools in northern Guam, the area with the highest current growth. Data on the schools in northern Guam show the following utilization information:

School	% Utilization
Simon Sanchez High	95%
F.B. Leon Guerrero Middle	90
Dededo Middle	90
Finegayan Elementary	98
Yigo Elementary	93
Andersen Elementary	90
M.A. Ulloa Elementary	87
Wettengel Elementary	87
Harmon Loop Elementary	87

Source: [Ref. 71]

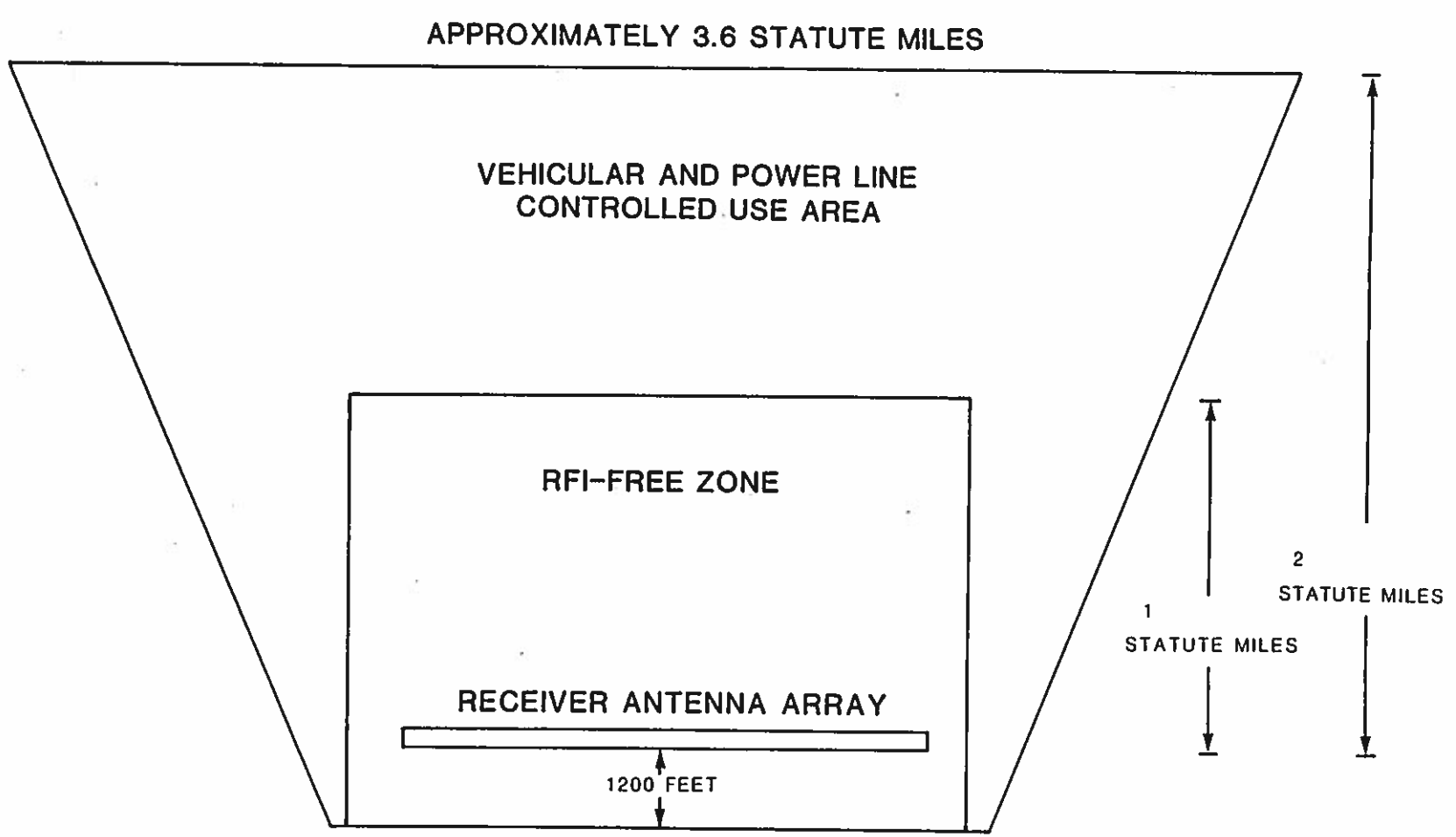
Based on this information, additional school enrollment in the elementary or middle grades may at some time in the future require construction of additional class rooms or dispersion of the students to schools in other areas of the island. Additional high school students could be accommodated in converted buildings or through new construction of facilities. [Ref. 71]

7.2.12 Radio Frequency Interference

7.2.12.1 Northern Sites. The proposed installation is a receiver, and as such will not emit electromagnetic radiation. Similarly, it will not interfere with any radio frequency in use on Guam. The proposed installations will create no adverse impacts to persons or to radio reception on Guam.

The RCVR will require a Radio Frequency Interference (RFI) free zone of one mile on the front, 1,200 LF behind and 700 LF from each end of the antenna area. In addition, a controlled zone extending for two miles in front of the antenna is required as a means of limiting electromagnetic interference. See Figure 7.2.1.

An RFI-free zone is normally desirable around receiving antennas to prevent interference with the receiving capabilities of the antenna. No vegetation clearing is required within the RFI free zone. The RFI-free zone for the northern site and the Runway site will include the privately-owned land above and below cliffs near the receiver site. Most residential or resort-type land uses on this private property would not affect the receiving capabilities of the RCVR. However, any structure such as a tall building higher than the cliffline, could affect the RCVR. According to topographic maps, the cliffline is about 300-500 feet above the coastal land below. In addition, any facility which transmits radio frequencies in the high frequency (HF) band or emits electromagnetic pulse signals would affect the receiving capability of the RCVR. Figure



RFI-FREE ZONE ROTHR RCVR

FIGURE 7.2.1

7.2.2 shows a composite of the RFI-free zones.

At this time, there are no existing facilities or structures within the project RFI-free zone on the northern sites which could adversely affect the receiving capability of the RCVRs.

Development of the Urunao Beach property owned by the Artero family at the northwest coast of Guam could pose potential conflict with the proposed ROTHR receiver at the Northwest Field area as well as the Navy communication operations at NAVCAMS WESTPAC. Incompatible development would be facilities that create or increase RFI affecting the operation of the receiver. Vehicles and electrical equipment could create or RFI and therefore need to be controlled within the one mile RFI-free zones shown in Figure 7.2.2 and the RFI-free zones for the ROTHR receiver shown in Figure 7.2.1. A RFI barrier or shield may need to be provided if vehicle traffic creates interference.

The Artero family proposed development of their lands below the cliffline, an area of about 430 acres. The conceptual development plan for this land shows construction of a mixed use development including a hotel, convention center, commercial and retail uses, resturants, a museum, and an 18-hole golf course. Based on this conceptual plan, construction of the ROTHR receiver at the northern site or Runway site does not appear to conflict with this development.

Development of the Urunao Beach property could result in increased number of workers and visitors requesting access to the site. Current access to the property is via an existing military road which routes through the existing RFI-free zones. However, this access is controlled by the military and authorization is required. Any plan for development of the Urunao Beach property will need to be reviewed to ensure RFI-free zones are maintained.

7.2.12.2 Harmon Annex Site. Although the receivers do not constitute a hazard from electromagnetic radiation, they must be sited so that other electronic installations, roadways and certain types of vehicles and motorcycles equipped with unshielded ignition systems do not interfere with their operation. Facilities near the Harmon Annex site which could adversely affect operation of the receiver include the existing Tanguisson Power Plant and the radio towers located above the cliff line. Traffic going to NAVCAMS Beach and Two Lovers Point could also affect operation of the receiver. Testing has shown that the RFI at the Harmon Annex is within acceptable limitation for operation of the ROTHR receiver.

7.2.12.3 Dandan Site. The NASA satellite tracking station is located within about 4,200 LF in front of the Dandan site. The tracking station has ceased operations and the facilities placed in caretaker status. This unused facility is not expected to adversely affect operation of a receiver at this location.

Visitors to Talofofo Falls Park, a privately-owned and operated facility, use the existing access road to the fornerly-used NASA facility to visit the Park. Private vehicles and tour buses are used by visitors to the

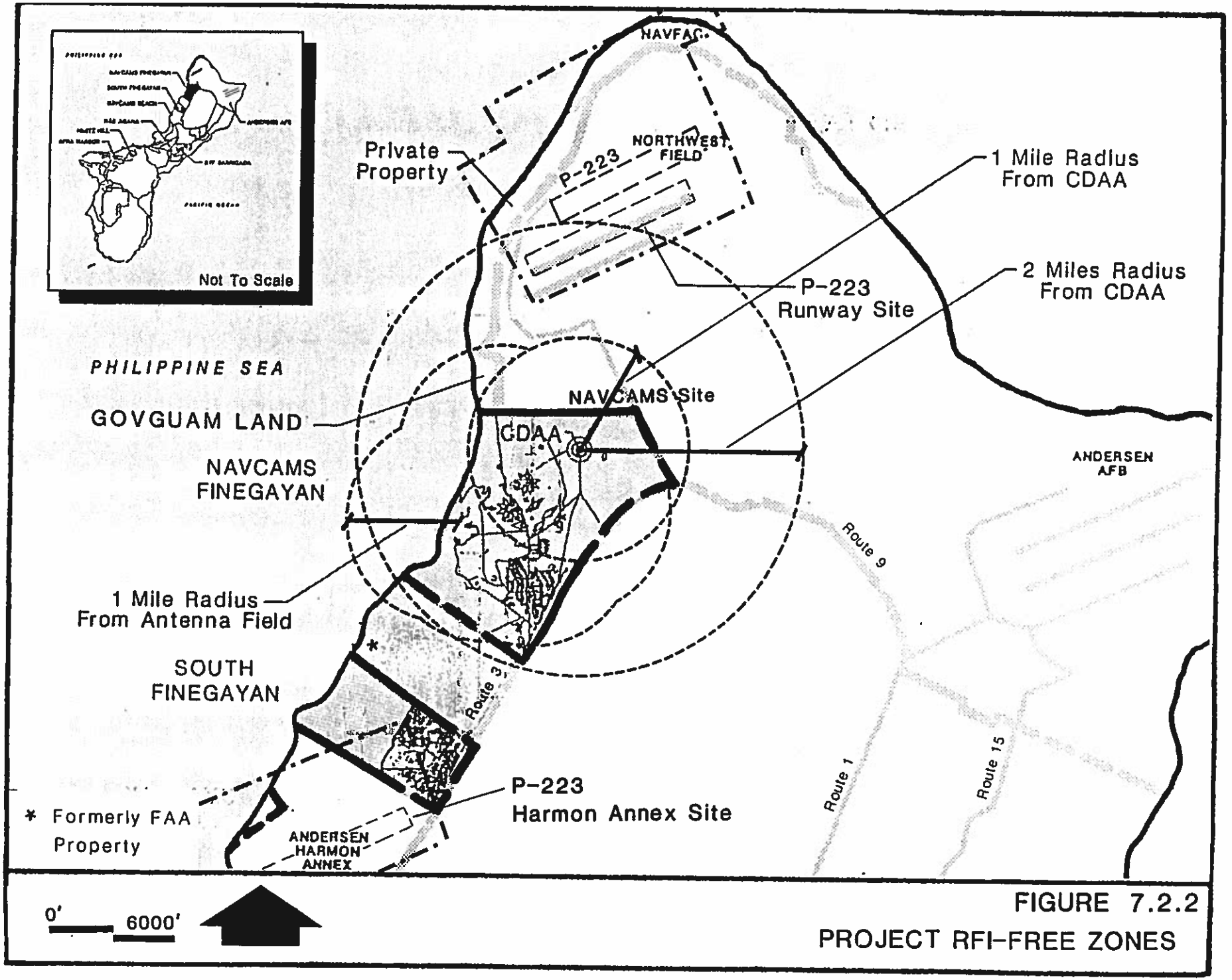


FIGURE 7.2.2
PROJECT RFI-FREE ZONES

Park. Since this traffic could adversely affect operation of the receiver, the access road to Talofofo Falls Park will have to be rerouted away from the receiver site.

7.2.13 Aeronautical Activity

The site for Project P-223 is located north of Runway 6R-24L, the South Runway of Northwest Field. Currently, Runway 6R-24L is the only one used by aircraft. The DOD has established standardized criteria for essential safe planning at airfields in the U.S., its trust territories and possessions. These minimum safe standards set forth dimensions and planes for planning around new fields and for determining whether an object or structure is an obstruction to air navigation. The criteria applies to existing and proposed man-made objects, objects of natural growth and terrain. [Ref. 42]

The DOD criteria establish a graded area within the Clear Zone at each runway end where no above-ground structures or objects are permitted. The antennas for Projects P-223 and P-225 will not be located within the graded area of the clear zone of Runway 6R-24L. Projects P-223 and P-225 will not create significant adverse impacts to operation of aircraft on Runway 6R-24L. (See Figure 5.5)

The Runway site for Project P-223 would use the existing north runway, Runway 6L-24R, for the receiver antennas. Currently, this runway is not used for aircraft operations in Northwest Field. Aircraft operations are conducted on the south runway, Runway 6R-24L.

Construction of the receivers would preclude aircraft operations on the north runway. The Department of the Air Force has determined use of this runway is no longer required for military purposes. Use of the Runway site for Project P-223 would not adversely affect military aircraft use of Northwest Field.

DOD airfield criteria also apply to lateral distances from the center line of the runway. The centerlines of the runways on northwest Field are located 1,175 LF apart. Construction of the receiver antennas on the North runway would not violate airfield criteria for the South runway. Aircraft operations could occur on the south runway without restrictions.

In addition, the DOD criteria set forth a series of imaginary surfaces surrounding runways to determine obstructions to air space. The antennas for Project P-223 are located outside of the approach-departure surface to Runway 6R-24L and will not adversely affect the continued use of the runway. (See Figure 5.5)

7.2.14 Aesthetics

7.2.14.1 Northern Site. The northern site and Runway site are located within established DOD installations and not visible from public roads or residential areas. They will be located in an area already disturbed by antennas and other facilities. Thus, although the RCVR will be visible, they will not be a significant adverse effect to the aesthetic character

of this area of Guam.

7.2.14.2 Harmon Annex Site. The Harmon Annex site is located north of Marine Drive, the major roadway in northern Guam, and west of Route 3, the access roadway to NAVCAMS WESTPAC and other single-family housing areas in north-western Guam. Other roads near the site provide access to the public beach area to the west and to Two Lovers Point near the cliffs overlooking the shore.

Antenna arrays constructed on the Harmon Annex site will be clearly visible to travelers along Route 3 and to visitors of the beach area to the west. This beach area has been identified as a future expansion area for the existing hotel and resort activities on Tumon Bay, which lies immediately to the south.

Construction of antenna arrays will be a sharp contrast to the existing open-space character of the area. Visitors to the existing adjacent beach and shoreline areas would clearly see the antenna arrays.

7.2.14.3 Dandan Site. The Dandan site is located in southeastern Guam in an area currently without military installations. The existing NASA satellite tracking station would be located about 4,200 LF to the north of the antenna array.

Antenna arrays on the Dandan site would be visible from Route 4, the only roadway along the coast in this area. The lack of similar military structures would mean that the antenna arrays would be an intrusion into the visible environment in this area of Guam.

7.2.15 Archaeological and Historical Sites.

7.2.15.1 Northern Sites. The northern site for Project P-223 and the Runway site lie in Northwest Field, which as previously noted has been nominated by the National Park Service as a National Historic Landmark. It is noted that at a meeting held at Andersen AFB on 14 February the U.S. Navy and the Guam Historic Preservation Office raised concerns regarding the eligibilty of Northwest Field as a National Historic Landmark. Nevertheless, it does seem likely that Northwest Field is eligible for inclusion on the National Register of Historic Places. Thus, the northern sites need to be evaluated as to their affect on the historic values of Northwest Field. In addition, the original boundary suggested by the National Park Service for the proposed Landmark, being comprised solely of the two runways and connecting taxiways, do not appear to represent the complexity and extent of Northwest Field.

Two archaeological sites were found during the 1986 archaeological resources survey for Project P-223. Both sites contained sparse surface scatters of pottery fragments; neither contained megalithic structural foundations or midden deposits. Thus, a permanent prehistoric settlement was probably not on the project site. The archeological sites are described as "threshold sites". The Guam Territorial Archaeologist and Deputy Historic Preservation officer agreed with the Department of the Navy, Pacific Division, Naval Facilities Engineering Command, Pearl

Harbor, Hawaii that all sherds at these sites could be removed. [See Appendix G] Thus, construction of the proposed project would not create a significant adverse effect on the archaeological or historic resources of Guam.

The northern site for Project P-223 is north of the Northwest Field National Historic Landmark, a site nominated for inclusion on the National Register of Historic Places. Since the northern site for Project P-223 does not include the runways identified in the Historic District, the project would not adversely impact this historic resource.

The Runway site for Project P-223 would be located partially within the nominated National Historic Landmark. As previously discussed, the runways on Northwest Field were nominated as a National Historic Landmark and, as a National Historic Landmark, and would be adversely impacted by construction of the project. Based on discussions between the U.S. Navy and Guam Historic Preservation Office regarding the nature of Northwest Field historic values and the impact of the ROTHR project, it was concluded that the primary value of Northwest Field was the interpretive value of archival documents. Northwest Field has not been identified with a specific significant activities such as the atomic bomb at North Field on Tinian.

Based on this assessment, a mitigative program will be implemented which will entail: (1) the collection of additional archival documents regarding the identification and locations of facilities and activities at Northwest Feild; (2) photographic documentation of existing runways, taxiways, hardstands, and other existing airfield remnants; (3) the deposition of copies of archival documents and photographs into suitable repositories for curation and future interpretation or research. These repositories will include the War in the Pacific National Historical Park and the GOVGUAM main library. A Memorandum of Agreement (MOA) to ensure the implementation of these mitigation measures is presently being prepared for signature by the Guam Historic Preservation Officer, the War in the Pacific National Historical Park, the U.S. Navy, Andersen AFB, and the Advisory Council on Historic Preservation.

7.2.15.3 Harmon Annex Site. An archaeological/historic resources survey conducted on the Harmon Annex site in March 1990 found two sites, one showing the U.S. military presence in Guam and the other Japanese presence. Neither is considered significant, although the U.S. site may require additional documentary research.

7.2.15.4 Dandan Site. The Dandan site was surveyed during February 1989. Based on the survey findings and other research in the area, no additional site work will be necessary. Construction on the Dandan site would not have significant adverse impacts.

7.2.16 Indirect Effects and Their Significance

The primary indirect effect from installation of the proposed antennas would be to preclude use of the project site for other purposes during the life of the operation. Although surface alteration to the site will

involve removal of all vegetation, the project site could be utilized for other purposes once the RCVR and support facilities are disestablished.

The RCVR would not preclude other nearby uses, although certain types of activities would cause degradation of the system. Thus, land use in the vicinity of the RCVR will not be adversely affected. The northern site for Projects P-223 and the Runway site are located in Northwest Field within an area where AAFB allows hunting during certain times of the year under an established permit procedure. Since the ground screen should not be disturbed, no hunting would be permitted within close proximity (130 to 150 FT) of the antennas. Subject to local regulations, hunting limited to the use of bow and arrow could be permitted in the forward reflective area which extends 565 FT in front of the ground screen.

Four of the 55 designated hunting areas will be closed for the Runway site. Six hunting areas which border the southern side of the antenna may be reduced in size for safety reasons. However, the exact areas to be closed will depend upon an on-site evaluation.

Hunting is not permitted on the Harmon Annex or Dandan sites.

As in many other places, development of residential, commercial and other types of land uses has limited the areas available for hunting on Guam. Thus, the available hunting areas are well used by local hunters. Notwithstanding, hunting is allowed upon issuance of a permit by AAFB, limitation of hunting on the northern and Runway sites would significantly reduce the land area available to Guam hunters.

7.2.17 Possible Conflicts Between the Proposed Action and the Objectives of Federal, State, and Local Land Use Policies and Controls

The Coastal Zone Management Act of 1972 as amended (P.L. 92-583) requires Federal agencies conducting or supporting activities directly affecting the coastal zone to be consistent to the maximum extent practicable with approved state coastal management programs. Any Federal agency undertaking any development project in the coastal zone shall insure that the project is consistent to the maximum extent practicable with approved state management programs (Section 307(c)).

Federal regulations contained in 15 Code of Federal Regulations Part 930, "Federal Consistency with Approved Coastal Management Programs" establish the regulatory requirements for compliance with the Federal consistency provisions of the Coastal Zone Management Act. The Territory of Guam has an approved coastal management program and administers the Federal consistency provisions through the Guam Bureau of Planning, Coastal Management Office.

Excluded from the definition of a state's coastal zone are lands which are owned or controlled by the Federal government. However, on excluded Federal lands, if the Federal agency determines there is a direct effect on the coastal zone, a consistency determination must be submitted. This consistency determination must examine the direct effects of the project on non-excluded lands. As to these "spillover effects," the activity, its

direct effects, associated facilities and the direct effects of associated facilities must all be consistent to the maximum extent practicable with the coastal management program (15 CFR 930.39). The northern sites and the Harmon Annex site are within land under the control of the DOD. Thus, it is excluded from land use policies and controls exercised by GOVGUAM. However, according to the Guam Coastal Management Plan, this exclusion does not remove Federal agencies from the obligation of complying with the consistency provisions of the CZM Act.

A Consistency Determination should be provided to the GOVGUAM Coastal Management Office lead agencies at least 90 days before final approval of the ROTHR projects. The consistency determination should include:

- A brief statement indicating whether the proposed activity will be undertaken in a manner consistent to the maximum extent practicable with the CZM program,

- A detailed description of the activity and its associated facilities, and

- An assessment of the coastal zone effects, including comprehensive and supportive information.

Federal agencies must ensure that their activities are consistent to the maximum extent practicable with the enforceable, mandatory policies of the management program, but need not evaluate effects for which there are no mandatory or recommended policies (15 CFR Part 930.39). Upon submission of the Consistency Determination, the GOVGUAM Coastal Management Office will have 45 days to respond, with a 15-day extension allowed, or the agency may presume agreement (15 CFR 930.41).

If GOVGUAM Coastal Management Office should disagree with the consistency determination submitted by the U.S. Navy, it must describe the nature of the inconsistency and alternative measures which could be adopted to proceed in a manner consistent to the maximum extent practicable. If there remains serious disagreement between the GOVGUAM Coastal Management Office and the U.S. Navy, either party may request mediation services by the Secretary of Commerce. However, both parties must agree to the mediation proceedings (15 CFR 930.42 and 930.112). Notably, the regulations do not specify that a Federal action cannot proceed in the event of a CZM agency's (in this case, the GOVGUAM Coastal Management Office) continuing disagreement.

The Dandan site is on privately owned land and fee title must be acquired by the Federal Government. Acquisition of land for construction of a receiver is a Federal action for which a consistency determination must be submitted. The 18 GCMP policies are listed below with a summary of the consistency of the proposed project to each policy, including "spillover" effects:

GOVERNMENTAL PROCESS POLICY:

More effective administration of natural resource related laws,

programs, and policies shall be achieved through improved coordination between Territorial and Federal agencies.

The proposed project is consistent with this policy through compliance with Federal environmental analysis procedures. The U.S. Navy also intends to comply with the requirements set forth in the GOVGUAM Bureau of Planning Guide for Achieving Federal Consistency. [Ref. 39]

DEVELOPMENT POLICIES:

(1) Shore Area Development: Only those uses shall be located within the Seashore Reserve which: 1) enhance, are compatible with or do not generally detract from the surrounding coastal area's aesthetic and environmental quality and beach accessibility; or 2) can demonstrate dependence on such a location and the lack of feasible alternative sites.

None of the alternative sites are located within a seashore reserve.

(2) Urban Development: Uses permitted only within Commercial, Multi-Family, Industrial and Resort-Hotel zones; and uses requiring high levels of support facilities shall be concentrated within urban districts as outlined on the Land-Use Districting Map.

None of the alternative sites are located within an urban development.

(3) Rural Development: Rural districts shall be designated in which only low density residential and agricultural uses will be acceptable. Minimum lot size for these uses should be one-half acre until adequate infrastructure, including functional sewering, is provided.

The policy is not applicable to the proposed project.

(4) Major Facility Siting: In evaluating the consistency of proposed major facilities with the goals, policies and standards of the Comprehensive Development and Coastal Management Plans, the territory shall recognize the national interest in the siting of such facilities, including those associated with electric power production and transmission, petroleum refining and transmission, port and air installations, solid waste disposal, sewage treatment and major reservoir sites.

The proposed project at any of the alternative sites can be considered a major facility. It is vital to the national security of the United States.

(5) Hazardous Areas: Identified hazardous lands including flood plains, erosion-prone areas, air installation crash and sound zones and major fault lines shall be developed only to the extent that such development does not pose unreasonable risks to the health, safety, or welfare of the people of Guam, and complies

with land-use regulations.

The Pugua Fault, a major fault in northwestern Guam, lies south of the northern sites and extends offshore. It is south of the northern site and Runway site. The project will be designed to comply with applicable DOD requirements for structures located in this area of Guam. Any hazard from an earthquake will be confined to the project site.

Similarly, the antennas on the Dandan site will meet DOD construction criteria.

> (6) Housing: The government shall encourage efficient design of residential areas, restrict such development in areas highly susceptible to natural and man-made hazards, and recognize the limitations of the island's resources to support historical patterns residential development.

This policy is not applicable to the proposed project.

> (7) Transportation: The Territory shall develop an efficient and safe transportation system while limiting adverse environmental impacts on primary aquifers, beaches, estuaries, and other coastal resources.

This policy is not applicable to the proposed project.

> (8) Erosion and Siltation: Development shall be limited in areas of 15% or greater slopes by requiring strict compliance with erosion, sedimentation, and land-use district guidelines, as well as other related land-use standards for such areas.

The northern sites have slopes of less than 5%. Since permeability of the soils is good on the northern sites, erosion is not anticipated to be a problem with these minimal slope conditions. All grading done on the project sites will be in compliance with applicable grading requirements established by GOVGUAM.

The Dandan site contains soils which are subject to the hazards of erosion. Thus, runoff of material could result to nearby areas during rainy periods. To prevent such occurrences, all grading on the Dandan site will meet applicable requirements established by GOVGUAM.

RESOURCE POLICIES:

> (1) Conservation of Natural Resources - Overall Policy: The value of Guam's natural resources as recreational areas, critical marine and wildlife habitats, the major source of drinking water, and the foundation of the island's economy, shall be protected through policies and programs affecting such resources.

The northern site and Runway site are located within the area which has been proposed as essential habitat by the forest birds and bats recovery plans prepared by the GOVGUAM Division of Aquatic Resources in cooperation

with the U.S. Fish and Wildlife Service. The project design and performance criteria have been established to confine all vegetation removal to the designated antenna area. There will be no removal of vegetation outside of the designated project areas. This will minimize impacts to surrounding areas and retain the maximum amount of habitat for native forest birds.

Portions of the Harmon Annex site are within the proposed essential habitat.

The Dandan site is not designated as proposed essential habitat for forest birds and bats.

The drinking water resource on northern Guam will be protected from accidental spills or leaks by a containment area constructed around and beneath any fuel tanks used by the project. The antennas and support equipment used by the receivers will not contain any hazardous substances.

> (2) Air Quality: All activities and uses shall comply with all air pollution regulations and all appropriate Federal quality standards in order to ensure the maintenance of Guam's relatively high air quality.

The operation of the proposed project would not have a significant affect on air quality, regardless of the sites. Construction would have a short-term effect from dust and exhaust emissions from construction equipment. Mitigation measures during construction such as watering of the area will be used to minimize effects on surrounding areas.

> (3) Water Quality: Safe drinking water shall be assured and aquatic recreation sites shall be protected through the regulation of uses and discharges that pose a pollution threat to Guam's waters particularly in estuarine, reef and aquifer areas.

None of the alternative sites would affect drinking water resources or aquatic recreation sites.

> (4) Fragile Areas: Development in the following types of fragile areas shall be regulated to protect their unique character: historic and archaeologic sites, wildlife habitats, pristine marine and terrestrial communities, limestone forests, and mangrove stands and other wetlands.

Construction of the antenna arrays and ground screens on the northern, site would result in loss on secondary growth limestone forest. The Runway and Harmon Annex sites for Project P-223 would not result in loss of limestone forest land.

The Dandan site does not contain limestone forest. None of the alternative sites contain mangrove stands, wetlands or historic and archaeologic sites.

(5) Living Marine Resources: All living resources within the territorial waters on Guam, particularly corals and fish, shall be protected from over-harvesting and, in the case of marine mammals, from any taking whatsoever.

This policy is not applicable to the proposed project.

(6) Visual Quality: Preservation and enhancement of, and respect for the island's scenic resources shall be encouraged through increased enforcement of and compliance with sign, litter, zoning, subdivision, building and related land-use laws; visually objectionable uses shall be located to the maximum extent practicable so as not to degrade significantly views from scenic overlooks, highways, and trails.

The northern sites are located within established DOD facilities and not visible from public roads or residential areas. The northern sites are located in areas not accessible to the public without permission. Thus, construction of the RCVR on the northern sites would not degrade public views from nearby locations.

The Harmon Annex site is located west of Route 3, the main roadway to northwestern Guam. The antenna array would clearly be visible to travelers along Route 3, to visitors of the family housing area to the west, and to visitors to Two Lovers Point.

The Dandan site is located west of Route 4, the only roadway along the coast in this area of Guam. The lack of similar military structures would mean that the antenna arrays would be an intrusion into the visible environment in this area of Guam.

(7) Recreational Areas: The Government of Guam shall encourage development of varied types of recreation facilities located and maintained as to be compatible with the surrounding environment and land uses; adequately serve community centers and urban areas, and protect beaches and such passive recreational areas as wildlife and marine conservation areas, scenic overlooks, parks and historic sites.

The portions of Northwest Field, including the areas designated for the northern site and Runway site, have been used for recreational hunting under a permit procedure established by the AAFB and NAVCAMS WESTPAC. Once constructed, gun hunting will be allowed in Northwest Field with restrictions in the recevier antenna area. Limitation of hunting in these areas will decrease the available hunting areas on Guam. The Harmon Annex site and Dandan site are not considered a hunting or recreation areas.

(8) Public Access: The public's right of unrestricted access shall be ensured to all non-federally-owned beach areas and all Territorial recreation areas, parks, scenic overlooks, designated conservation areas and other public lands; and agreements shall be encouraged with the owners of private and Federal property for the provision of reasonable access to, and use of, resources

of public nature located on such land.

The northern site and Runway site are located on existing military installations not open to the public. The Harmon Annex site is located on land which has been declared excess by the DOD. Once interest to Dandan site has been obtained and the antennas constructed, public access to the designated area will be restricted.

(9) Agricultural Lands: Critical agricultural lands shall be preserved and maintained for agricultural use.

There are no agricultural lands within the northern site, Runway site, or the Harmon Annex site.

Portions of the Dandan site are currently being used for small-scale agricultural production of melons and vegetables. Once the site has been cleared and the antennas erected, the area in front of the antenna array, about 110 acres, can be used for agricultural production of low-growth crops such as melons and vegetables. Thus, most of the site can be maintained for agricultural use.

Federal Land Use Policies and Controls: Executive Order 11990, "Protection of Wetlands", does not apply to the proposed project, since there are no wetlands within any of the alternative sites. (The western portion of the Dandan site contains vegetation typically found in wetlands. The area has not been designated as a wetland by the Department of the Army Corps of Engineers.) Executive Order 11988, "Floodplain Management", does not apply to the proposed project, since none of the alternative sites are in designated floodplain areas.

AAFB does not have plans for development in the areas designated as the northern sites. Thus, the proposed RCVRs would not conflict with AAFB land use plans. However, site approval from the Air Force will be required for construction of the RCVRs in Northwest Field.

The Harmon Annex site an area of about 1,520 acres has been declared excess by the DOD pursuant to a 1977 Guam Land Use Plan (GLUP) Study and are being processed for disposal. Ultimate release of this land is pending action on special legislation by the U.S. Congress on the recipient of these lands. Use of the lands identified as excess will require removal of these sites from the list of excess properties. The Harmon Annex site will also have to be transferred from the U.S. Air Force to the U.S. Navy.

7.2.18 Energy Requirements and Conservation Potential of Various Alternatives and Mitigation Measures

Energy will be required to construct and operate the RCVRs. The energy used during construction will depend upon the type and number of pieces of equipment used by the construction contractor. This information is not known at this time.

7.2.19 Irretrievable and Irreversible Resource Commitments

Site preparation and related construction activities would employ a wide variety of trades, skills and machinery to ensure rapid completion of the RCVRs and related support facilities. Many of the skills required are expected to be available from the local labor market, though some outside workers and equipment may be required.

Materials used for construction of the RCVRs and related support facilities would be irretrievably committed during the period of operations. Once committed to the project, use of the materials at other locations is not considered practicable.

7.2.20 Short-Term Use Versus Long-Term Productivity

Use of the project sites for a RCVR would preclude other uses, as the ground screen must be kept clear of structures and facilities to ensure efficient operation. However, small-scale agricultural production and certain types of hunting could occur on portions of the area in front of the ground screen. Once the RCVR and support facilities are disestablished, the project sites could be used for other purposes as the surface disturbance will be minimal. Thus, the short-term use of the project sites would not foreclose long-term productivity.

The installation is vital to the national security of the United States. Thus, the long-term productivity from the use of the project sites for RCVRs would outweigh any short-term losses from other uses of the sites.

7.2.21 Urban Quality, Historic and Cultural Resources

The northern sites are located within established DOD installations and not visible from public roads or residential areas. Thus, construction of the antennas on the northern sites will not be a visible intrusion into the urban environment of Guam.

None of the project sites contain any significant archaeological resources. The proposed Northwest Field National Historic Landmark is located outside of the northern site. The Runway site for Project P-223 would use the north runway for the receivers.

7.2.22 Means of Mitigating Potentially Adverse Effects

See Sections 4.4 and 8.5 for discussion of mitgation measures.

8.0 CUMULATIVE ENVIRONMENTAL CONSEQUENCES

8.1 AFFECTED ENVIRONMENT AT TRANSMITTER SITES (TINIAN)

8.1.1 Introduction

This section describes the existing environmental conditions at the transmitter sites for Project P-225 and Project P-002, both to be constructed sometime after Project P-223. Two alternative sites have been identified for both projects. For Project P-225, one northern and one western site have been identified, and one northern and one eastern site for Project P-002. The northern sites for Projects P-225 and P-002 would be collocated with the northern site for Project P-223. The western site for Project P-225 would be in the vicinity of the western site for Project P-223. The sites are shown on Figures 8.1.1, 8.1.2, 8.1.3 and 8.1.4.

8.1.2 Physiography and Topography

8.1.2.1 Northern Sites. The northern sites lie on the northwest coastal area of the Northern Flatland, one of five physiographic units on Tinian. The Northern Flatland encompasses about seven square miles. The northern sites lie primarily at an elevation of around 100 feet above Mean Sea Level (MSL). Both project areas are relatively flat with slope less than 1%. The site for Project P-225 has a gradual slope to the south and west, while the site for Project P-002 has almost no gradient.

8.1.2.2 Eastern Site. The eastern site lies on a plateau at about 300-310 FT elevation. The site slopes from the north to south with about a 10-FT change in elevation. The far western edge of the site has a rapid drop-off to the valley floor.

8.1.2.3 Western Site. The western site for Project P-225 lies at an elevation of about 210-215-FT and shows a slope to the west.

8.1.3 Soil Characteristics

8.1.3.1 Northern Sites. Soils on the project sites are primarily of the Dandan-Chinen complex, a mixture of 50% Dandan clay loam and 40% Chinen clay loam. Dandan soil is moderately deep and well drained. It was formed in sediment over porous coralline limestone. Chinen soil is shallow and well drained. Runoff is slow for both soil types and with only a slight hazard of water erosion. Other characteristics of these soils are: Shrink-swell potential: moderate; and plasticity index: 15-30. [Ref. 8]

8.1.3.2 Eastern Site. Soils in and around the eastern site are represented by Masalong Clays (0-15% slopes) which are peculiar to this north eastern plateau and similar to the Dandan series. Below this complex lies the Chinen clay loam (0-5% slopes) and the Takpochao Rock Outcrop Complex (3-15% slopes). Takpochao soils are shallow, well drained cobbly clays represented by long slopes with occasional low

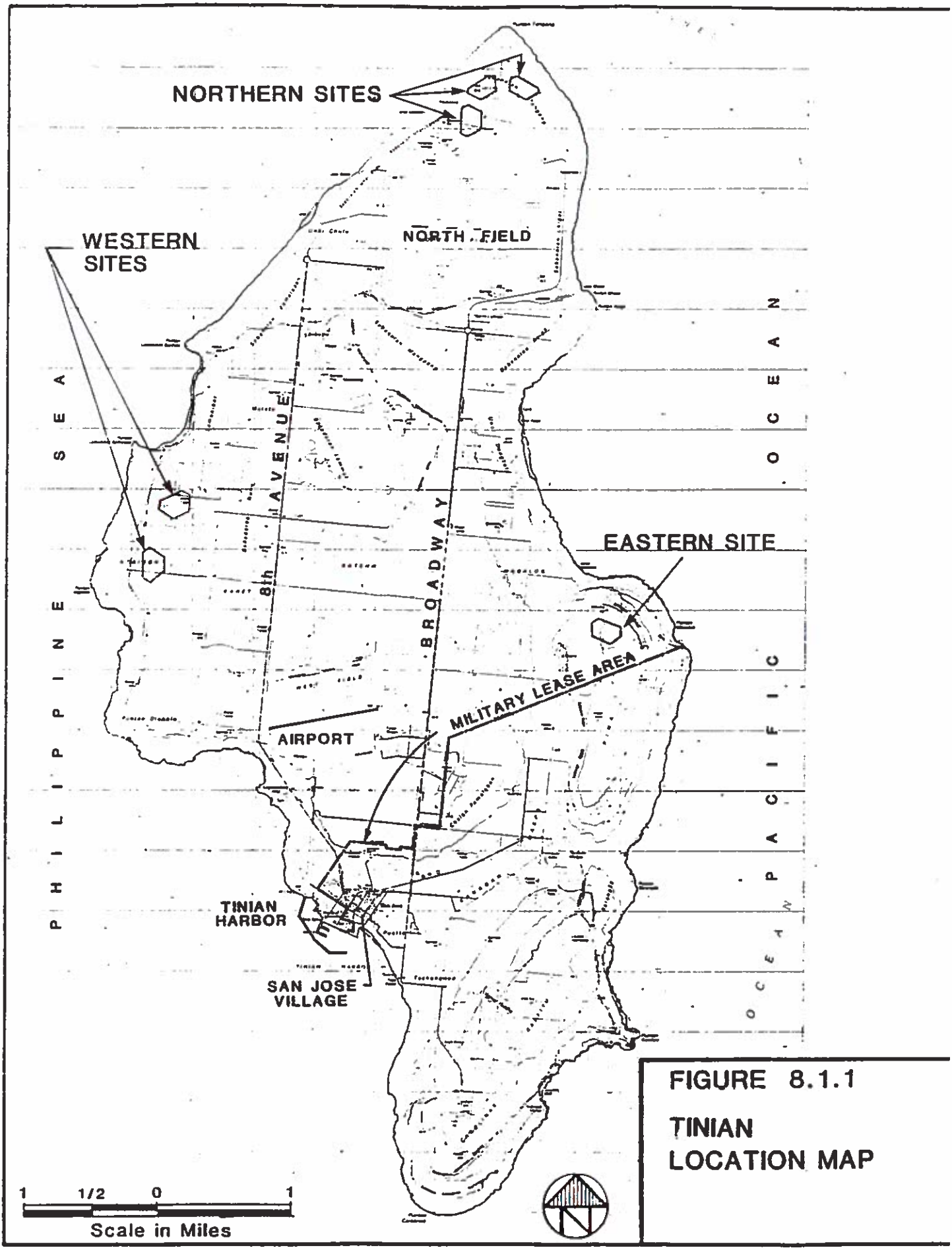


FIGURE 8.1.1

TINIAN
LOCATION MAP

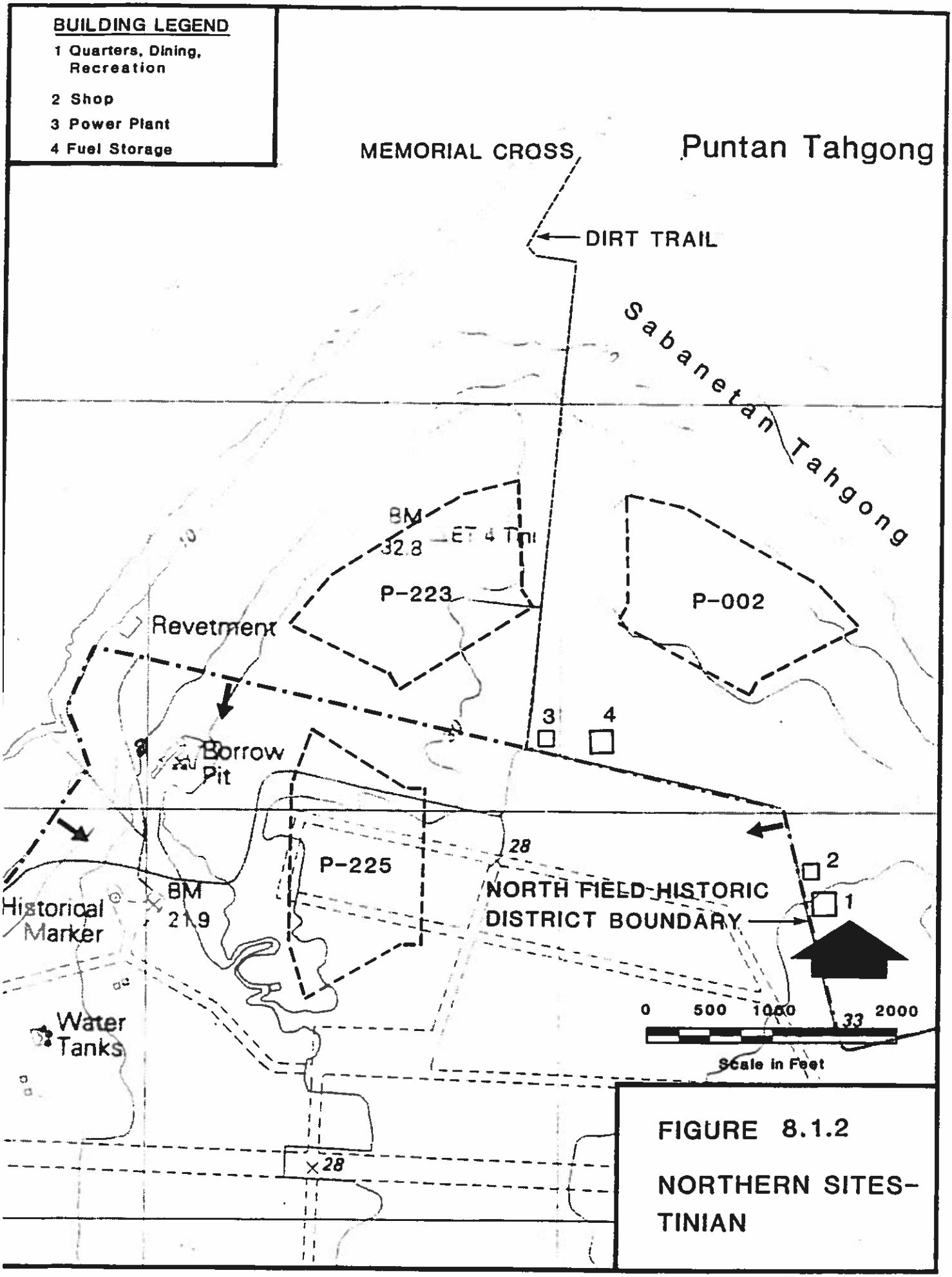


FIGURE 8.1.2

NORTHERN SITES-TINIAN

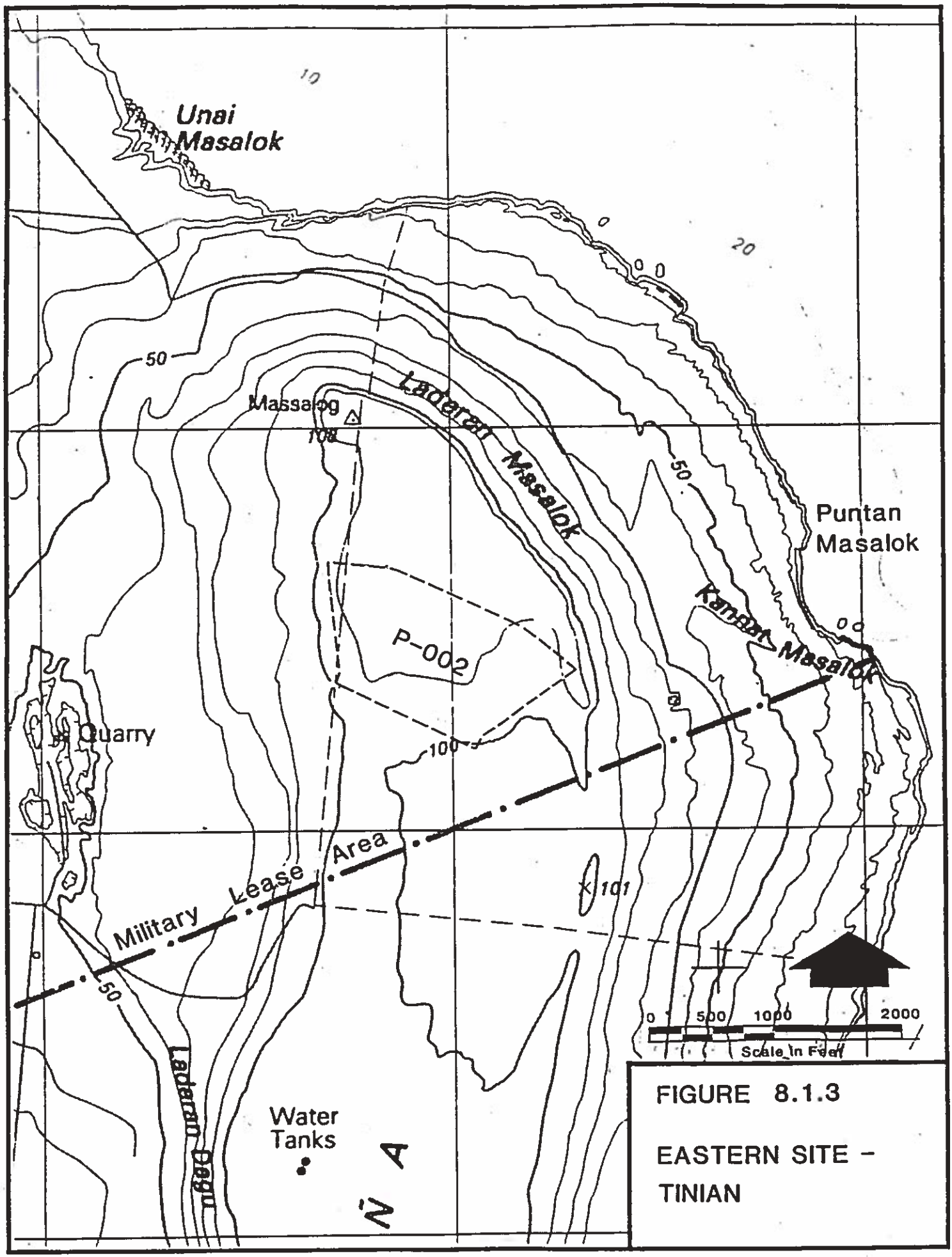


FIGURE 8.1.3

EASTERN SITE - TINIAN

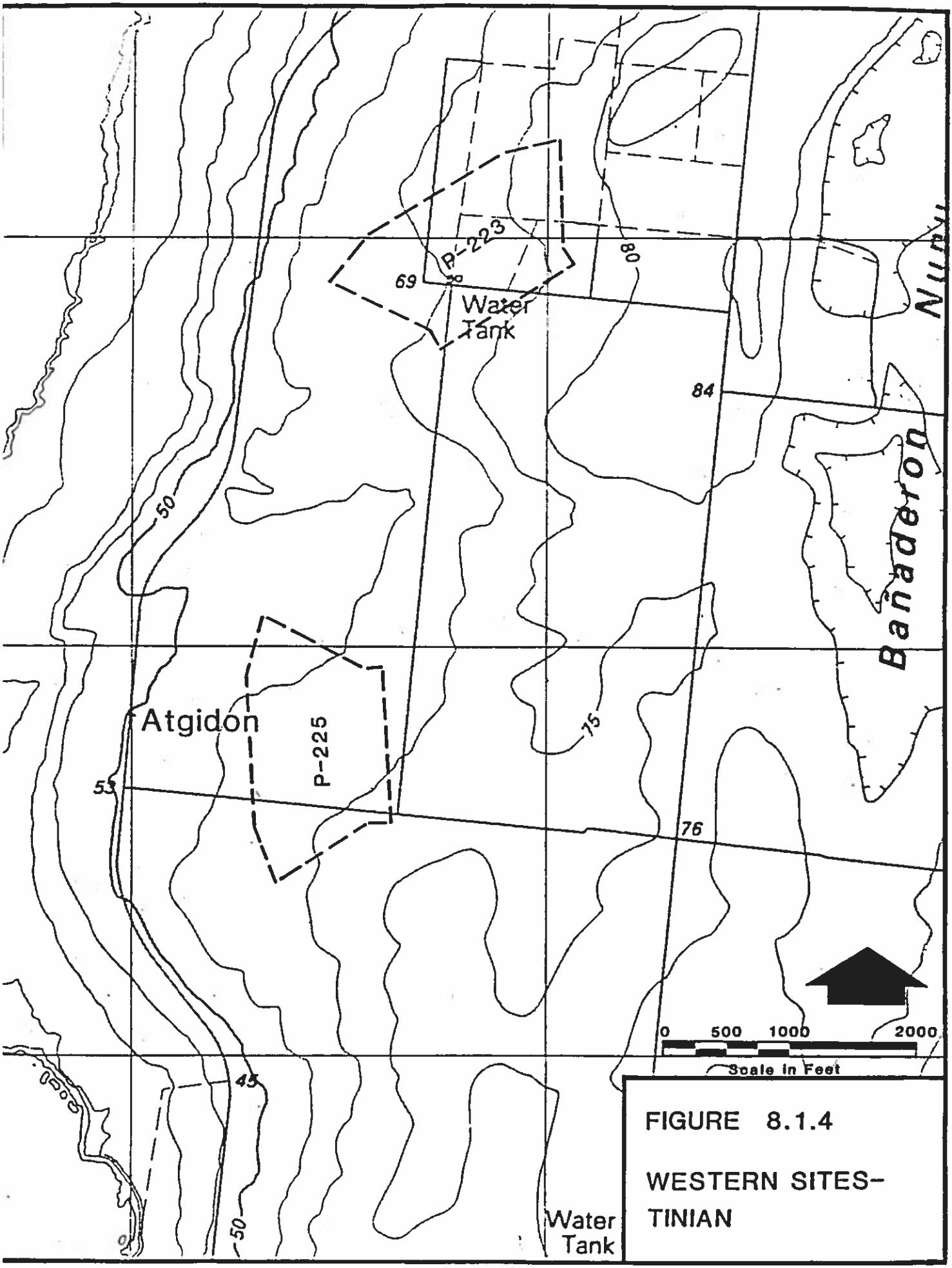


FIGURE 8.1.4

WESTERN SITES-TINIAN

protruding escarpments of porous coralline limestone. [Ref. 8] Chinen clay loams in the area reflect the same characteristics as the northern sites and western site. Other characteristics of these soils are: Shrink-swell potential: moderate; and plasticity index: 15-30.

8.1.3.3 Western Site. The western site almost completely overlies the Dandan Chinen Complex soils. Comprised of 50% Dandan clay loam and 40% Chinen clay loam, this complex is alternately deep and well drained or shallow and well drained and overlays coralline limestone. These soils form long and undulating slopes of 3-15% and are covered mainly by secondary forest and some pasture grasses. Other characteristics of these soils are: Shrink-swell potential: moderate; and plasticity index: 15-30. [Ref. 8]

8.1.4 Geological Characteristics

See Section 3.1.4 for general background information.

8.1.4.1 Northern Sites. These sites lie within the northern lowlands and is dominated by a 100-FT high limestone plateau comprised of alternately porous to compact fine-grained and elastic materials. The sites also lie on the uplifted block side of the fault which has been artificially emphasized by wave erosion during a past period of submergence. [Ref. 9]

8.1.4.2 Eastern Site. The eastern site lies atop a limestone promontory roughly 300 FT high. Extending almost directly north-south, the promontory is surrounded by cliffs that are the product of numerous visible and subterranean faults that form a roughly arcuate wreath of cliffs around the uplifted landscape. A series of vertical faults running from the southeast to the northwest converge on either side of the eastern site. The eastern site lies upon a large up-thrust block of limestone between the two fault systems. Any movement along these faults may cause the movement or instability of grounds around the periphery of the site. [Ref. 9]

8.1.4.3 Western Site. The area underlying the proposed western site is a relatively fault free collection of porous fossil bearing and recrystallized limestone conglomerate. A vertical fault running from the northwest to the southeast corresponds to an area of salt water intrusion of the island's Ghyben-Herzberg lens. [Ref. 9]

A rather large though narrow sinkhole extending in the same general north-south direction runs parallel and northeast of the vertical fault structure. This sinkhole also corresponds to another subterranean strike-slip fault. Although these faults and sinkhole structures fall outside the western site, it runs quite close to the site and may extend beneath it at deeper levels. [Ref. 9]

8.1.5 Meteorology

See Section 3.1.5 for this discussion.

8.1.6 Hydrology

See Section 3.1.6 for general information.

8.1.6.1 Northern Sites. The northern project sites overlie a portion of the northern fresh ground water resource of Tinian. The central ground water resource is the source for potable water. The northern and central aquifers are not connected. [Ref. 9]

The northern project sites for Projects P-225 and P-002 contain no surface water bodies, wetlands or potable water sources.

8.1.6.2 Eastern Site. Geological evaluations indicate the eastern site probably has no basal groundwater because the area is crossed by an extensive series of fault channels admitting seawater at depths equivalent to sea level. However, the ground water resources in this area have not been actively sought.

The eastern project site contains no surface water bodies, wetlands or potable water sources.

8.1.6.3 Western Site. The western project site for Project P-225 lies above the central water resource of Tinian which is considered to be a well developed body of subsurface groundwater. Located below ground at depths close to sea level, the area is considered to offer some of the best potential well sites available. The extreme western area of the overlies a narrow channel of saltwater encroachment through a series of faults running from northeast to southwest. The groundwater in the immediate area surrounding this underground channel is considered too saline for potability. [Ref. 9]

The western project site contains no surface water bodies, wetlands or potable water sources.

8.1.7 Fauna

See Section 3.1.7 for background information.

8.1.7.1 Northern Sites. Surveys of the northern site for Project P-225 was conducted from August 13 to 16, 1986 and on a half-day walk-through basis on June 22, 1988 for Project P-002. The bird and mammal survey conducted on the site for Project P-225 and the nearby site for Project P-223 found 24 individuals of the Tinian Monarch, a Federally listed threatened species, and a number of other bird species. None of the species observed during the surveys are believed to be concentrated in the northern sites. [Ref. 10] The Tinian Monarch was one of the most common birds in the project sites. No other Federally listed or candidate threatened or endangered species of birds or mammals were seen or heard on the site for Project P-225. The complete bird and mammal survey is in Appendix B.

These survey results are consistent with those of other recent surveys conducted on Tinian which also found the Tinian Monarch to be a common

species. Based on these findings, the U.S. Fish and Wildlife Service down-listed the Tinian Monarch to threatened on 6 May 1987. (See Appendix B) With this exception, there have been no changes to the list of Federal endangered or threatened species of birds as it affects Tinian.

The Common moorhen and Mariana mallard were not detected during the August 1986 survey. This can be expected as the birds are both aquatic species and the site for Project P-225 does not contain wetlands. Similarly, the Island swiftlet was not seen on the northern site. This can also be expected as the Island swiftlet nests and roosts in caves and the site for Project P-225 does not contain caves. (See Appendix B). Although the botanical survey showed trees used as food sources by the Mariana fruit bats were on the northern site, fruit bats were not observed during the 1986 survey.

Other birds detected during the 1986 survey included the Bridled White-Eye (Zosterops conspicillata saypani), Rufous Fantail (Rhipidura rufifrons uraniae), Cardinal Honeyeater (Myzomela cardinalis saffordi), Collared Kingfisher (Halcyon chloris), Micronesian Starling (Aplonis opaca), Mariana Fruit-Dove (Ptilinopus roseicapilla), White-throated Ground-Dove (Gallicolumba kubaryi), and Philippine Turtle-Dove (Streptopelia bitorquata). At least 10 individuals were seen of each species except for the Cardinal Honeyeater (3), Mariana Fruit-Dove (4), and White-throated Ground-Dove (1). (See Appendix B)

The only mammals seen were 2 rats (species unidentified). (See Appendix B)

The June 1988 half-day walk-through survey of the site for Project P-002 also found the Tinian Monarch to be common throughout the site. No other Federally listed or candidate endangered or threatened bird species were observed on the site for Project P-002. A number of other native forest birds were detected in the half-day survey. (See Appendix B)

8.1.7.2 Eastern Site. The eastern site was surveyed during February 1989. Native birds detected during the survey were the Bridled White-Eye, Collared Kingfisher, Micronesian Starling, the Mariana Fruit Dove and the Tinian Monarch. Although the Tinian Monarch was found during the survey, it was not as common as on the northern or western sites. No other Federally-listed or candidate threatened or endangered species of birds were detected. (See Appendix B)

8.1.7.3 Western Site. The western site for Project P-225 was also surveyed during February 1989. The Tinian Monarch was common throughout the site and was the only Federally-listed threatened species of bird detected on the project sites. A number of other species of native birds were detected on the western site. (See Appendix B)

8.1.8 Flora

8.1.8.1 Northern Sites. Botanical surveys were conducted from August 16 to 21, 1986 for Project P-225, and on a half-day walk-through basis on June 22, 1988 for Project P-002. About one-half of the species found on

the site for Project P-225 are indigenous to the northern Mariana Islands. No Federally listed or candidate species of threatened or endangered plants were found on the project site during the survey. The complete botanical survey is in Appendix C.

According to the botanical survey for Project P-225, tangantangan was the primary canopy tree found. Other species of trees on the site included Formosan koa and ironwood. The understory was composed of five species of vines; Mikania scandens (no common name), bitter melon, alalag, banago and love-in-a-mist. The herb layer, mostly introduced plants, was restricted to the edges of the roads, runways and aprons. (See Appendix C). Since all of both project site was probably cleared during World War II, the vegetation on the site is regrowth over previously cleared land.

The half-day walk-through survey of the site for Project P-002 found the vegetation to be predominantly tangantangan, with emergent trees of Formosan koa, some which were 25-30 FT high. Based on the results of the half-day walk-through, no Federally-listed or candidate endangered or threatened plant species were found on the site. (See Appendix C)

8.1.8.2 Eastern Site. The eastern site was surveyed during February 1989. According to this survey, there were two vegetation types on the Eastern site. Most of the eastern site is presently being used as a pasture. About two thirds of the vegetation is made up of grasses and forbs palatable to domestic grazing animals. The remaining one third consists predominantly of undesirable and weedy vegetation and noxious species such as tuba-tuba. Along the western edge of the site, there is a wooded area comprised of trees all less than about 35 FT in height.

Based on the results of the survey, no Federally-listed or candidate endangered or threatened species of plants were found on the eastern site. No endemic plants were found on the eastern site. (See Appendix C)

8.1.8.3 Western Site. The western site for Project P-225 was also surveyed during February 1989. The vegetation on the western site for Project P-225 is composed of introduced trees, shrubs, and herbs. The majority of the species found on the site, about 76 percent of the total, were introduced species. The native species on the site were also found in the sites surveyed on Tinian. No Federally listed or candidate threatened or endangered plant species were found on the western site for Project P-225.

8.1.9 Population

See Section 3.1.9 for this discussion.

8.1.10 Land Use, Plans, Policies, and Controls

See Section 3.1.10 for background information.

8.1.10.1 Northern Sites. The site for Project P-002 is north of the North Field National Historic Landmark, a site listed on the National Register of Historic Places. Support facilities for the northern project

sites would be located outside of the Landmark, except for the water wells. Project P-225 is located entirely within the North Field Historic Landmark.

A dirt road west of the site for Project P-002 provides access to the northern tip of the island. It is used to visit a Memorial Cross dedicated to eight people who drowned when their boat capsized near Punton Tahong, the point at the northern tip of the island. The Cross has been accepted for listing on the Commonwealth Register of Historic Places. Memorial services are conducted in a small chapel at the site twice a year. [Ref. 12].

Military exercises are conducted within North Field two to four times per year. The northern most runway is primarily used to land aircraft and to bring personnel, fuel and ordnance to the area. Depending upon the type of exercise, anywhere from 25 to 500 personnel may be present for periods of one week to several weeks. Live firing usually occurs two or three days out of every exercise. During these exercises, the area north of the two traffic circles are closed to the civilian population on Tinian. [Ref. 16] The training exercises are coordinated with the U.S. Fish and Wildlife Service, as directed by the Endangered Species Act.

8.1.10.2 Eastern Site. The eastern site lies within the military lease area and is currently used for cattle grazing by Micronesian Development Corporation (MDC) under a lease from the Marianas Public Land Corporation. The eastern site lies within a 4,979-acre parcel which is leased by MDC under an agreement expiring in 1991. Cattle are grazed on the site under a rotational system. Normally, cattle are on the site for about one month and then it remains vacant for two to three months. Up to 500 head of cattle may be on the eastern site at one time. [Ref. 17]

Military exercises are currently not conducted on the eastern site.

The eastern site is within the area which would be leased back to CNMI under the current leaseback proposal.

8.1.10.3 Western Site. The western site also lies within the military lease area portions of which are for grazing and agricultural production. A small portion of the land is used for cattle grazing on a rotating basis similar to the system used on the eastern site.

Military exercises are currently not conducted on the western sites.

The western site for Project P-225 is within the area which would be leased back to CNMI under the current leaseback proposal.

8.1.11 Infrastructure

See Section 3.1.11 for this discussion.

8.1.12 Economic Characteristics

See Section 3.1.12 for this discussion.

8.1.13 Aeronautical Activities

See Section 3.1.13 for this discussion.

8.1.14 Archaeological/Historical Resources

8.1.14.1 Northern Sites. An archaeological/historic resources field reconnaissance of the project site for Project P-225 was conducted from September 6 to 11, 1986 and followed by detailed recording of sites from September 12 to 16, 1986. The archaeological field reconnaissance of the site for Project P-225 identified 13 archaeological/historic sites which ranged from small scatters of pottery to beverage cans and pieces of American military equipment. With one exception, all of these sites were not considered significant. However, the field reconnaissance did identify a ferro-concrete, Japanese fuel storage bunker approximately 250 LF beyond the front of the project site for Project P-225 and within the North Field National Historic Landmark. This bunker is the largest structure of this type found to date in the Mariana Islands and can be considered a contributing element to the National Historic Landmark. (See Site T-45 in Appendix D)

The findings indicate this bunker is the most significant extant structure located within the sites for either Project P-223 or Project P-225. The architectural detail and overall size of the bunker make it unique to Micronesia. Over 16,500 gallons of fuel burned inside the structure, yet its walls and ceiling did not collapse. It has been described as an unique resource and an integral part of the North Field National Historic Landmark. The archaeological field reconnaissance indicated removal of the site from the North Field National Historic Landmark would adversely affect the integrity of the North Field Landmark, which has been determined to be a significant cultural resource. (See Appendix D) Appendix D contains the complete historic resources survey and inventory.

The site for Project P-002 was surveyed on a half-day walk-through basis in July 1988. This survey found American and Japanese military sites, pottery scatters, and what may have been an entry structure normally found at the base of a shrine. Since the field work was limited, more intensive archaeological/historic work will have to be conducted to determine the significance of the sites discovered in the walk-through.

8.1.14.2 Eastern Site. The eastern site was surveyed during February 1989. The survey identified three sites, including World War II - era Japanese military structures and possible pre-war Japanese structures. All three structures were heavily damaged by bombing and do not warrant preservation. (See Appendix D)

8.1.14.3 Western Site. The western site was surveyed during February 1989. The survey of the western site for Project P-225 identified four sites, including one prehistoric pottery scatter and three areas formerly used by the U.S. military. The prehistoric pottery scatter was very sparse and confined to the ground surface. No further data collection is necessary at this prehistoric pottery scatter site.

The U.S. military areas occupy portions of the eastern side, the central and western portions, and southwestern portion of the site for Project P-225. In most cases, these sites are primarily structural remains, roads, walkways and foundations that do not appear worthy of preservation. However, if the CNMI Historic Preservation Officer deems them significant, further data collection would be necessary prior to construction on the site.

8.2 AFFECTED ENVIRONMENT AT RECEIVER SITES (GUAM)

8.2.1 Introduction

This section describes the existing environmental conditions at the receiver sites for Project P-225 and Project P-002, both to be constructed sometime after Project P-223. Two alternative sites have been identified for Project P-225, one northern site near the Runway site for Project P-223 and the other on land formerly controlled by the FAA. Due to the uncertainty of the siting for Project P-002, field studies consisted on half-day walk throughs in the Area of Consideration for this project. The area considered is near the northern site and the Runway site for Project P-223. The sites are shown on Figures 8.2.1, 8.2.2, 8.2.3 and 8.2.4.

8.2.2 Physiography and Topography

8.2.2.1 Northern Sites. The northern project sites are on the northwest corner and the western coast of the northern plateau area of Guam, a single broad surface that slopes from north to south. Mount Santa Rosa lies to the south and east of the project sites and rises to about 800 FT above Mean Sea Level (MSL).

The site for Project P-225 is relatively flat, with approximate elevations of between 440 FT above MSL on the south to about 515 FT above MSL on the north end.

The Area of Consideration for Project P-002 slopes from north northwest (approximately 600 FT above MSL) to east southeast (about 520 FT above MSL). The northern portion of the site includes several long dikes, approximately 12-15 FT high, that appear to be remnants of the earth work performed to build the Northwest Field runways and taxiways.

8.2.2.2 Former FAA Site. The former FAA site slopes from north to south and includes one large borrow pit in the northern portion. The northern portion of the site lies at an elevation of about 400 FT above MSL and slopes to about 360 FT above MSL in the southern edge.

8.2.3 Soil Characteristics

8.2.3.1 Northern Sites. Soils on the northern site for Project P-225 are typical of those developed on limestone plateaus of northern Guam. The soils are generally reddish, granular, friable clays that are generally less than 12 inches thick. [Ref. 24] Permeability of these soils is good and erosion potential slight. [Ref. 25] Other characteristics of the soils are: Shrink-swell potential: low; and

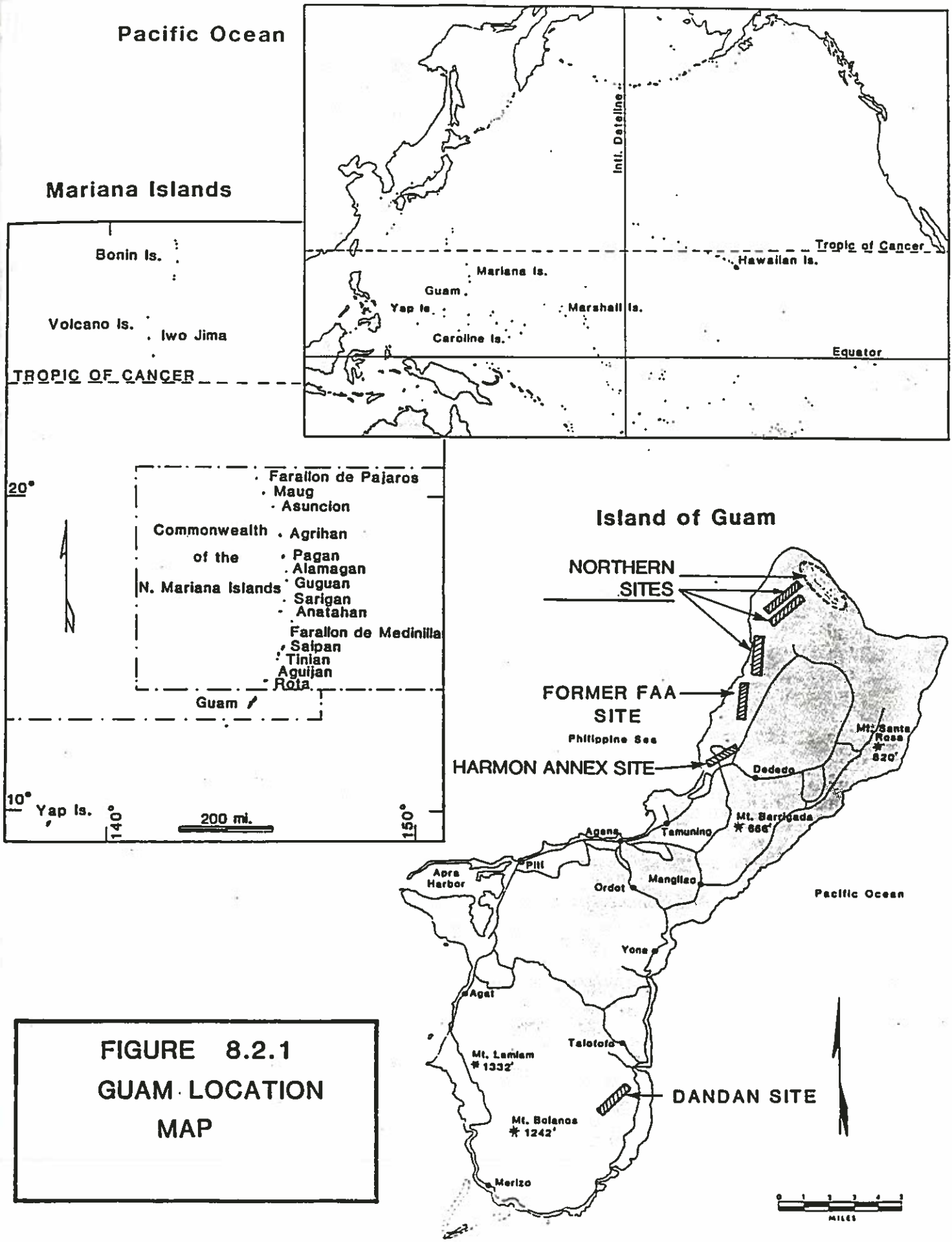


FIGURE 8.2.1
GUAM LOCATION
MAP

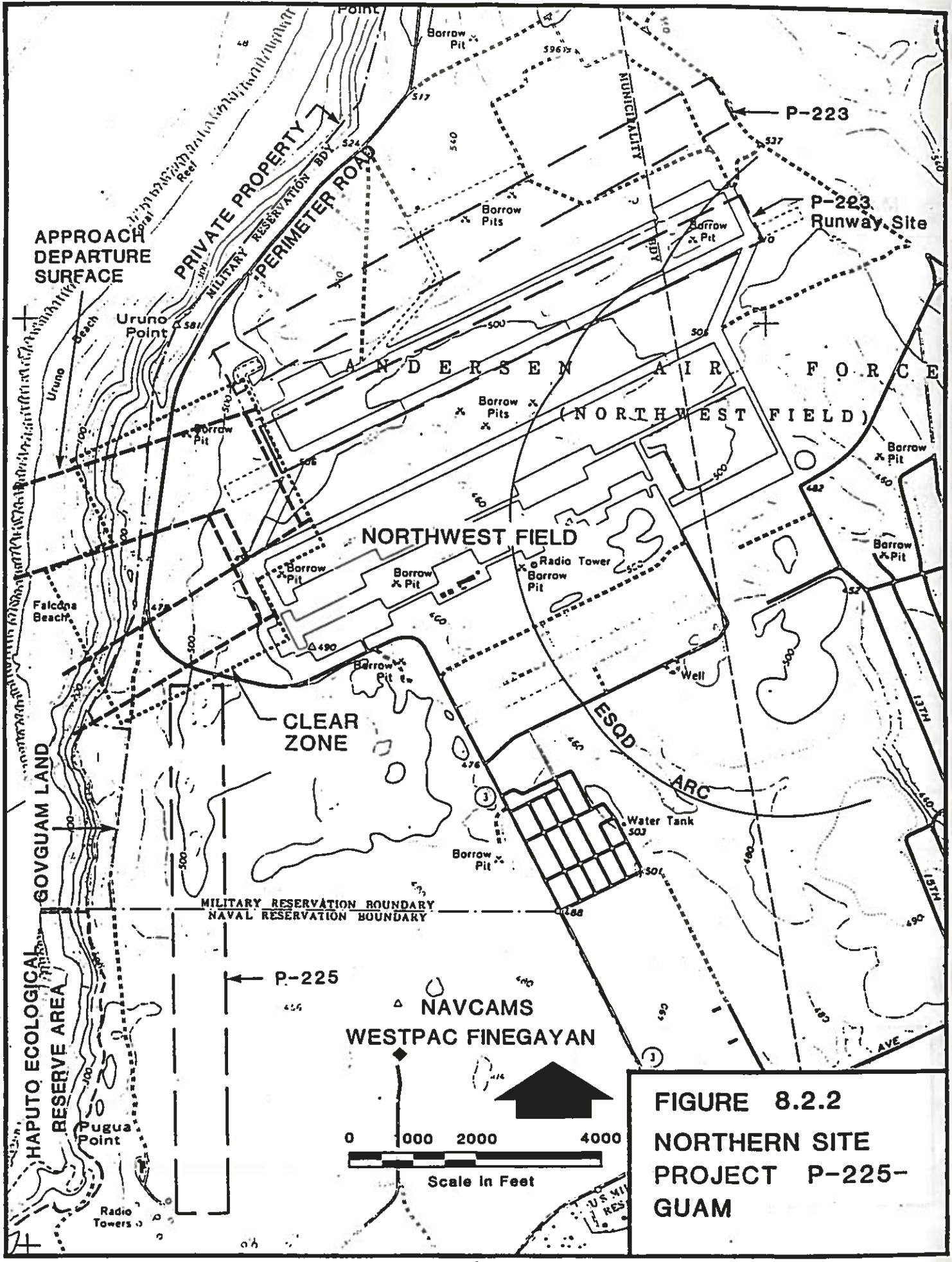


FIGURE 8.2.2
NORTHERN SITE
PROJECT P-225-
GUAM

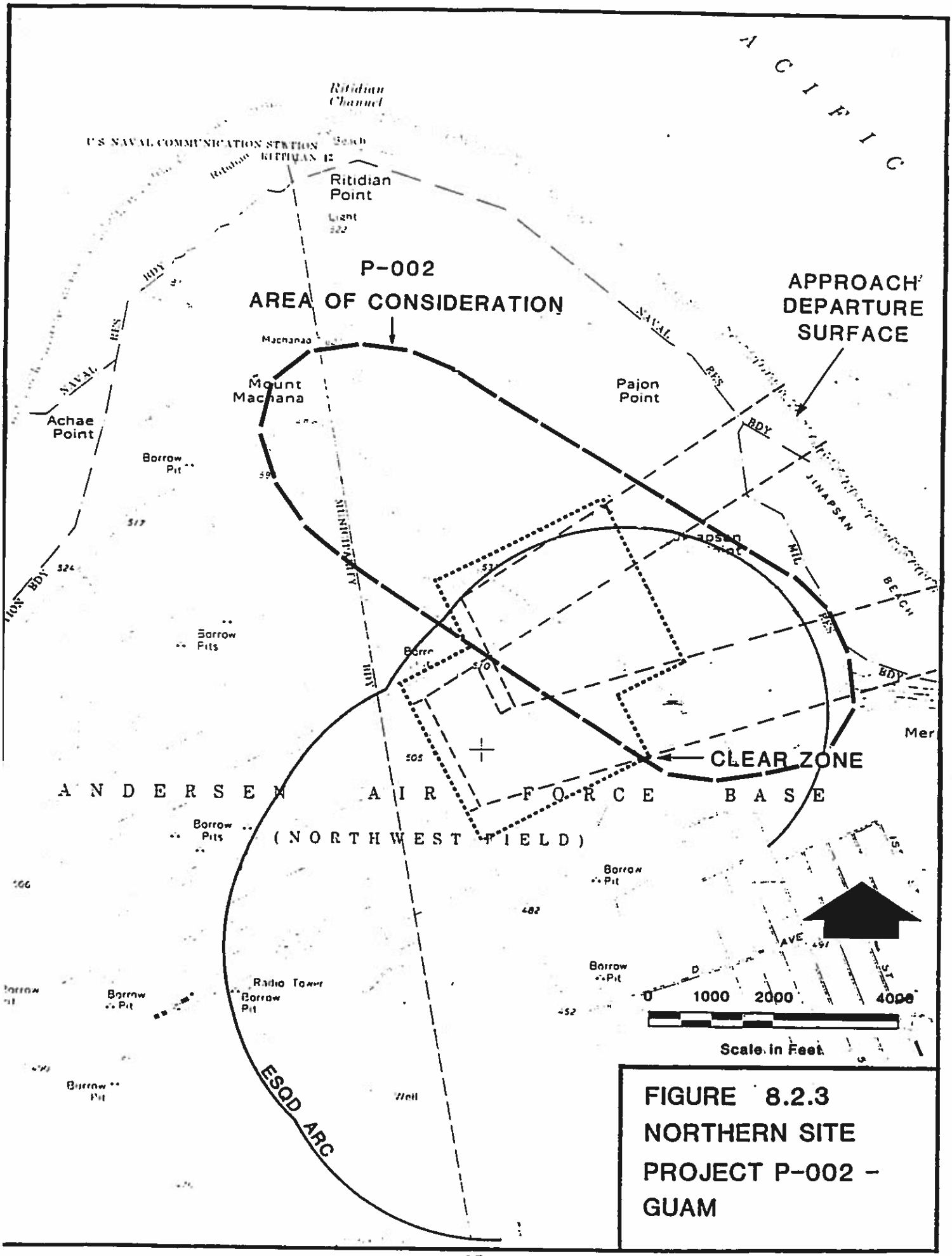


FIGURE 8.2.3
NORTHERN SITE
PROJECT P-002 -
GUAM

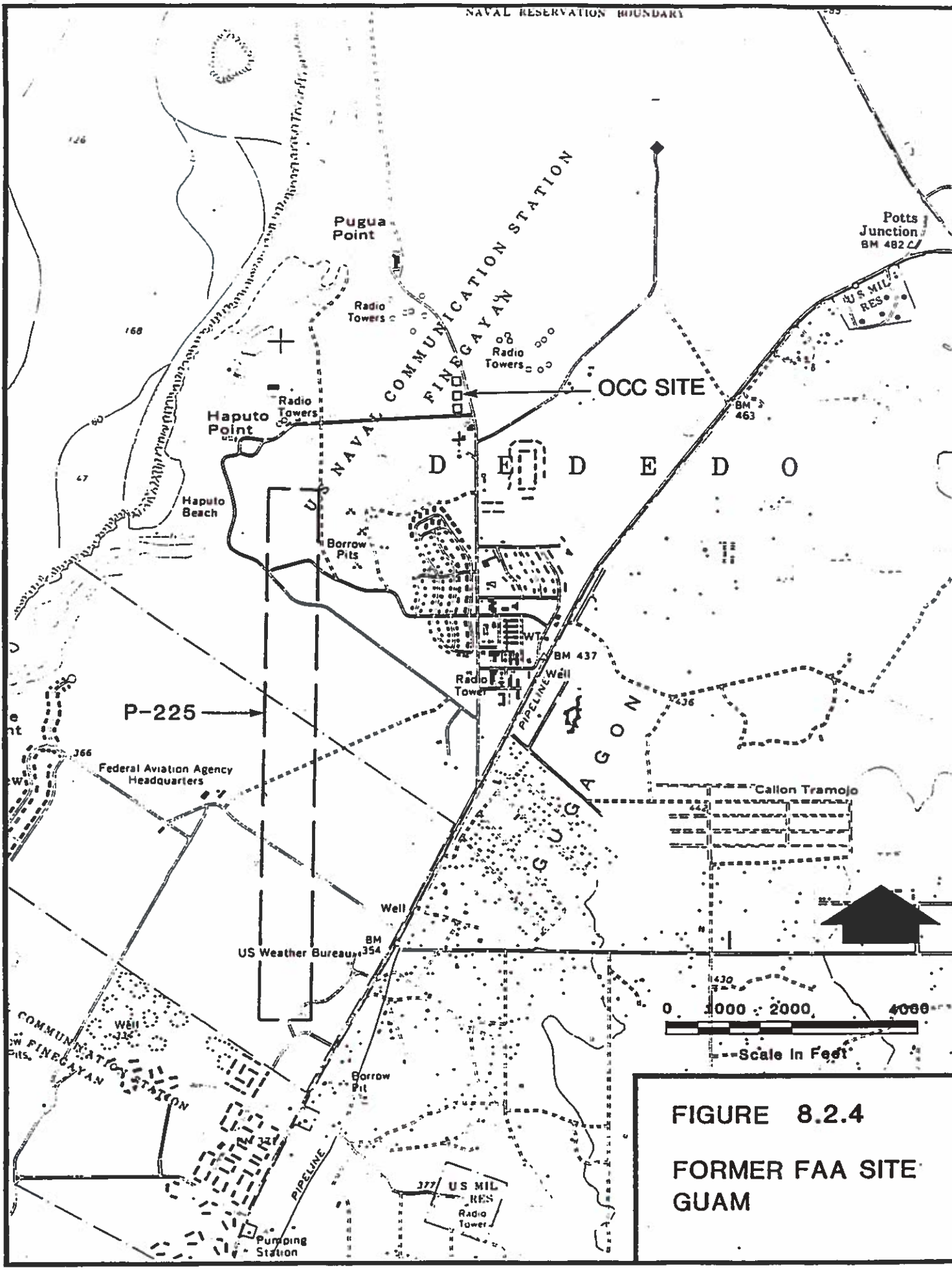


FIGURE 8.2.4

FORMER FAA SITE
GUAM

plasticity index: 10-20. [Ref. 26]

The soil in the Area of Consideration for Project P-002 is primarily Ritidian-rock, about 45 percent Ritidian extremely cobbly clay loam and 35 percent rock outcrop. The Ritidian soil is very shallow and well drained, and the permeability moderately rapid. Runoff is slow and the hazard of water erosion is slight. The rock outcrop is exposed areas of white, porous coralline limestone. Permeability is rapid and runoff very slow. Other characteristics of the soils are: Shrink-swell potential: low; and plasticity index: 10-25. [Ref. 26]

8.2.3.2 Former FAA Site. The soil on the former FAA site is primarily Guam cobbly clay loam. This soil type is similar to the soils on the northern sites. Permeability and erosion characteristics are similar to the northern sites. Other characteristics of the soils are: Shrink-swell potential: low; and plasticity index: 10-20. [Ref. 26]

8.2.4 Geologic Characteristics

8.2.4.1 Northern Sites. Guam is located in an active seismic zone and is currently classified in seismic probability Zone 3. It is subject to as much earthquake risk as southern California. The Pugua Fault, a major fault in northwestern Guam, lies approximately 1,500 LF west of the southern edge of the site for Project P-225. The north-south lying fault crosses the southern portion of NAVCAMS Finegayan. [Ref. 24]

The Area of Consideration for Project P-002, which lies on the northeast coast of Ritidian Point, is approximately 3.5 miles from the Pagua Fault. [Ref. 24]

8.2.4.2 Former FAA Site. The former FAA site lies directly east of the Pugua Fault.

8.2.5 Meteorology

See Section 3.2.5 for this discussion.

8.2.6 Hydrology

8.2.6.1 Northern Sites. See Section 3.2.6 for background information.

The Guam Northern Lens Study (GNLS) which examined ground water resources in Northern Guam. The GNLS indicates the northern sites are located over a basal ground water aquifer. Results of the surveys taken during the GNLS indicate the ground water of northern Guam to be of excellent quality, unusually free of pollutants. [Ref. 28]

There are no surface water bodies, wetlands or potable water sources on the northern sites.

8.2.6.2 Former FAA Site. The former FAA site is also located over the northern basal water lens. The former FAA site does not include any surface water bodies, wetlands or potable water sources.

8.2.7 Fauna

8.2.7.1 Northern Sites. Based on much of the research conducted to date, the northern area of Guam appears to be part of the habitat for the remaining bird population of the island. Numerous surveys have been conducted in the northern portion of the island, including a number on Northwest Field and, on NAVCAMS WESTPAC properties. These surveys have reported a number of species which are Federal and GOVGUAM listed as endangered or threatened.

The northern site for Project P-225 was surveyed with 100 percent coverage of the area from June 25 to 30, 1988. The Area of Consideration for Project P-002 was surveyed on a half-day walk-through basis on June 28, 1988. (See Appendix E)

The transect survey of the site for Project P-225 identified three endangered species within the designated area for the antenna array. Vocalizations were heard of at least two different individuals of the Mariana crow on two occasions and vocalizations of one Micronesian Kingfisher and one Guam Broadbill were heard. The Micronesian Kingfisher and the Guam Broadbill are Federal and GOVGUAM listed as endangered. The Guam Broadbill was last detected in Northwest Field in March 1984 and in Barrigada in central Guam in September 1984. (See Appendix E)

One Mariana Fruit Bat was seen to roost just north of the northern end of the site for Project P-225. Fruit Bats have rarely been in this area of Northwest Field in the last 10 years. This sighting indicates the area is still used by this species, a Federal and GOVGUAM listed endangered species. (See Appendix E)

The half-day walk-through transect survey in the Area of Consideration for Project P-002 detected a distant vocalization of several individuals of the Mariana crow. In addition, a member of the botanical team attracted a Crow into visual proximity by initiating a vocalization. No other species of Federal or GOVGUAM listed endangered species were detected during the half-day walk-through survey. The apparent absence of other endangered species in this area of Guam is consistent with the general decline of birds on Guam. However, the relatively undisturbed forest within the Area of Consideration for Project P-002 would provide habitat for forest birds. (See Appendix E)

These findings are consistent with other surveys conducted by the GOVGUAM Division of Aquatic and Wildlife Resources. Their work has detected the Mariana crow in Northwest Field in a number of locations. GOVGUAM has located active crow nests in Northwest Field and has "snake proofed" the trees in which the nests were located. Subsequently, observation has confirmed the hatching of three crows in the nests. This confirms Northwest Field as a habitat area for this endangered species.

The surveys also sighted feral dogs, cats, pigs, and evidence of Guam deer on the site for Project P-223. These findings were expected as hunting for pigs and deer are allowed on portions of Northwest Field, including all of the Area of Consideration for Project P-002, under procedures

established by AAFB. Hunting on the northern portion of the site of Project P-225 is controlled by NAVCAMS WESTPAC. None of the hunted species is a Federal or GOVGUAM listed or candidate threatened or endangered species.

Eight species of birds, in addition to Guam's endangered forest birds, inhabit or have been known to inhabit the areas on or near the proposed ROTHR project sites. These include the Philippine turtle dove, Streptopelia bitorquata: Eurasian tree sparrow, Passer montanus; black drongo, Dicrurus macrocerus; rock dove, Columba livia; black francolin, Francolinus francolinus; yellow bittern, Ixobrychus sinensis; lesser golden plover, Pluvialis dominica; and the white-tailed tropicbird, Phaethon lepturus.

Eight species of mammals, in addition to Guam's endangered bats, are known to occur on or near the proposed ROTHR project sites. These include the feral pig, Sus, scrofa; Guam deer, Cervus unicolor mariannus; black rat, Rattus rattus; Polynesian rat, Rattus exulans; house mouse, Mus musculus; musk shrew, Suncus murinus; feral dog, Canis familiaris; and the feral cat Felis catus. Many of the aforementioned mammals are considered undesirable or pest species.

Reptiles such as the blue-tailed skink, Emoia werneri; brown skink, Carlia fuscata; house gecko, Hemidactylus frenatus; monitor lizard, Varanus indicus; and the neo-tropical toad, Bufo marinus are known to occur on or near the proposed project sites. Five species of lizards are known to be in the Northwest Field area.

8.2.7.2 Former FAA Site. The former FAA site was surveyed during February 1989. During this survey, no native birds were detected on the site. Although the former FAA site contains forested areas and open cleared areas along the roadways, this lack of bird and mammal species could be expected. (See Appendix D)

Based on the results of the biological survey, no Federal or GOVGUAM listed or candidate endangered or threatened bird or mammal species were detected on the former FAA site. Most of the former FAA site is outside of the area designated as proposed essential habitat in the Forest Bird, Swiflets or Fruit Bat Recovery Plans.

8.2.8 Flora

8.2.8.1 Northern Sites. A transect botanical survey of the site for Project P-225 was conducted during July 1988. According to the findings of this survey, this site contains four major and three minor vegetation types. One major type, open grassland, is the area maintained by NAVCAMS WESTPAC for antennas. The second major type, Pandanus Scrub, occupies about one-quarter of the project site. This vegetation type is the result of previous human disturbance to the forest. The other two major types, Cycad Forest and regrowth limestone forest, occupy the northern portion of the project site. Both these vegetation types represent regrowth forest as a result of human disturbance or the high winds which affect this area of Guam. (See Appendix F)

Based on the results of the survey, no Federal or GOVGUAM listed or candidate endangered or threatened plant species were found on the site for Project P-225. No such plants have been reported here and, based on the field work and previous studies, there is no evidence to indicate that endangered species may be present on this site.

The botanical survey of the Area of Consideration for Project P-002 on Northwest Field was conducted on a half-day walk-through basis on June 28, 1988. According to this survey, the transect area for Project P-002 contained dense forests, with two small, weedy areas. Vegetation included modified limestone forest with little recent disturbance, a type of forest not found on the other northern sites. Large areas of concentrated native forest trees such as Ahgao, Mapunyao, Umumu, and Faia are found here. (See Appendix F) Based on the results of the half-day walk-through botanical survey, no Federal or GOVGUAM listed or candidate endangered or threatened species of plants were found on the site for Project P-002.

The single known surviving individual of the Serianthes nelsonii on Guam is located about 2,500 to 3,000 LF northeast of the northern end of the of the area surveyed for Project P-002. The Serianthes nelsonii is listed as an endangered species by the USFWS and GOVGUAM.

8.2.8.2 Former FAA Site. The former FAA site was surveyed during February 1989. According to this survey, the vegetation of the site is second growth limestone forest, except for two cleared areas where the cover is weeds. A 25 to 30-acre area south of the access road to the FAA headquarters building contains coconut trees. Lemae, dokdok, yoga and nunu trees, some more than 60 FT tall, were found in the borrow pit located north of Haputo Point Road on NAVCAMS WESTPAC lands. (See Appendix F)

In addition, 12 species of orchids and a number of other epiphetic flowering plants and ferns were found on this FAA site. None of the species found on this site were Federal or GOVGUAM listed or candidate threatened or endangered species.

8.2.9 Population

See Section 3.2.9 for this discussion.

8.2.10 Land Use Plans, Policies, and Controls.

See Section 3.2.10 for background discussion.

8.2.10.1 Northern Sites. The primary land use near the northern site for Project P-225 is the Northwest Field Perimeter Road, a two lane paved road, which provides access to the Navy and Air Force facilities at Ritidan Point. This road will not be affected by Project P-225. In addition, the Perimeter Road is used by the Artero family under a permit procedure established by AAFB. The Perimeter Road is the only land access currently available to the Artero family property, a portion of which lies above the cliffline and the remainder on the slopes and below the cliffline.

Hunting on Northwest Field south of the Perimeter Road is controlled by NAVCAMS WESTPAC. Persons hunting on the area between the Perimeter Road and NAVCAMS WESTPAC property must obtain permission from the NAVCAMS WESTPAC security office.

The Area of Consideration for Project P-002 lies entirely within Northwest Field. The Area does not contain any structures. Depending on the final site for Project P-002, portions could lie within the Explosive Safety Quantity Distance (ESQD) hazard area generated by the ordnance stored in Northwest Field.

Depending on the final site for Project P-002, a portion may lie within the Clear Zone for Runway 24R. DOD land use compatibility guidelines for clear zones allow certain types of facilities (communication, utilities, highway and street rights-of-way) within the area of Project P-002. [Ref. 42]

The Area of Consideration for Project P-002 is within the area designated for hunting by AAFB.

8.2.10.2 Former FAA Site. The northern one-half of this project site ia located on NAVCAMS WESTPAC and the remainder on land formerly controlled by the FAA and now under the control of the U.S. Navy. Although most of the project site is vacant of structures, an access road used by FAA personnel and residents of 89 family housing units crosses the project site slightly south of the center. The access road to the family housing units will have to be re-routed to minimize traffic through the antenna array. The family housing units are under the control of Public Works Center (PWC) Guam.

NAVCAMS WESTPAC South Finegayan lies immediately south of the former FAA property and has been identified as land which can be released by the Department of Defense according to the Guam Land Use Plan (GLUP) prepared in 1977. Subsequently, in 1982, GOVGUAM Coastal Management, Bureau of Planning, prepared a document entitled Proposal for Zoning of Releasable Military Lands which identified zoning for certain of the lands to be released. The zoning was intended to ensure that the releasable land would be used in a manner compatible with GOVGUAM land use objectives. [Ref. 44]

The 1982 GOVGUAM study shows the western one-half of the South Finegayan site is zoned open space, about one-quarter residential and the remainder military housing. [Ref. 44] (See Figure 6.2.3)

The former FAA site is closed to recreational hunting.

8.2.11 Radio Frequency Interference (RFI)

See Section 3.2.11 for this discussion. Figure 6.2.4 shows the existing RFI-free zones for NAVCAMS WESTPAC Finegayan.

8.2.12 Explosive Safety

See Section 3.2.12 for background information.

An ESQD arc generated by the weapons storage area in Northwest Field covers a portion of the Area of Consideration for Project P-002. Figure 8.2.3 shows the ESQD arc for Project P-002.

8.2.13 Aesthetic Considerations.

8.2.13.1 Northern Sites. The northern sites are located within established DOD installations. As such, antennas and other electronic installations are located within the vicinity of the northern sites. However, the northern sites are not visible from public roads which serve this area of Guam.

8.2.13.2 Former FAA Site. The former FAA site is located west of Route 3, the main roadway that serves this area of Guam. The project site is clearly visible from Route 3.

8.2.14 Archaeological/Historical Resources

8.2.14.1 Northern Sites. A 100 percent survey of the northern site for Project P-225 was conducted during July 1988. This survey identified a total of nine sites which consisted of isolated artifacts and scatters of prehistoric pottery. The sites are interpreted as temporarily occupied sites which were possibly used in conjunction with upland resource exploitation.

All sites were assessed as being significant under National Register of Historic Places Criterion D, which defines significant resources as ones which "have yielded, or may be likely to yield, information important in prehistory or history" (36 CFR Sec. 60.4).

No further work is recommended for five of the nine identified sites. These sites have been measured, mapped, described, photographed, and plotted. Test excavations at these sites indicate that no subsurface cultural materials are present. Data collected from them during the present survey is considered sufficient, and their continued physical preservation is not essential. For the remaining four sites, further data collection is recommended which would primarily consist of areal excavations. Upon completion of adequate excavation, continued physical preservation of the sites would no longer be essential.

A half-day walk-through archaeological transect survey of the Area of Consideration for Project P-002 was conducted in July 1988. According to this transect, two prehistoric pottery scatters were found, both consisting of relatively small areas (10 to 15 meters in diameter) with densities of about 3 to 6 sherds per square meter. Isolated sherds were also noted along the survey corridor. All of the pottery was found in areas of mature limestone forest. These pottery remains undoubtedly represent temporary use sites, probably occupied by coastal residents engaged in upland resource exploitation. (See Appendix G)

While no previous archaeological work has been conducted in the Area of Consideration for Project P-002, the adjacent coastal lowland areas have been examined in past surveys. Three sites, all located on the adjacent lowlands, have been designated in the Guam Register of Historic Places (Ritidian (66-04-0012), Pagan Point (66-04-0013), and Jinapsan (66-04-0014). The sites are not listed on the National Register of Historic Places. The three sites probably represent permanent prehistoric coastal village sites. (See Appendix G)

Based on the results of the half-day walk-through survey, it is likely that additional prehistoric sites are present in the native forest area. Elsewhere, disturbance has, most likely, obliterated most prehistoric remains. A complete 100 percent survey would be required to confirm the presence of additional archaeological resources.

8.2.14.2 Former FAA Site. The former FAA site was surveyed in February 1989. According to this survey, one very sparse prehistoric scatter was identified during the survey near the northern edge of the site. The scatter was confined to the surface and no further data collection is necessary at the site. (See Appendix G)

8.3 CUMULATIVE ENVIRONMENTAL CONSEQUENCES AT TRANSMITTER SITES (TINIAN)

8.3.1 Introduction

This section describes the cumulative environmental consequences of constructing and operating the ROTHR system transmitters for Projects P-225 and P-002 at the sites identified in Section 8.1.1. The effects are organized according to the information presented in Section 8.1. The site specific direct effects are discussed for each of the alternative sites considered. If the consequences are similar regardless of the alternative sites, the impacts are discussed in Section 4.1.

8.3.2 Physiography and Topography

8.3.2.1 Northern Sites. The northern sites are relatively flat with less than 1 percent slope. Cut material from the northern sites will be reused for fill, to the extent feasible. Preliminary estimates show that total earthwork of approximately 200,000 CY of cut and fill will be required for Project P-225 and 450,000 CY for Project P-002. Cutting, filling and grading the project sites will permanently alter the topographic conditions of the project sites.

8.3.2.2 Eastern Site. The eastern site lies on a plateau at about the 300-310 FT contour elevation. Preliminary estimates show that total earthwork of approximately 600,000 CY of cut and fill will be required for Project P-002. Cutting, filling and grading will permanently alter the topographic conditions of the project site.

8.3.2.3 Western Site. The western site lies at a contour elevation of about 210-215 FT. Preliminary estimates show that total earthwork of approximately 400,00 CY of cut and fill will be required for Project P-225.

8.3.3 Soils Characteristics

8.3.3.1 Northern Sites. The Dandan and Chinen soils on the northern project sites are well drained as they were formed over porous coralline limestone. Runoff under these conditions is slow with only a slight hazard of water erosion or siltation to adjacent shoreline areas.

8.3.3.2 Eastern Site. Soils on the eastern site include Masalong clays, Chinen clay loam, and the Takapochao Rock Outcrop Complex. These soils are well drained, with only a slight hazard of water erosion. The eastern site should not present a potential for siltation to adjacent shoreline areas.

8.3.3.3 Western Site. Soils on the western site are almost all of the Dandan-Chinen Complex. Since these soils are well-drained, they present only a slight erosion hazard. The western site is located well back from the shorelines and does not present a potential for siltation to shoreline areas.

8.3.4 Geologic Characteristics

8.3.4.1 Northern Sites. The base of the antenna towers and the guy wire anchorage systems will require excavations below the existing ground during construction activities. The excavations will not alter the geologic conditions of the project sites.

Tinian is located in a region of seismic instability. Thus, the antennas will be subject to hazards from earthquakes. In the event of a severe earthquake and antenna failures, they would buckle at the point of failure. This design will confine any hazard from a severe earthquake to the project sites.

8.3.4.2 Eastern Site. The eastern site lies near the convergence of a series of vertical faults which run from the southeast to the northwest. Any movement along these faults may cause the movement or instability of grounds around the periphery of the site. The antenna towers will be designed to buckle at the point of failure, thus any hazard from an earthquake will be confined to the project site.

8.3.4.3 Western Site. The area underlying the western site for Project P-225 is relatively fault free, although nearby faults may extend beneath it at deeper levels. As previously discussed, any failure of the antenna towers will be confined to the project site.

8.3.5 Meteorology

The impacts to air quality would be similar for any of the alternative project sites as the locations are relatively close to each other.

Clearing and grading the project sites could create dust and temporarily impact air quality, if conducted during the three month dry season, from February through April. Water spraying of the area being cleared will mitigate adverse impacts from dust. Emissions from operation of gasoline

and diesel-fueled heavy equipment would also temporarily impact air quality. These adverse effects would last only during the operation of mechanical equipment. Any pollutants and particles to be emitted will be dispersed by winds on the island.

See Section 4.1.5 for power plant emissions data.

8.3.6 Solid and Hazardous Waste

See Section 4.1.6 for this discussion.

8.3.7 Noise

See Section 4.1.7 for this discussion.

8.3.8 Hydrology

8.3.8.1 Northern Sites. Construction and operation of the transmitters and support facilities will not affect percolation of rainfall, as there will only be a minor increase in impervious surfaces over existing conditions. Thus, no adverse effects to groundwater resources are anticipated due to decreased percolation.

There are no existing potable water sources on the northern sites. Potable water will be supplied from new sources in the general vicinity of the project area. The total withdrawal of water is not expected to be significant.

Groundwater resources and other nearby surface areas will be protected from fuel stored for the power plant. An impervious containment area will be constructed around and beneath the storage tanks to contain accidental spills or leaks. The containment area for Project P-223 will be sufficient to contain the contents of one fuel storage tank or 200,000 gallons. Project P-225 and Project P-002 will each add one additional storage tank and associated containment area. The impervious containment area will protect groundwater resources of Tinian against accidental spills or leaks.

8.3.8.2 Eastern Site. The eastern site is not located over the central ground water resource of Tinian. Although this is the case, nearby ground water resources will be protected from accidental spills or leaks by an impervious containment area constructed around and beneath the fuel storage tanks. There are no existing potable water sources on the eastern site. Potable water will be trucked to a water storage tank at the project site.

8.3.8.3 Western Site. The western site for Project P-225 is located over the central groundwater resource aquifer of Tinian. The water quality of the aquifer will be protected by the impervious containment area constructed around and beneath the fuel storage tanks.

There are no existing potable water sources on the western site. Potable water for the transmitter and support facilities will be supplied for new

sources constructed in the general vicinity of the project area. The total withdrawal of water is not expected to be significant.

8.3.9 Fauna

8.3.9.1 Northern Sites. Construction of the antenna array and ground screen will remove all vegetation from the project site. Removal of vegetation will result in loss of wildlife habitat and ultimately the loss of the fauna dependent on the habitat. However, replacement of grassy areas will provide some measure of habitat for migratory shorebirds. The bird survey found that the northern sites provide a habitat for a number of species including the Tinian Monarch, a Federally listed threatened species. No other Federally listed or candidate threatened or endangered species of mammals were located on the northern sites. (See Appendix B)

The 1984 survey of the military lease area showed most species of birds found on the northern sites, including the Tinian Monarch, to be widespread on the island. Thus, although resident birds will be lost from the area to be cleared, the species present on the site, including the Tinian Monarch, are found in great enough densities elsewhere on the island that the loss will not significantly impact the island wide populations. See Appendix K for the USFWS biological opinion.

8.3.9.2 Eastern Site. The potential adverse effects to birds on the eastern site would be similar to the northern sites. Construction of the antenna array and ground screen will remove all vegetation from the project site. Removal of vegetation will result in loss of wildlife habitat and ultimately the loss of the fauna dependent on the habitat. However, since the eastern site is not located in the assumed flight path of the Common moorhen, if it flies between Tinian and Saipan, the potential impacts for bird strikes and collisions with the transmitter antenna towers should be lower than that which may exist for the northern sites.

The eastern site has a lower potential for effective shielding as it is located on a plateau and does not have a large number of nearby trees.

8.3.9.3 Western Site. The potential adverse effects to birds on the western site would be similar to the northern sites and the eastern site. Removal of vegetation will result in loss of habitat and ultimately the loss of fauna dependent on the habitat. Since the western site is surrounded by forested areas, shielding mitigation may be effective on this site.

The western site is located south of Lake Hagoi, the Common moorhen habitat area. This site would not be in the presumed flight path between Tinian and Saipan.

8.3.10 Flora

8.3.10.1 Northern Sites. Construction of the antenna arrays and ground screens would require removal of all vegetation on the project sites. After grading the site, grass or other suitable ground cover will be

planted. According to the botanical survey, vegetation of the northern sites are primarily large trees and a jungle composed of vines. Since all of the northern sites were probably previously cleared during World War II, the vegetation is secondary growth. None of the species found during the botanical survey are Federally listed or candidate threatened or endangered plants. Construction of the installation will not have a significant adverse effect to the flora of Tinian. (See Appendix C)

If all three ROTHR projects were to be implemented, the total cleared area would be about 207 acres or about 1.2 percent of the total vegetated land within the military lease area.

8.3.10.2 Eastern Site. Most of the eastern site is currently used for cattle grazing by the Micronesian Development Corporation. About two-thirds of the vegetation is composed of grasses and forbs palatable to domestic cattle. The remainder of the vegetation is poisonous plants such as tuba. Based on the botanical survey, no Federally listed or candidate endangered or threatened plant species were found on the eastern site. (See Appendix C)

Construction of the transmitter antennas would require removal of all vegetation and erection of a radiation hazard exclusion fence to protect humans and animals from RF radiation. Thus, cattle would have to graze in other areas of the island.

Although construction of the transmitter antennas would remove vegetation used for grazing, there will be no significant adverse effect to the vegetation of Tinian. The clearing required for Project P-002 is about 69 acres, or about 1.7 percent of the total area leased (4,010 acres) by the Micronesian Development Corporation in the military lease area. Other areas of the military lease area could be made available to Micronesian Development Corporation for cattle grazing purposes.

8.3.10.3 Western Site. The western site currently contains extensive growth of tangantangan and large numbers of ironwood and poinciana trees. Based on the botanical survey, no Federally listed or candidate endangered or threatened plant species were found on the western site. (See Appendix C)

Construction of the transmitter antennas would require removal of all vegetation from the designated area. Cattle grazing occurs on about 10 acres of the site for Project P-225. Although the botanical characteristics of the western site is not unique, construction of a transmitter on the site would remove the current agricultural use of the land area. The personnel exclusion fence would preclude cattle grazing and agricultural production within fenced areas. Current lessees of the land would have to relocate to other sites on the island or cease production.

8.3.11 Social and Economic Characteristics

See Section 4.1.11 for this discussion.

8.3.12 Infrastructure

See Section 4.1.12 for this discussion.

8.3.13 Archaeological and Historic Sites

8.3.13.1 Northern Sites. The site for Project P-225 is located entirely within the North Field National Historic Landmark. Project P-225 will involve construction of transmitter antennas on approximately 69 acres located within the National Historic Landmark. Construction will involve alteration (construction will alter existing conditions) of part of the property within the National Historic Landmark and will introduce visual elements that are out of character with the other areas of the Landmark. Thus, based on these criteria, Project P-225 will have an adverse effect on the North Field National Historic Landmark. However, the visual effects will not be permanent in that the antenna arrays will be removed at the end of the operational life of the system. Also, the World War II historic features in the Project P-225 site that were encountered during the 1986 inventory survey will be reassessed for significance based on the findings of the archival study noted above.

The personnel exclusion fence is located about 250 LF from a former Japanese fuel bunker which has been identified as one of the largest structures of this type found in the Mariana Islands. This bunker will be outside of the ROTHR construction site and not be adversely affected by Project P-225.

Section 106 of the National Historic Preservation Act of 1966, as amended, requires a Federal agency with jurisdiction over a Federal project to take into account the effects of the agency's undertaking on properties included in or eligible for the National Register of Historic Places and, prior to the undertaking, to afford the Advisory Council on Historic Preservation a reasonable opportunity to comment on the undertaking. In addition, 36 CFR Part 800, Protection of Historic Properties, sets forth the procedures the Federal agency must follow to ensure that historic preservation concerns are accommodated with its proposed undertaking. [Ref. 60] Furthermore, Section 110 (f) of the National Historic Preservation Act specifically notes that:

> Prior to the approval of any Federal undertaking which may directly and adversely affect any National Historic Landmark, the head of the responsible Federal agency shall, to the maximum extent possible, undertake such planning and actions as may be necessary to minimize harm to such landmark, and shall afford the Advisory Council on Historic Preservation a reasonable opportunity to comment on the undertaking. [Ref. 60]

The CNMI Historic Preservation Officer and the Tinian Historic Preservation Representative have been consulted by the U.S. Navy to develop appropriate mitigation measures for Project P-223 which are responsive to the historic values of the North Field National Historic Landmark. These mitigation measures will include: (1) additional archival data gathering especially focusing on the identifications and locations of facilities and activities associated with the two atomic bomb pits located in North Field; (2) photographic documentation of significant historic resources likely to be impacted by Project P-223 construction including a representative sample of those runways, hardstands, taxiways, building foundations and other such features that are most amenable to photography; and (3) disposition with the CNMI Historic Preservation Office of a complete set of collected archival documents, negatives, and prints of all photographs. (The photographs will follow the guidelines for photography established by the National Park Service.)

If Project P-225 at the northern site were to be implemented, similar mitigation measures would have to be determined and agreement with the CNMI Historic Preservation Officer would be necessary prior to construction.

The site for Project P-002 is located north of the North Field Historic Landmark District. The half-day walk-through archaeological and historic survey identified sites which will require further field and literature research to determine the significance of the sites.

8.3.13.2 Eastern Site. The archaeological survey of the eastern site revealed three sites, all remnants of World War II era Japanese structures. All three of these remnants were heavily damaged by bombing. Although the sites do not warrant preservation, if the CNMI Historic Preservation Office deems it necessary, additional limited data recovery would be performed prior to construction on the site.

8.3.13.3 Western Site. The survey of the western site for Project P-225 revealed four sites, one prehistoric pottery scatter and three areas formerly used by the U.S. military. The prehistoric pottery scatter was very sparse and confined to the surface. No further data collection is necessary at this site. The U.S. military sites consisted were primarily structural remains, roads, walkways, and foundations that do not appear worthy of preservation. If deemed significant by the CNMI Historic Preservation Officer, further data collection may be necessary prior to construction on the project site.

8.3.14 Aesthetics

8.3.14.1 Northern Sites. The northern project sites are located on the tip of Tinian in an uninhabited area. The relatively flat terrain of the North Field area and nearby existing dense vegetation should limit visibility of the antenna towers to short distances on Tinian. Notwithstanding this condition, the XMTR and support facilities will be an intrusion into the visual environment of this area of Tinian.

The historical markers identifying the sites where the atomic bombs dropped on Japan were loaded on aircraft are frequently visited by tourists to Tinian. These historical markers are approximately 1,000 LF feet in front of the personnel exclusion fence for Project P-225. The antenna towers, ground screen, support facilities and fencing will clearly be visible to visitors of the historical sites.

Project P-002 is sited east of the trail that leads to the Memorial Cross on the northern end of the island. The antenna towers, ground screen, support facilities and personnel exclusion fencing for Project P-002 will be clearly seen by visitors to the Memorial Cross.

The northern tip of Tinian is about 2.75 miles south-southwest from the southern end of Saipan. Although the antenna towers will be constructed from lattice work and cable, they will be visible from portions of southern Saipan and from higher elevations in the central area of Saipan. As seen from Saipan, the antenna towers will be a contrast to the existing vegetation covered and undeveloped visual environment of this area of Tinian.

8.3.14.2 Eastern Site. The eastern site is located on a plateau at an elevation of approximately 300-310 FT. Since the area on Broadway near the West Tinian Airport is at an elevation of approximately 240 FT, the eastern project site should be visible from the roadway, a distance of about two miles. The antenna towers will be a contrast with the cattle ranching activities in this area of Tinian.

The eastern site is about 8 miles south-southwest of Saipan and may be visible from the southern portions of Saipan. Most likely, the antenna towers will not be visible from southern portions of Saipan.

8.3.14.3 Western Site. The western site for Project P-225 is located in an area used for cattle ranching and other farming activities. The project site and surrounding areas have relatively flat terrain, tall trees, and other dense vegetation which should limit the visibility of the antenna towers to short distances. The antenna towers will be an intrusion into only a limited area of the visual environment of this area of Tinian.

The western project site is approximately 10 miles south-southwest of Tinian and should not be readily visible from Saipan.

8.3.15 Electromagnetic Radiation

8.3.15.1 Radio Frequency Electromagnetic Radiation (RFEMR). See Section 4.1.15.1 for this discussion.

8.3.15.2 Biological Exposure. See Section 4.1.15.2 for this discussion.

8.3.15.3 Hazards to Fuel and Flammable Atmospheres (HERF). See Section 4.1.15.3 for background information.

As previously discussed, no operations involving transfer of volatile fuels or flammable gases such as natural gas or propane will be permitted in the vicinity of the ROTHR transmitters within the limits as shown in Figure 4.1.2. Figure 8.3.1 presents a composite scaled overlay of the ROTHR HERF Restricted Zone for all three sites at North Field. Fueling operations outside of the given zone will not be at risk. Signs will be posted in areas with public access warning visitors about fueling activities. None of the proposed transmitter sites on Tinian will have any adverse effect on aircraft fueling operations at any of the surrounding airports.

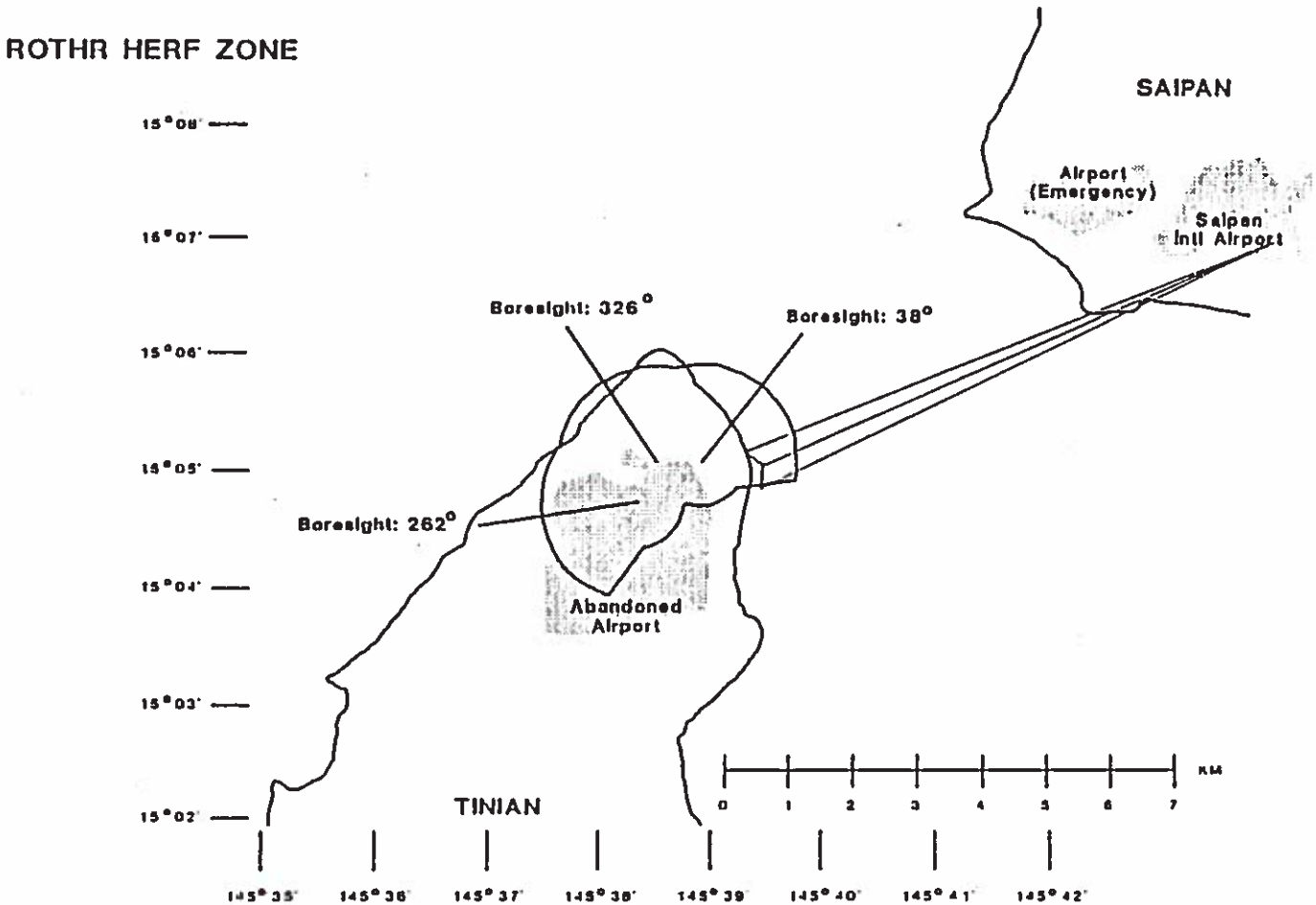
8.3.15.4 Hazards to Ordnance (HERO). See Section 4.1.15.3 for background discussion.

HERO Susceptible Ordnance. Civil or military aircraft containing only HERO SUSCEPTIBLE cartridge actuated devices (CADs) such as fire extinguisher actuators may normally be safely flown anywhere in the vicinity of the ROTHR transmitters. However, since some CADs have demonstrated susceptibility to RF emissions in the HF spectrum, restricted zone has been established extending 700 meters in front of the antenna and up to an altitude of 650 feet. All aircraft carrying CADs may safely operate outside of the limits of this zone. The boundaries of the HERO Restricted Zone for CADs is depicted in Figure 4.1.3. Figure 8.3.2 is a composite scale overlay of Figure 4.1.3 for the three proposed sites at North Field. Figure 8.3.3 shows the relationship of the Saipan International Airport instrument approach to the limits of Figure 4.1.3 for Project P-002 which points toward the runway.

Flights of aircraft carrying other, more potent forms of ordnance (mostly military aircraft) will be restricted according to their degree of susceptibility to electromagnetic radiation. Ordnance or explosives certified HERO SUSCEPTIBLE in the presence of HF radiation greater than 10 or 20 volts per meter may be safely carried outside the limits of Figure 4.1.4. Figure 8.3.4 is a composite scaled overlay of Figure 4.1.4 for the three proposed sites at North Field. The largest restriction zone applies to 10 volt per meter susceptibility. The 20 volt per meter susceptibility zone is bounded by the smaller area.

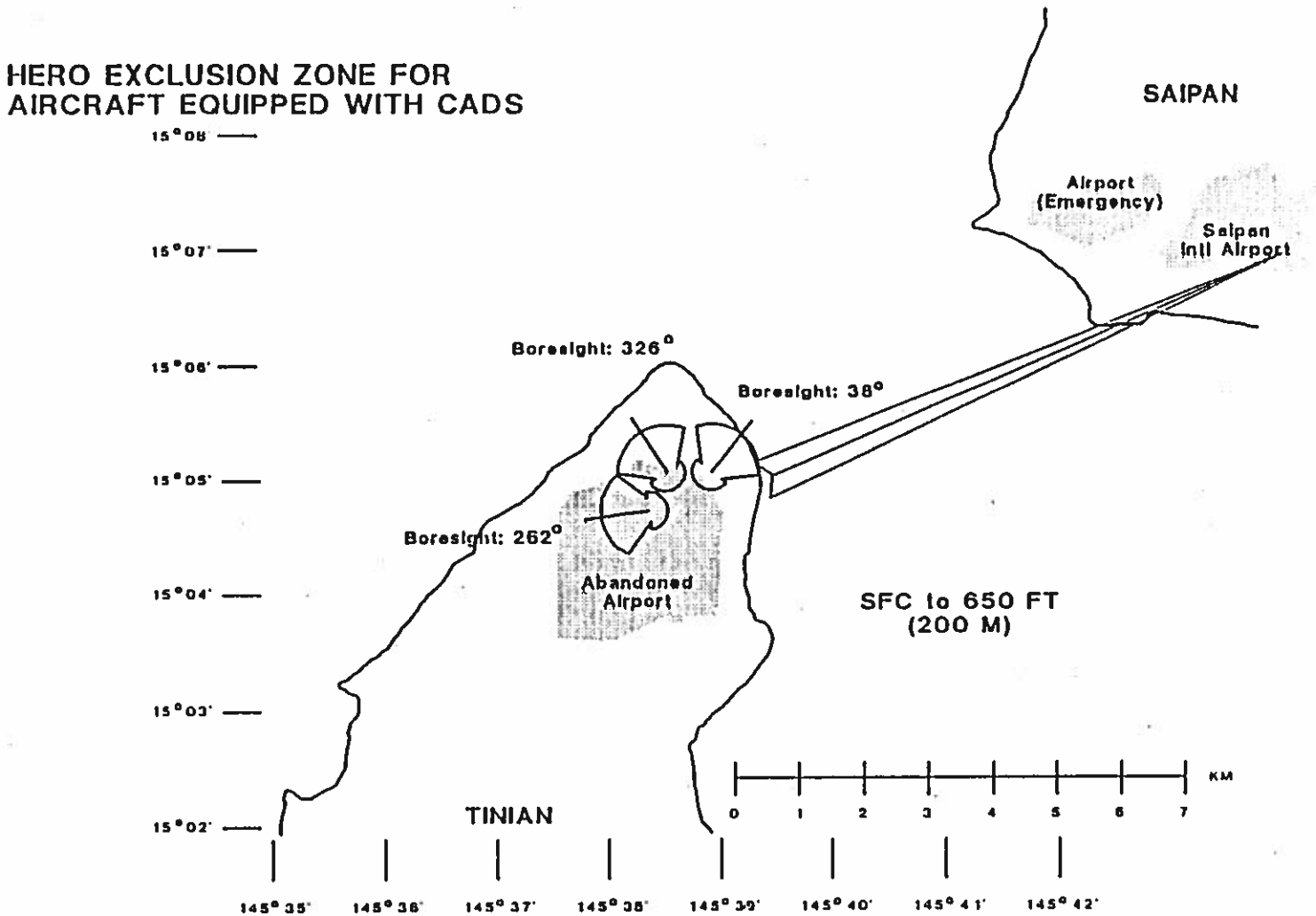
For HERO SUSCEPTIBLE ordnance which has not been tested, operations must remain clear of the limits of Figure 4.1.5 until actual susceptibility limits of the ordnance are determined by test. Figure 8.3.5 is the composite scaled overlay of Figure 4.1.5 for the three proposed sites at North Field. Operations with HERO SAFE ordnance are unrestricted.

HERO Unsafe Ordnance. Ground operations involving the handling of ordnance as HERO UNSAFE should not be conducted within the boundaries of Figure 4.1.6 Activities which meet this criterion include munitions factories, ordnance depots and military airfields were ordnance is loaded, tested or otherwise handled in an unsafe configuration. When the ROTHR transmitter is located very close to the shoreline as with Tinian, the boundary shown in Figure 4.1.6 may be extended due to the more favorable propagation characteristics of seawater compared to land. The degree to which this will actually occur will be determined by the electromagnetic



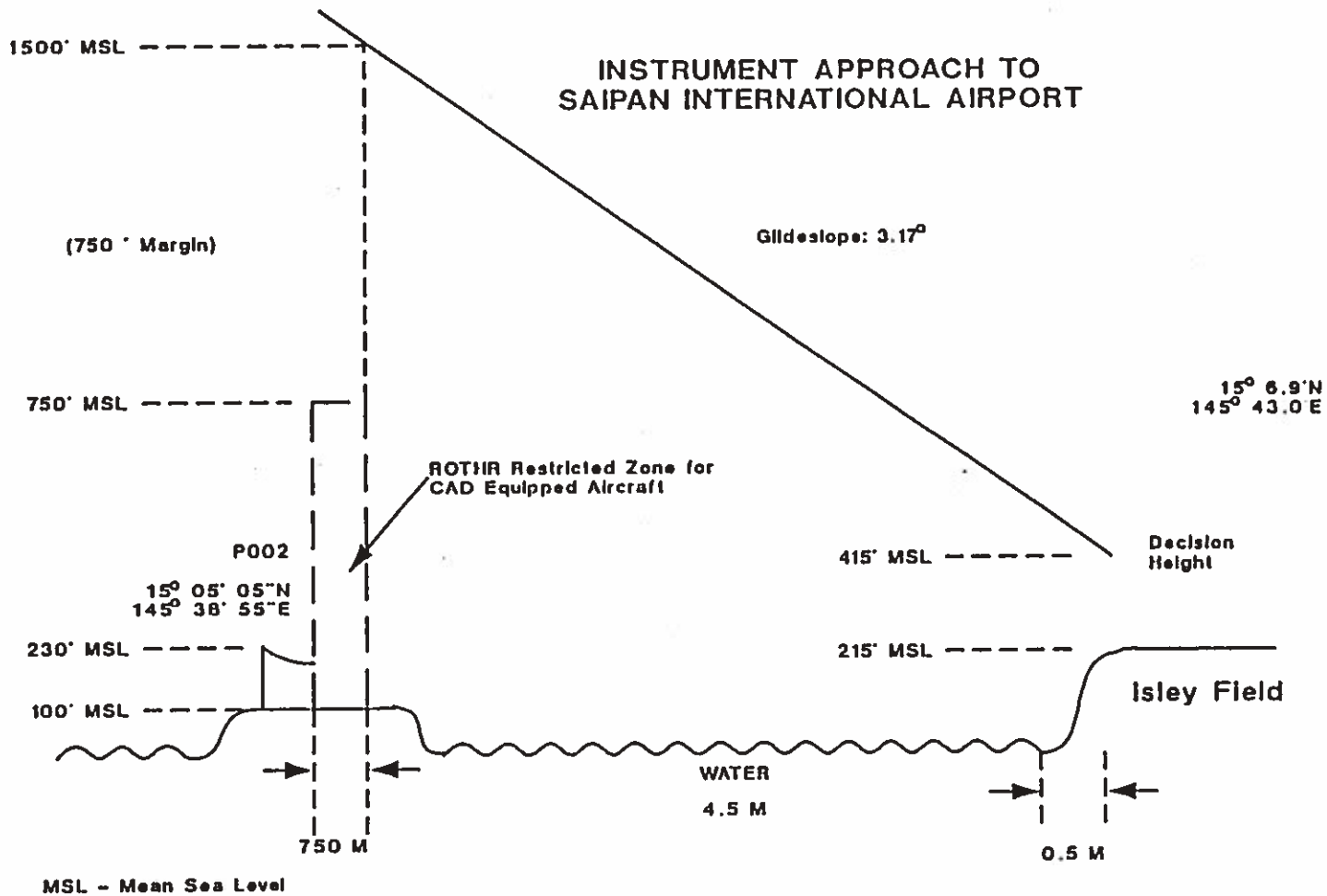
COMPOSITE ROTHR HERF
RESTRICTED ZONE

FIGURE 8.3.1



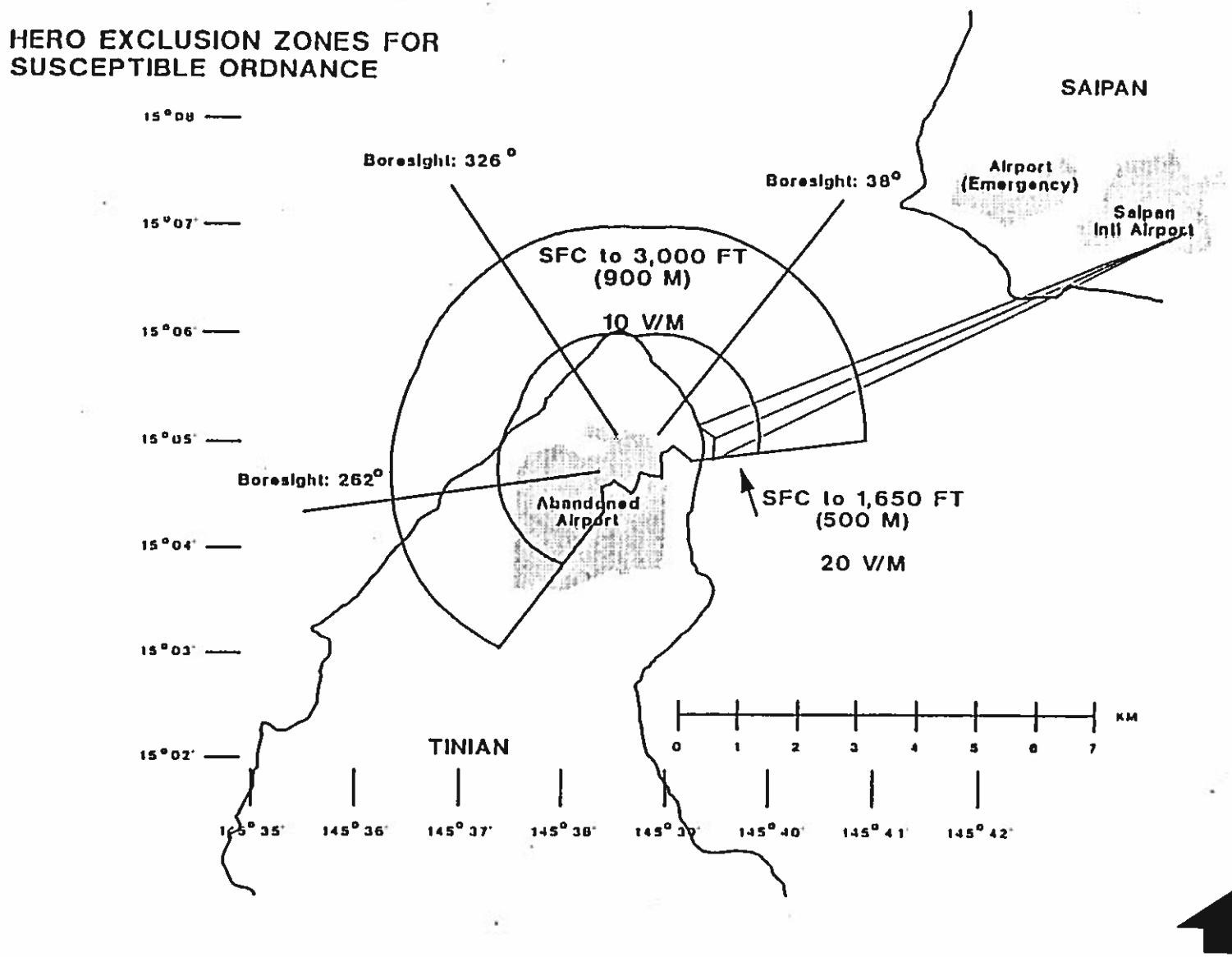
COMPOSITE ROTHR HERO RESTRICTED ZONE

FIGURE 8.3.2



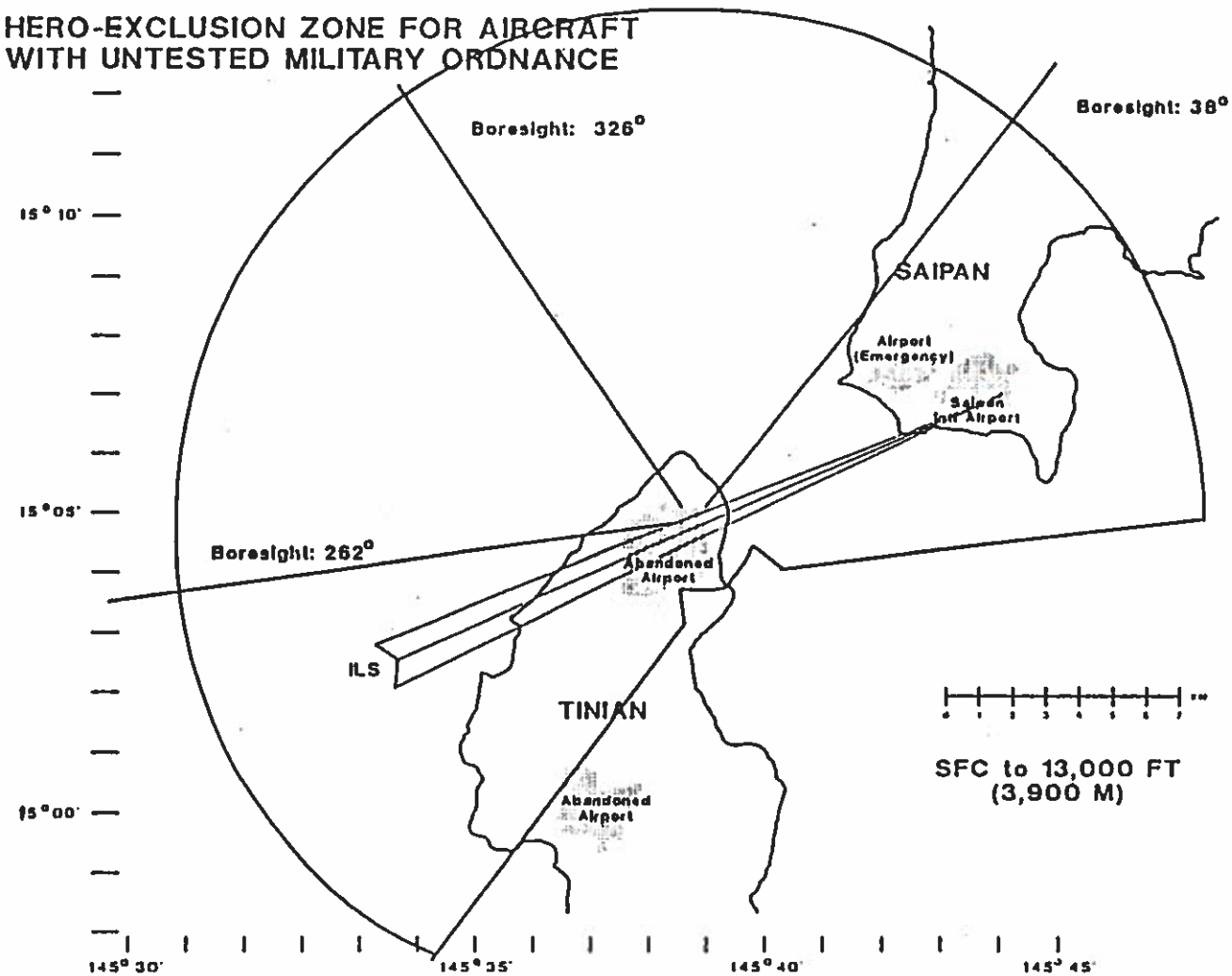
INSTRUMENT APPROACH TO SAIPAN INTERNATIONAL AIRPORT

FIGURE 8.3.3



COMPOSITE ROTHR SPECIFIC HERO
SUSCEPTIBLE RESTRICTED ZONE

FIGURE 8.3.4



COMPOSITE ROTHR HERO
SUSCEPTIBLE RESTRICTED ZONE

FIGURE 8.3.5

field strength survey which will be conducted as the system is activated. For analysis, Figure 8.3.6 presents a composite scale overlay of Figure 4.1.6 for all three proposed sites at North Field. No existing HERO UNSAFE activities have been identified within these restricted zones.

8.3.15.5 Radio Frequency Interference (RFI). See Section 4.1.15.5 for this discussion.

8.3.16 Aeronautical Activities

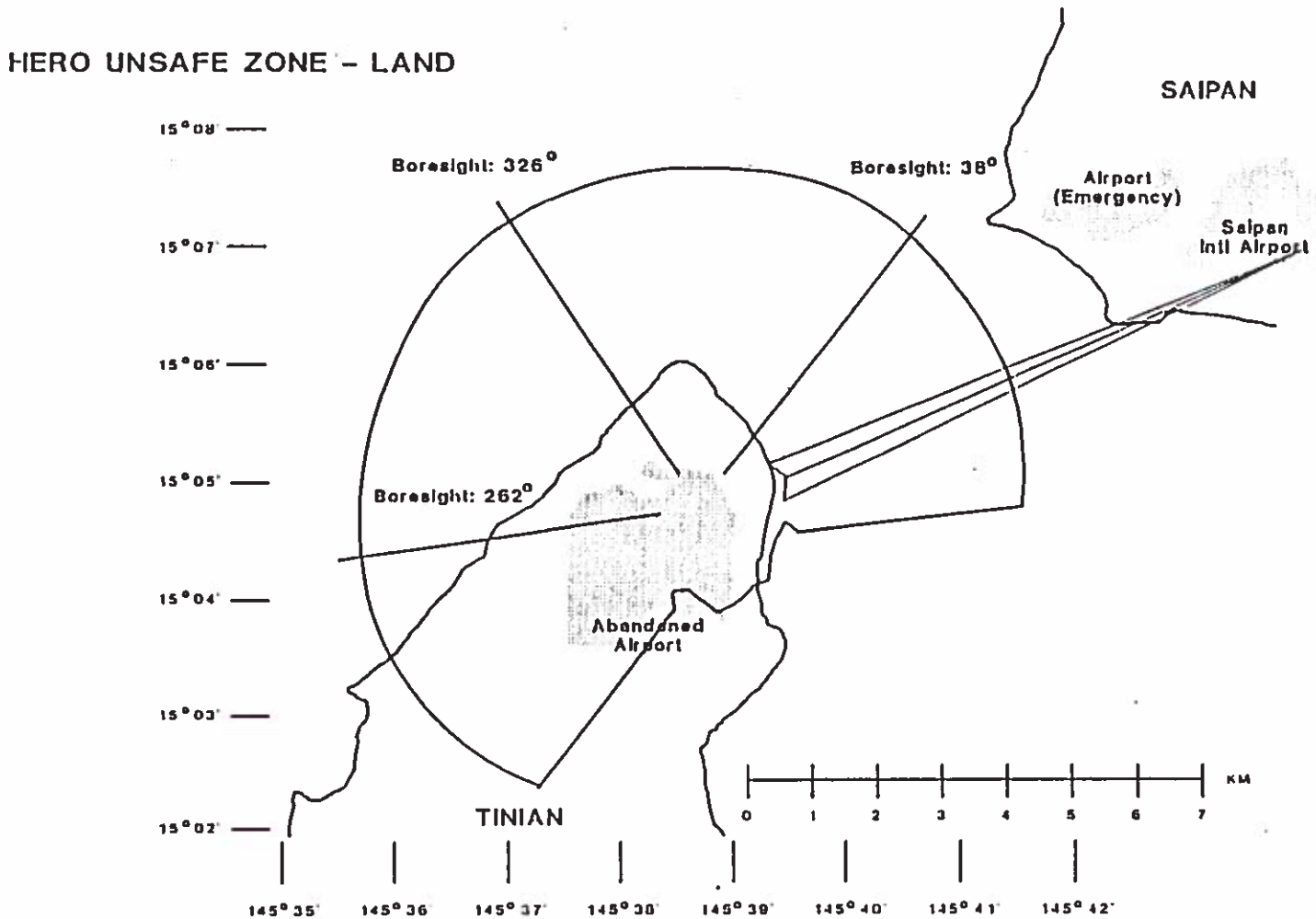
8.3.16.1 Saipan International Airport. The northern sites are located on a bearing of S 71^{0}W about 5.6 miles (approximately 29,600 LF) from the end of Runway 7 on Saipan International Airport. Analysis of Federal Air Regulations (FAR) Part 77, Objects Affecting Navigable Airspace, indicates the northern project site would be located under the approach surface for Runway 7. (The approach surface for a civilian airfield is defined as an imaginary surface longitudinally centered on the extended runway centerline and extending outward and upward from each end of the primary surface). The approach surface starts 200 FT from the end of Runway 7 and extends for 10,000 FT at a slope of 50 to 1 with an additional 40,000 feet at a slope of 40 to 1. Objects or structures protruding into this imaginary surface are considered an obstruction to air navigation. [Ref. 62]

Based on wind conditions at the Airport, about 90 percent of the departures are to the east, or from Runway 7. Similarly, about 90 percent of the approaches would be on Runway 7 from the west. Based on a normal 3% glide slope approach, aircraft would be 900 to 1,000 FT above the North Field area when approaching Runway 7. [Ref. 63] Some of the transmit antennas will be 125 FT high. Thus, the northern project site will not adversely affect aircraft approach patterns to Runway 7 at Saipan International Airport.

The effects of ROTHR RF emissions upon aircraft operations at Saipan International Airport have been the subject of experiments conducted by the Naval Research Laboratories (NRL) and the Electromagnetic Compatibility Analysis Center (ECAC). These experiments were performed to specifically measure the coupling of the ROTHR transmitted signal to the instrument landing system (ILS) onboard aircraft. The FAA is currently reviewing the results of these experiments to determine the impact on ILS operations. No restrictions must be applied to aeronautical activities at Saipan Airport which are incompatible with present and anticipated future operations. No degradation of the ground-based or airborne radio-navigation systems is expected.

See Section 10.0 for additional discussion on aircraft operations.

8.3.16.2 West Tinian Field. West Tinian Field is located about 1.5 miles south of the western site and two miles west of the eastern site. The Field is not equipped with navigational aids and primarily accommodates single engine air taxi operations to and from Saipan International Airport. Aircraft normally approach and depart to the east on Runway 8. Aircraft approaching Runway 8 from Saipan would circle in east of the



COMPOSITE ROTHR HERO UNSAFE RESTRICTED ZONE

FIGURE 8.3.6

western sites before landing at West Tinian Field. Aircraft departing for Saipan on Runway 8 would turn north before the eastern site. Thus, there will be no adverse impact to aircraft operations at West Tinian Field.

See Section 10.0 for additional discussion on aircraft operations.

8.3.17 Possible Conflicts Between the Proposed Action and the Objectives of Federal, State, and Local Land Use Policies and Controls

The Coastal Zone Management Act (CZM) of 1972 as amended (P.L. 92-583) requires Federal agencies conducting or supporting activities directly affecting the coastal zone to be consistent to the maximum extent practicable with approved local coastal management programs. The CZM Act requires that any Federal agency undertaking any development project in the coastal zone shall ensure that the project is consistent to the maximum extent practicable with approved local management programs (Section 307(c)). [Ref. 14]

A Consistency Determination should be provided to the CNMI at least 90 days before final approval of the ROTHR project. The Consistency Determination should include:

- a brief statement indicating whether the proposed activity will be undertaken in a manner consistent to the maximum extent practicable with the CZM program,
- a detailed description of the activity and its associated facilities, and
- an assessment of the coastal zone effects, including comprehensive and supportive information.

Federal agencies must ensure that their activities are consistent to the maximum extent practicable with the enforceable, mandatory policies of the management program, but need not evaluate effects for which there are no mandatory or recommended policies (15 CFR Part 930.39). Upon submission of the Consistency Determination, CNMI, CRM Program Office will have 45 days to respond, with a 15 day extension allowed, or the U.S. Navy may presume agreement (15 CFR 930.41).

If CRM Program Office should disagree with the Consistency Determination submitted by the U.S. Navy, it must describe the nature of the inconsistency and alternative measures which could be adopted to proceed in a manner consistent to the maximum extent practicable.

If there remains serious disagreement between the CRM Program Office and the U.S. Navy, either party may request mediation services by the Secretary of Commerce. However, both parties must agree to the mediation proceedings (15 CFR 930.42 and 930.112). Notably, the regulations do not specify that a Federal action cannot proceed in the event of a CZM agency's (in this case the CRM Program Office) continuing disagreement. Presumably, therefore, the U.S. Navy may proceed with its proposed action, unless other judicial remedy is sought by CNMI.

The project sites are located within lands leased by the U.S. Government for defense purposes. However, notwithstanding the exclusion of Federal government lands, as previously discussed, the CNMI Coastal Resources Management (CRM) program provides that proposed projects on Federally excluded lands which have a direct and significant impact on areas subject to the CRM program shall be consistent with the CRM Rules and Regulations and applicable Federal and CNMI laws. The applicable CNMI policies set forth in Public Law 3-47 (CNMI Coastal Resources Management Act) are discussed below:

> Section 3. (3)(D) Improvement of Coordination Between Commonwealth and Federal Agencies

The Department of Navy, U.S. Pacific Fleet, Commander Naval Forces Marianas, Commander Naval Base Guam announced the ROTHR projects by letter, dated 26 January 1987 to Governor Tenorio. Subsequently, newspaper and newsletter articles were written describing the proposed project. (See Appendix A).

In addition, on 23 March 1987, representatives of the Department of the Navy, Commander Naval Forces Marianas, Guam and Department of the Navy Pacific Division, Naval Facilities Engineering Command Pearl Harbor, Hawaii met with CNMI agencies to discuss the proposed project and to solicit comments and concerns.

Subsequently, on December 24, 1987, the Department of the Navy, Pacific Division Naval Facilities Engineering Command published a Notice of Intent (NOI) in the Federal Register to prepare an EIS for the Construction of Electronics Installations on Tinian, CNMI, and on Guam, MI. The NOI solicited comments to be addressed in the EIS.

Scoping meetings to identify and narrow the issues to be addressed in the EIS were held on Saipan on February 3, 1988 in the Governor's conference room and in Garapan Elementary School. A scoping meeting was also held in the Tinian Social Hall, Village of San Jose, on February 4, 1988. A total of approximately 20 members of the public and CNMI agency personnel attended the meetings on Saipan. Approximately 80 members of the public, CNMI agency personnel, and Tinian officials attended the scoping meeting on Tinian.

Subsequent to publication of the DEIS in July 1989, the U.S. Navy held public hearings to solicit comments on the DEIS. Public hearings were held on Saipan in the afternoon and evening on August 16, 1989, and in the afternoon on August 17, 1989 on Tinian. The list of questions and comments from the public hearings are shown Section 10.0.

> Section 3. (4) Plan for and manage any use or activity with the potential for causing a direct and significant impact on coastal resources. Significant adverse impacts shall be mitigated to the extent practicable.

Bird strikes and collisions with the transmitter antennas and guy wires could be a significant adverse effect on the birds near the project sites.

Previous research has shown that bird strikes and collisions may be mitigated by using trees and other visible obstacles. The U.S. Navy will institute the specific mitigation measures set forth in Section 5.4, Means of Mitigating Potentially Adverse Effects.

Accidental introduction of the Brown Tree Snake could cause a direct and significant adverse effect to the forest birds on Tinian, if it is introduced and becomes established. Cargo and equipment for construction and operation arriving on Tinian and originating in Guam or being transhipped through Guam have the potential for accidental introduction of the Brown Tree Snake. The U.S. Navy will institute the Specific mitigation measures for Guam and Tinian discussed in Section 4.4, Means of Mitigating Potentially Adverse Effects.

> Section 3.(6) Provide for adequate consideration of the national interest, including that involved in planning for, and in the siting of, facilities which are necessary to meet requirements which are other than local in nature.

The transmitter sites for the proposed ROTHR project are sited in optimal locations considering technical and operational factors, accessibility and land ownership. In addition, the sites have also been located to minimize potential adverse effects to presumed bird flight paths and the North Field National Historic Landmark. The ROTHR projects are to provide for the strategic defense of the U.S. by providing wide area surveillance for at-sea battle groups.

> Section 3.(9) Require any development to strictly comply with erosion, sedimentation, and related land and water use districting guidelines, as well as other related land and water use policies for such areas.

The northern sites are located on the Northern Flatland of Tinian at an elevation of about 100 feet MSL. It is relatively flat with slope less than 1% with a gradual up slope to the west. The Dandan-Chinen complex soil is well drained with only a slight hazard of water erosion.
The eastern and western sites are also well drained with only a slight hazard of water erosion.

> Section 3.(10) Maintain or improve coastal water quality through control of erosion, sedimentation, runoff, siltation, sewage and other discharges.

Soils on the northern project sites are well drained such that there will only be a slight hazard of erosion, sedimentation, runoff or siltation to nearby coastal waters. Septic tanks and leach lines will be used for sewage disposal. There will be no discharge of sewage. Other liquid wastes will be disposed according to existing Navy regulations for handling such materials.

The eastern and western sites will only have a slight hazard of erosion. No discharge of sewage or other liquid wastes will occur on the eastern or western sites.

> Section 3.(11) Recognize and respect locations and properties of historical significance throughout the Commonwealth, and ensure that development which would disrupt, alter or destroy these, is subject to Commonwealth and any applicable federal and regulations.

According to the archaeological and historic field survey, the northern site for Project P-223 contained 12 archaeological and historic sites, none which were considered significant. Project P-223 would not result in direct and significant adverse impacts to archaeological and historic sites.

The northern site for Project P-225 is located entirely within the North Field National Historic Landmark, a site listed on the National Register of Historic places. Project P-225 has the potential to create significant adverse impacts to the North Field National Historic Landmark. As required by 36 CFR Section 800, Protection of Historic Properties, the U.S. Navy will initiate a Memorandum of Agreement (MOA) with the CNMI Historic Preservation Officer.

The half-day walk-through survey of the site for Project P-002 indicated archaeological sites may be present. Additional research prior to construction will be required to assess the impacts of Project P-002. The archaeological and historic field survey found no significant resources within the eastern or western sites. However, further data collection may be required at some of the sites, if deemed necessary by the CNMI Historic Preservation Officer. Once the data collection is complete, construction of transmitters and support facilities could proceed.

> Section 3.(12) Recognize areas of cultural significance. Development which would disrupt the cultural practices associated with such areas shall be subject to a consultation process with concerned ethnic groups and any applicable laws and regulations.

A Memorial Cross dedicated to persons who drowned in a boating accident is located near the northern tip of Tinian. A dirt road located between Projects P-223 and P-002 provides access to this site. This road will remain open to visitors of the Memorial Cross. Other nearby roads leading to the Cross will remain open for unrestricted use.

> Section 3. (13) Require compliance with all local air and water quality laws and regulations and any Federal air and water quality standards.

Analysis of the pollutant emissions indicate the combined emissions from power plants required for all three ROTHR systems would be considered a "major stationary source", as defined by the CNMI Air Pollution Control Regulations. According to these Regulations, a Permit to Operate and Construct must be obtained for all new major sources of emissions. The Chief of the Division of Environmental Quality shall approve an application for a Permit to Construct and Operate, if the applicant can show to the satisfaction of the Chief that:

- o The new source is designed, built, and equipped in accordance with reasonably available control technology, and

- o The new source is designed and will be constructed or modified to operate without causing a violation of applicable rules and regulations.

The Permit to Construct and Operate shall be issued for any term not to exceed five years.

Sewage at any site will be disposed of through a septic tank and leach field. There will be no off-site disposal of sewage. Thus, water quality standards will be maintained. Similarly, the fuel storage tanks will be located within an area designed to contain any spill or leaks.

> Section 3. (14) Not permit, to the extent practicable, development with the potential for causing significant adverse impact in fragile areas such as designated and potential historic and archaeological sites, critical wildlife habitats, beaches, designated and potential pristine marine and terrestrial communities, limestone and volcanic forests, designated and potential mangrove stands and other wetlands.

The project sites do not contain critical wildlife habitats, beaches, designated and potential terrestrial communities, limestone and volcanic forests, designated and potential mangrove stands and other wetlands.

Except for the northern site for Project P-225, none of the other sites contain designated and potential historic and archaeological sites. The northern site for Project P-225 is located entirely within the North Field National Historic Landmark.

> Section 3. (19) Discourage, to the maximum extent practicable, visually objectionable uses so as not to significantly degrade scenic views.

The northern sites are located within the military lease area on the northern tip of Tinian. The relatively flat terrain of the North Field area and the existing dense vegetation should limit visibility of the XMTRs. The antenna towers may be visible from off-shore areas when looking toward the shoreline. Visibility should not extend more than a mile off shore. Considering the lattice and cable construction and the dense vegetation, the antennas should not be intrusive.

> Section 3. (21) encourage the preservation of traditional rights of public access to and along the shoreline consistent with the rights to private property owners.

The northern sites are located on the Northern Flatland above the cliffline. Access to the shoreline areas will be consistent with existing policies for access within the military lease area.

The eastern project site is located on a plateau at about the 300-310-FT contour elevation. Access to the shoreline areas will not be affected by this project.

The western project site is located at a contour elevation of about 210-215 FT. Access to the shoreline areas will not be affected by this project.

8.3.18 Energy Requirements and Conservation Potential of Various Alternatives and Mitigation Measures

See Section 4.1.18 for this discussion.

8.3.19 Irretrievable and Irreversible Resource Commitments

See Section 4.1.19 for this discussion.

8.3.20 Short-Term Use Versus Long-Term Productivity

See Section 4.1.20 for this discussion.

8.3.21 Urban Quality, Historic and Cultural Resources

See Section 4.1.21 for this discussion.

8.3.22 Means of Mitigating Potentially Adverse Effects

See Sections 4.4 and 8.5 for a discussion of mitigation measures.

8.4 CUMULATIVE ENVIRONMENTAL CONSEQUENCES AT RECEIVER SITES (GUAM)

8.4.1 Introduction

The following sections describe the cumulative environmental consequences of constructing and operating the ROTHR system receivers for Projects P-225 and P-002 at the sites identified in Section 8.2.1. The effects are organized according to the information presented in Section 8.2. The site specific-direct effects are discussed for each of the alternative sites considered. If the consequences are similar regardless of the alternative sites, the impacts are discussed in Section 4.2.

8.4.2 Physiography and Topography

8.4.2.1 Northern Sites. The northern project sites and the area for support facilities will be cleared by mechanical means of all vegetation and other features and graded to specified requirements of the RCVR. This clearing will be confined to the 850 LF wide by 8,700 long area (approximately 172 acres). There will be no removal of vegetation or cutting of trees outside of the specified clear area. Once preparation of the project sites has been completed, the antennas will be erected and the anchoring systems and ground screen will be completed.

Cut material will be re-used for fill, to the extent feasible. Based on aerial photographs of the northern project sites, preliminary estimates show that there will be a balance of cut and fill material. Total earthwork of approximately, 2,00,000 CY of cut and fill will be necessary for Project P-225, and 3,300,000 CY for Project P-002. Cutting, filling and grading the project site will permanently alter the topographic conditions of the northern project sites.

8.4.2.2 Former FAA Site. The former FAA site slopes from north to south and includes one large borrow pit. Preliminary estimates show about 1,700,000 CY of the cut and fill required for the former FAA site.

8.4.3 Soil Characteristics

The construction contractor will be responsible to devise a plan for review and acceptance by the Navy and coordination with GOVGUAM agencies, that will address grading plans and erosion control measures.

8.4.3.1 Northern Sites. Soils on the northern site for Project P-225 are permeable and well drained. Erosion and runoff should not be significant upon completion of construction as the northern site is relatively flat. Portions of the sites will be covered with low-growth vegetation and portions with crushed aggregate. Runoff will percolate through the either portion and should not create erosion problems to nearby areas.

Soils on the Area of Consideration for Project P-002 are very shallow and well drained and the permeability moderately rapid to rapid. Erosion and runoff should not be significant upon completion of construction as the area does not have a significant slope and will be covered with low-growth vegetation and crushed aggregate. Runoff will percolate through the vegetation or aggregate and should not create erosion problems to nearby areas.

8.4.3.2 Former FAA Site. Soils on the former FAA site are similar to the northern site for Project P-225. Erosion and runoff should not be significant upon completion of construction, as there is only a minor slope.

8.4.4 Geologic Characteristics

8.4.4.1 Northern Sites. The bases of the antenna and anchoring systems will require excavations below the existing ground surface. These excavations will be compacted during the construction activities. They will not alter the geologic conditions of the northern sites.

Guam is a seismically active area. Thus, the antennas will be subject to hazards from earthquakes. In the event of a severe earthquake and antenna failures, they would collapse to the base or buckle at the point of failure.

This design will confine any hazard from a severe earthquake to the project sites.

8.4.4.2 Former FAA Site. Construction of the RCVR should not alter the geologic conditions of the former FAA site. The antennas would be subjected to the same earthquake hazard as the northern sites.

8.4.5 Meteorology

Clearing and grading of any of the project sites could create dust, if conducted during the seven month dry season, from December to June. This impact would occur during the clearing period. Water spraying of the area being cleared will be used to mitigate adverse impacts from dust.

Upon completion of construction, the major portion of the project sites will be covered with low-growth vegetation or crushed aggregate. Thus, significant adverse impacts to air quality from dust should not occur.

See also discussion in Section 4.2.5.

8.4.6 Solid and Hazardous Waste

See Section 4.2.6 for this discussion.

8.4.7 Noise

See also discussion in Section 4.2.7.

The northern site for Project P-225 and the Area of Consideration for Project P-002 are located within DOD installations. Noise from operation of the receivers and the emergency generators should not be a public nuisance.

The former FAA site is located near the U.S. Navy family housing areas. Noise from construction activities could present a public nuisance to nearby residents. Once construction is complete, the long-term noise impacts will not be a public nuisance at the former FAA site as the RCVRs do not create significant noise.

8.4.8 Hydrology

8.4.8.1 Northern Sites. Construction and operation of the RCVRs and support facilities will not adversely affect percolation of rainfall, as only a minor portion of the required area will be covered with impervious surfaces.

Both the northern site for Project P-225 and the Area of Consideration for Project P-002 are located within the groundwater resource area of northern Guam. Groundwater resources and other nearby surface areas will be protected from accidental spills or leaks from the emergency generator above-ground diesel fuel storage tank. An impervious containment area will be constructed around and beneath the tank to contain spills or leaks. Thus, groundwater or other nearby surface areas will not be adversely affected by the installation.

There are no existing potable water sources on either northern site. Required potable water will be obtained by connecting to existing water supply lines.

8.4.8.2 Former FAA Site. The former FAA site is also located over the groundwater resource area of northern Guam. The groundwater and other nearby areas will not be adversely affected by the RCVRs.

There are no existing potable water sources on the former FAA site. Required potable water will be obtained by connecting to the existing water supply lines.

8.4.9 Fauna

The general decline of the bird population is a great concern on Guam. Loss of habitat from vegetation clearing for the receivers or other adverse impacts could be a serious threat to the declining bird population of the island. The USFWS has listed ten bird species and two bats as endangered species on Guam. GOVGUAM has listed 15 bird species and three bats as endangered species. At the time the USFWS listed these species, August 27, 1984, designation of areas of critical habitat was not considered prudent. The USFWS indicated that a determination of critical habitat would result in no known benefit to the species involved. [Ref. 66]

In February 1989, the USFWS agreed with a petition requesting designation of critical habitat for most of the areas designated as essential habitat in the draft Guam Forest Birds and Fruit Bat Recovery Plans. The USFWS is in the process of developed a proposed rule and writing the economic analysis regarding the critical habitat designation. In response, the U.S. Navy has requested the USFWS to make recommendations on ways to minimize or avoid adverse effects.

8.4.9.1 Northern Sites. As previously discussed, much of northern Guam has been proposed as essential habitat, a designation used in recovery plans to identify important habitat areas and to show areas where habitat should be preserved for reintroduction of endangered forest birds and bats. Essential habitat is not defined in the Endangered Species Act and not afforded the Federal protection established for critical habitat. Notwithstanding this distinction, extensive loss of habitat could adversely affect the ability of any of the endangered species to continue to exist in the wild or to be re-introduced at a later date, should the Brown Tree Snake be controlled.

Construction of the RCVRs would require removal of vegetation and grading the sites to meet operational requirements. This clearing would be confined to the approximate area of the receiver. No clearing of vegetation or cutting of trees outside of the designated area would be required. The staging area for the construction contractor will be outside of the designated project site on existing paved areas of the former airfield. Topographic data is still required to establish finish array elevations and to confirm existing terrain elevations at both the

northern site for Project P-225 and the Area of Consideration for Project P-002.

Based on the clearing requirements and the information collected from the botanical survey, the approximate amount of forested area to be cleared is shown below:

Project	Forested Area to be Cleared
P-223 (Northern site)	172 acres
P-225 (Northern site)	65 acres*
P-223 (Runway site)	110 acres**
P-002 (Northern site)	172 acres ***

* Approximate area, remaining area is previously cleared open grassland located within NAVCAMS WESTPAC property.

** Includes use of the North runway for the receiver antennas.

*** Includes modified limestone forest and undisturbed limestone forest area, not found on other northern sites. Based on the limited botanical survey, the exact area of this limestone forest has not been determined.

Clearing the forested areas for construction of the antenna arrays will cause the remaining Mariana crows and kingfishers in the these areas to seek other habitat. Estimates vary on the amount of habitat available on Guam for the endangered bird species. These estimates range from approximately 17,300 acres to 24,700 acres on northern Guam and from 42,000 to 49,400 acres on all of Guam. (The lower estimate of habitat was developed by GOVGUAM Division of Aquatic and Wildlife Resources based on 1986 aerial photographs and includes adjustments for recently developed lands. The higher estimate was developed by the Fish and Wildlife Service based on 1983 mapping data which used 1975 aerial photographs.) [Ref. 67] The estimates for northern Guam include undisturbed limestone forest, broken forest of mixed vegetation types, and scrub forest. The botanical surveys on the northern sites confirm this general description of the vegetation types.

Based on the clearing required for each of the northern sites and the estimates of available habitat, the range of possible loss of habitat from construction of each project is shown below:

Project	Cumulative Cleared Area	Range of Habitat Loss N. Guam*	All Guam**
P-223 (Northern site)	172 acres	0.7 - 1.0%	0.3 - 0.4%
P-225 (Northern site)	237 acres	1.0 - 1.4	0.5 - 0.6
P-002 (Northern site)	409 acres	1.7 - 2.4	0.8 - 1.0

* Based on area of 17,300 to 24,700 acres.
** Based on area of 42,400 to 49,400 acres.

If the Runway site for Project P-223 was selected, the cleared area would decrease from about 172 acres to approximately 110 acres. The range of possible loss of habitat is shown below:

Project	Cumulative Cleared Area	Range of Habitat Loss N. Guam*	All Guam**
P-223 (Runway site)	110 acres	0.5 - 0.6%	0.2 - 0.3%
P-225 (Northern site)	175 acres	0.7 - 1.0	0.3 - 0.4
P-002 (Northern site)	347 acres	1.4 - 2.0	0.7 - 0.8

* Based on area of 17,300 to 24,700 acres.
** Based on area of 42,400 to 49,400 acres.

As shown, depending upon the assumption of available habitat and the selected site for Project P-223, the range of habitat loss for northern Guam will be 1.0% for Project P-223 to 2.4% for all three sites. Except for the vegetation for Project P-002 site, the botanical surveys show all of the sites are second growth limestone forest. The habitat within the area designated for Project P-002 includes undisturbed limestone forest, not found on the other northern sites.

Based on similar analysis, the worst case analysis for habitat loss for all of Guam ranges from 0.4% for Project P-223 to 0.9% for all three sites.

As previously discussed, the transect botanical survey indicated the site for Project P-225 consists primarily of mixed vegetation types and regrowth limestone forest. Thus, these areas are similar to habitat available in northern Guam for the remaining native forest birds.

Although information about the habitat requirements of birds in Guam is not well established, limited information suggests that the kingfisher and Mariana Crow occur at their highest densities in undisturbed mature forest. This is the type of forest identified in the half-day walk-through botanical survey of the Area of Consideration for Project P-002. Portions of this undisturbed area would be lost with construction of Project P-002.

There are a number of reasons for the decline of the various species of native forest birds, including decreases in undisturbed native forest and predation by the Brown Tree Snake. Of these two reasons, predation by the Brown Tree Snake has been shown by GOVGUAM to be the overriding cause of the decreased populations of native forest birds. The expanding range of the Brown Tree Snake has matched the pattern of decline of many of the native forest birds.

Available information suggests that the northern plateau and coastline of Guam were the last areas to experience the spread of the Brown Tree Snake population on the island. Snakes are now found in Northwest Field and the sites for all three projects. Predation by the snake on the eggs and young is believed to be the significant reason for the endangered status of the crow and kingfisher.

The decline in population of the Mariana Fruit Bat is thought to be from a combination of snake predation and illegal hunting. Most recent surveys (1988) indicate a population of less than 500 to 600 individuals are on Guam. Most of these are confined mainly to the limestone forest of Andersen Air Force Base. Poaching of this species remains a significant reason for their decline. Bats are prized as a fiesta food, and illegal hunting is lucrative.

Upon completion of construction, the area occupied by the antenna arrays and ground screen will be closed to all types of hunting. An agreement between the Air Force and the Navy will be completed to determine the exact boundaries in which hunting will be restricted. The Navy will have the responsibility for maintaining security for each antenna area. This security would be in addition to the current measures maintained by Andersen Air Force Base personnel. The increased security should help to decrease instances of illegal hunting of fruit bats in the areas of the antenna arrays.

As previously discussed, in December 1987, the Sierra Club Legal Defense Fund, representing the National and Marianas Audubon Societies, petitioned the USFWS to designate, on an emergency basis, critical habitat on Guam.

In March 1988, the Governor of Guam similarly requested the Secretary of the Interior to commence emergency critical habitat designation procedures as a result of the Navy's reported plans to construct up to three radar receiver installations on Guam. The Governor advised Interior that a total area of 1,600 acres of land would be adversely affected by one project (Project P-223). U.S. Navy projections indicated that for all three projects, if installed on their initial prospective sites, a maximum of 500 acres of assorted vegetation would be affected on Guam. Present (1990) calculations indicate that if Project P-223 is located on the preferred Runway site, no more than 110 acres of secondary forest would be removed while a total of 1,670 acres around the receiver would need to be access-restricted and free of most human structural interference. In that way, an area of 1,670 acres would be required to be preserved in its naturally vegetated state.

On July 1988, the Secretary of Interior replied to the Governor of Guam that the emergency rule-making process would not be used for considering critical habitat designation as the species' habitat was protected through the provisions of Section 7 of the Endangered Species Act and "the current plight of Guam's endangered species is largely the result of predation by the Brown Tree Snake, not loss of habitat, ..." The Secretary concluded that an emergency situation did not appear to exist. [Ref. 29]

Subsequently, on February 27, 1989 the USFWS responded to the original petition by the Governor of Guam to designate critical habitat for seven species on Guam, five species of birds, the Mariana fruit bat and the Little Mariana fruit bat. The USFWS agreed with the merits of the petition that a critical habitat designation may be beneficial for six of species (all except the Guam rail). The USFWS indicated that such designation would protect important habitat necessary to support the recovery of these six species. [Ref. 30]

Clearing, filling and grading would remove the project sites as habitat for the endangered bird species. Most likely, the remaining forest birds would no longer be seen within the cleared areas under current population conditions and with snake predation. However, under normal resident bird population conditions, one would expect to see, on occasion, species such as starlings and migratory shorebirds using the cleared area for foraging.

Similarly, although no fruit bats were seen within the northern sites, (the individual noted in the bird survey was outside of the designated sites for any of the ROTHR receivers) the area which includes the northern sites has been included as the proposed essential habitat for reintroduction of these species. Habitat within DOD controlled areas would provide some protection to fruit bats as access into these lands is normally restricted.

Birds striking the antenna arrays or anchoring systems during normal movement or migration could have an adverse affect to the bird population. However, the single pole antennas without guy wires would minimize the chance of collisions or bird strikes. Moreover, the GOVGUAM Department of Aquatic and Wildlife Resources has indicated no knowledge of bird strikes to the numerous antennas on the island. [Ref. 56] Research on the island of Yap has indicated no reported cases of bird strikes to a 1,000 foot LORAN-C tower and anchoring system located there. [Ref. 68] Thus, it is highly unlikely that bird strikes or collisions with the receiver antenna arrays will have any adverse impact on the bird population of the island.

Eight species of birds, in addition to Guam's endangered forest birds, inhabit or have been known to inhabit the areas on or near the proposed ROTHR project sites. These include the Philippine turtle dove, Streptopelia bitorquata; Eurasian tree sparrow, Passer montanus; black drongo, Dicrurus macrocerus; rock dove, Columba livia; black francolin, Francolinus francolinus; yellow bittern, Ixobrychus sinensis; lesser golden plover, Pluvialis dominica; and the white-tailed tropicbird, Phaethon lepturus. Construction of the ROTHR projects are expected to displace several bird species, however, the open areas created by the project are likely to increase the habitat available for the lesser golden plover, Eurasian tree sparrow, black francolin, black drongo, and yellow bittern. The White-tailed tropicbird nests in coastal cliffs and is not expected to be adversely affected by the proposed projects.

Eight species of mammals, in addition to Guam's endangered bats, are known to occur on or near the proposed ROTHR project sites. These include the feral pig, Sus scrofa; Guam deer, Cervus unicolor mariannus; black rat, Rattus rattus; Polynesian rat, Rattus exulans; house mouse, Mus musculus; musk shrew, Suncus murinus; feral dog, Canis familiaris; and the feral cat Felis catus. Many of the aforementioned mammals are considered undesirable or pest species. Although the proposed projects are likely to displace many of these mammals, the overall populations of these animals on Guam will not be significantly affected. The proposed projects will increase the amount of open areas or "edge" habitats available for Guam deer and feral pigs which are likely to find these areas desirable for foraging.

Reptiles such as the blue-tailed skink, Emoia werneri; brown skink, Carlia fuscata; house gecko, Hemidactylus frenatus; monitor lizard, Varanus indicus; and the neotropical toad, Bufo marinus are known to occur on or near the proposed project sites. Although the proposed projects are expected to displace these reptiles, their numbers on Guam are abundant, and the overall populations of these animals will not be significantly affected.

8.4.9.2 Former FAA Site. The biological survey of the former FAA site detected no species of native birds. Although the site is primarily forested area with some cleared lands, this lack of bird species could be expected for this area of Guam.

Most of the former FAA site is outside the area proposed as essential habitat in the USFWS recovery plans.

Construction on this site would have impacts similar to those previously described.

8.4.10 Flora

Construction of the receivers at any of the project sites would require removal of all vegetation within the 850 LF wide by 8,700 LF long area. No vegetation or trees will be removed outside of this designated area.

An area of about 19 acres will be in the Clear Zone of Runway 24R, an inactive runway. This portion lies beyond the area which must be graded and free of above ground structures. Runway 24R would be closed, if the Runway Site for Project P-223 is used.

8.4.10.1 Northern Sites. Transect botanical surveys covering the site for Project P-225 was conducted in late June 1988. Similarly, in late June 1988, the Area of Consideration for Project P-002 was surveyed on a half-day walk-through basis. According to the survey for the site for Project P-225, there are four major vegetation types on the site. About half of the project site is maintained open grassland within the property controlled by NAVCAMS WESTPAC. The next largest area, Pandanus Scrub, is a result of prior clearing and is returning to forest. The remaining two types, Cycad forest and second growth Limestone Forest, comprise smaller areas within the site for Project P-225. (See Appendix F)

None of the species found on the site for Project P-225 are Federal or GOVGUAM listed or candidate endangered or threatened species. Thus, although construction of Project P-225 would remove the existing vegetation from the designated area, there would be no significant adverse effects to the vegetation of Guam.

According to the survey of the Area for Consideration for Project P-002, most of the site was dense forest with only two small weedy areas. The vegetation included good modified limestone forest with little recent disturbance, which was not found on the other northern sites. The site for Project P-002 contained a large concentration of native forest trees when compared to the other northern sites.

Based on the results of the half-day walk-through survey of the site for Project P-002, no Federal or GOVGUAM listed or candidate endangered or threatened plant species were detected on the site. Notwithstanding this finding, construction of Project P-002 would remove good modified limestone forest with a large concentration of native trees.

8.4.10.2 Former FAA Site. The botanical survey of the former FAA site found second growth limestone forest and several clear areas dominated by weeds. None of the species found on the Former FAA Site was a Federal or GOVGUAM listed or candidate endangered or threatened species. Construction of a RCVR on the former FAA site would remove existing vegetation from the designated area.

8.4.11 Social and Economic Characteristics

See Section 4.2.11 for this discussion.

8.4.12 Radio Frequency Interference

8.4.12.1 Northern Sites. The proposed installation is a receiver, and as such will not emit electromagnetic radiation. Similarly, it will not interfere with any radio frequency in use on Guam. The proposed receiver installations will create no adverse impacts to persons or to radio reception on Guam.

The RCVR will require a Radio Frequency Interference (RFI) free zone of one mile on the front, 1,200 LF behind and 700 LF from each end of the antenna area. In addition, a controlled zone extending for two miles in front of the antenna is required as a means of limiting electromagnetic interference. See Figure 4.2.1. An RFI-free zone is normally desirable around receiving antennas to prevent interference with the receiving capabilities of the antenna. No vegetation clearing is required within the RFI free zone.

The RFI-free zone for the northern site Project P-225 and the Area of Consideration for Project P-002 would include land above and private property below cliffs near the receiver site. Most residential or resort-type land uses on this private property would not affect the receiving capabilities of the RCVR. However, any structure such as a tall building higher than the cliffline, could affect the RCVR. Any facility which transmits radio frequencies in the high frequency (HF) band or emits electromagnetic pulse signals would affect the receiving capability of the RCVR. Figure 8.4.1 shows a composite of the RFI-free zones.

At this time, there are no existing facilities or structures within the project RFI-free zone on the northern site for Project P-225 and the Area of Consideration for Project P-002 which could adversely affect the receiving capability of the RCVRs.

Development of the Urunao Beach property owned by the Artero family at the northwest coast of Guam could pose potential conflict with the proposed ROTHR receiver at the Northwest Field area as well as the Navy communication operations at NAVCAMS WESTPAC. Incompatible development

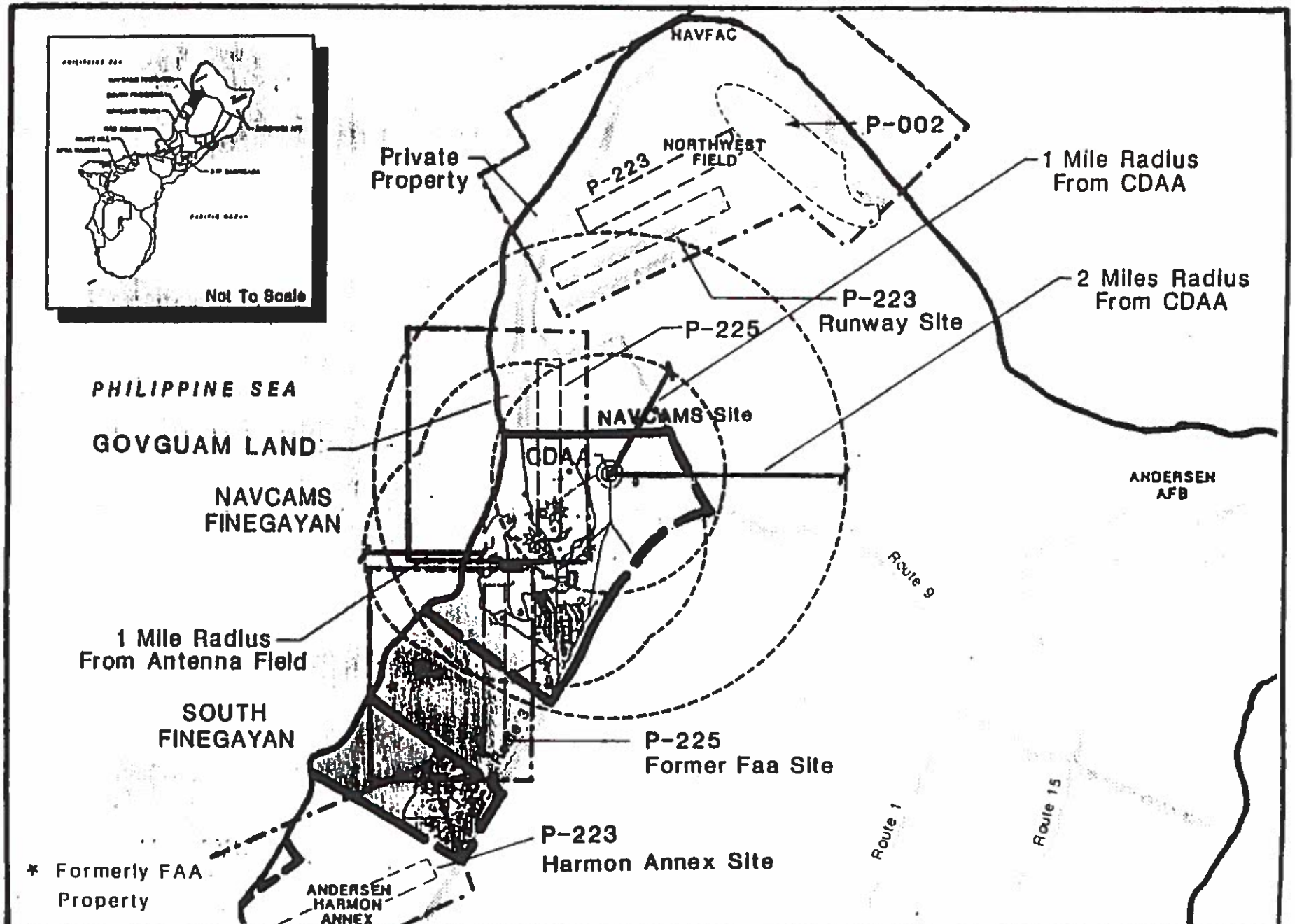


FIGURE 8.4.1

PROJECT RFI-FREE ZONES

would be facilities that create or increase RFI affecting the operation of the receiver. Vehicles and electrical equipment could create increase RFI and therefore need to be controlled within the one mile RFI-free zones shown in Figure 4.2.1 and the RFI-free zones for the ROTHR receiver shown in Figure 8.4.1. A RFI barrier or shield may need to be provided if vehicle traffic creates interference.

Development of the Urunao Beach property could result in increased number of workers and visitors requesting access to the site. Current access to the property is via an existing military road which routes through the existing RFI-free zones. However, this access is controlled by the military and authorization is required. Any plan for development of the Urunao Beach property will need to be reviewed to ensure RFI-free zones are maintained.

8.2.12.2 Former FAA Site. Although the receivers do not constitute a hazard from electromagnetic radiation, they must be sited so that other electronic installations, roadways and certain types of vehicles and motorcycles equipped with unshielded ignition systems do not interfere with their operation. Facilities near the former FAA site which could adversely affect operation of the receiver include the existing U.S. Navy family housing located near the cliffline. The access road to this housing area will cross the receiver in approximately the center. Traffic going to the family housing area could also affect operation of the receiver.

8.2.13 Aeronautical Activity

Currently, Runway 6R-24L on Northwest Field is the only one used by aircraft. The DOD has established standardized criteria for essential safe planning at airfields in the U.S., its trust territories and possessions. These minimum safe standards set forth dimensions and planes for planning around new fields and for determining whether an object or structure is an obstruction to air navigation. The criteria applies to existing and proposed man-made objects, objects of natural growth and terrain. [Ref. 42]

The DOD criteria establish a graded area within the Clear Zone at each runway end where no above-ground structures or objects are permitted. The antennas for Project P-225 will not be located within the graded area of the clear zone of Runway 6R-24L. The northern site for Project P-225 will not create significant adverse impacts to operation of aircraft on Runway 6R-24L.

DOD airfield criteria also apply to lateral distances from the center line of the runway. The centerlines of the runways on northwest Field are located 1,175 LF apart. Construction of the receiver antennas on the North runway would not violate airfield criteria for the South runway. Aircraft operations could occur on the south runway without restrictions. A portion of the Area of Consideration for Project P-002 is within the Clear Zone for Runway 6L-24R. The affected portion of the site for Project P-002 lies beyond the area which must be graded and free of above-ground structures. DOD Land Use Compatibility Guidelines for Clear Zones

allow certain types of facilities (communication, utilities, highway and street rights-of-way) within the area of Project P-002. (See Figure 8.2.3)

A portion of the Area for Consideration for Project P-002 lies within the approach-departure surface to Runway 6L and 24R. The height of the antennas and the distance to the end of the runways should ensure no obstructions to aircraft operations will occur. (See Figures 8.2.2 and 8.2.3)

8.4.14 Aesthetics

8.4.14.1 Northern Site. The northern site for Project P-225 and the Area of Consideration for Project P-002 are located within established DOD installations and not visible from public roads or residential areas. They will be located in an area already disturbed by antennas and other facilities. Thus, although the RCVR will be visible, they will not be a significant adverse effect to the aesthetic character of this area of Guam.

8.4.14.2 Former FAA Site. The former FAA site is located west of Route 3, the access roadway to NAVCAMS WESTPAC and other single-family housing areas in north-western Guam. Antenna arrays constructed on the former FAA site will be clearly visible to travelers along Route 3.

Construction of antenna arrays will be a contrast to the existing open-space character of the area. Visitors to the family housing units and shoreline areas would clearly see the antenna arrays.

8.4.15 Archaeological and Historical Sites.

8.4.15.1 Northern Sites. The portions of the northern site for Project P-225 and the Area of Consideration for Project P-002 lie in Northwest Field, which as previously noted has been nominated by the National Park Service as a National Historic Landmark. It is noted that at a meeting held at Andersen AFB on 14 February the U.S. Navy and the Guam Historic Preservation Office raised concerns regarding the eligibility of Northwest Field as a National Historic Landmark. Nevertheless, it does seem likely that Northwest Field is eligible for inclusion on the National Register of Historic Places. Thus, the northern sites need to be evaluated as to their affect on the historic values of Northwest Field. In addition, the original boundary suggested by the National Park Service for the proposed Landmark, being comprised solely of the tow runways and connecting taxiways, do not appear to represent the complexity and extent of Northwest Field.

The northern site for Project P-225 was surveyed during July 1988. A total of nine sites were found, consisting of isolated artifacts and scatters of prehistoric pottery. No further archaeological work is recommended for five of these sites. Upon completion of adequate excavation for the other four sites, continued physical preservation of the sites would not be required. (See Appendix G) Thus, construction of

Project P-225 on the northern site would not have significant adverse impacts to the archaeological and historic resources.

The half day walk through survey of the Area of Consideration for Project P-002 was conducted in July 1988. Two prehistoric pottery scatters and isolated sherds were found along the survey corridor. It is unlikely that additional prehistoric sites are present in the native forest area and previous disturbance has, most likely, obliterated any remains in other parts of the Area for Consideration for Project P-002. However, construction of Project P-002 on a site within the Area of Consideration will require a more detailed field inventory survey prior to any activities in the field.

8.4.15.2 Former FAA Site. The former FAA site was surveyed during February 1989. One prehistoric pottery scatter was identified in the survey. No further work is necessary at the site. Construction on the former FAA site would not have significant adverse impacts to this cultural resource.

8.4.16 Indirect Effects and Their Significance

The primary indirect effect from installation of the proposed antennas would be to preclude use of the project sites for other purposes during the life of the operation. Although surface alteration to the site will involve removal of all vegetation, the project sites could be utilized for other purposes once the RCVR and support facilities are disestablished.

The RCVR would not preclude other nearby uses, although certain types of activities would cause degradation of the system. Thus, land use in the vicinity of the RCVR will not be adversely affected. The Area of Consideration for Project P-002 is located in Northwest Field within an area where AAFB allows hunting during certain times of the year under an established permit procedure. Hunting in the area of Project P-225 is controlled by NAVCAMS WESTPAC. Hunting is allowed on portions of the former FAA site located within NAVCAMS WESTPAC. Since the ground screen should not be disturbed, no hunting would be permitted within close proximity (130 to 150 FT) of the antennas. Subject to local regulations, hunting limited to the use of bow and arrow could be permitted in the forward reflective area which extends 565 FT in front of the ground screen.

As in many other places, development of residential, commercial and other types of land uses has limited the areas available for hunting on Guam. Thus, the available hunting areas are well used by local hunters. Notwithstanding, hunting is allowed upon issuance of a permit by AAFB or NAVCAMS WESTPAC, limitation of hunting on the project sites would significantly reduce the land area available to Guam hunters.

8.4.17 Possible Conflicts Between the Proposed Action and the Objectives of Federal, State, and Local Land Use Policies and Controls

The Coastal Zone Management Act of 1972 as amended (P.L. 92-583) requires Federal agencies conducting or supporting activities directly affecting

the coastal zone to be consistent to the maximum extent practicable with approved state coastal management programs. Any Federal agency undertaking any development project in the coastal zone shall insure that the project is consistent to the maximum extent practicable with approved state management programs (Section 307(c)).

A Consistency Determination should be provided to the GOVGUAM Coastal Management Office lead agencies at least 90 days before final approval of the ROTHR projects. The consistency determination should include:

- A brief statement indicating whether the proposed activity will be undertaken in a manner consistent to the maximum extent practicable with the CZM program,
- A detailed description of the activity and its associated facilities, and
- An assessment of the coastal zone effects, including comprehensive and supportive information.

Federal agencies must ensure that their activities are consistent to the maximum extent practicable with the enforceable, mandatory policies of the management program, but need not evaluate effects for which there are no mandatory or recommended policies (15 CFR Part 930.39). Upon submission of the Consistency Determination, the GOVGUAM Coastal Management Office will have 45 days to respond, with a 15-day extension allowed, or the agency may presume agreement (15 CFR 930.41).

If GOVGUAM Coastal Management Office should disagree with the consistency determination submitted by the U.S. Navy, it must describe the nature of the inconsistency and alternative measures which could be adopted to proceed in a manner consistent to the maximum extent practicable. If there remains serious disagreement between the GOVGUAM Coastal Management Office and the U.S. Navy, either party may request mediation services by the Secretary of Commerce. However, both parties must agree to the mediation proceedings (15 CFR 930.42 and 930.112). Notably, the regulations do not specify that a Federal action cannot proceed in the event of a CZM agency's (in this case, the GOVGUAM Coastal Management Office) continuing disagreement.

The 18 GCMP policies are listed below with a summary of the consistency of the proposed project to each policy, including "spillover" effects:

GOVERNMENTAL PROCESS POLICY:

More effective administration of natural resource related laws, programs, and policies shall be achieved through improved coordination between Territorial and Federal agencies.

The proposed project is consistent with this policy through compliance with Federal environmental analysis procedures. The U.S. Navy also intends to comply with the requirements set forth in the GOVGUAM Bureau of Planning Guide for Achieving Federal Consistency. [Ref. 39]

DEVELOPMENT POLICIES:

(1) Shore Area Development: Only those uses shall be located within the Seashore Reserve which: 1) enhance, are compatible with or do not generally detract from the surrounding coastal area's aesthetic and environmental quality and beach accessibility; or 2) can demonstrate dependence on such a location and the lack of feasible alternative sites.

None of the alternative sites are located within a seashore reserve.

(2) Urban Development: Uses permitted only within Commercial, Multi-Family, Industrial and Resort-Hotel zones; and uses requiring high levels of support facilities shall be concentrated within urban districts as outlined on the Land-Use Districting Map.

None of the alternative sites are located within an urban development.

(3) Rural Development: Rural districts shall be designated in which only low density residential and agricultural uses will be acceptable. Minimum lot size for these uses should be one-half acre until adequate infrastructure, including functional sewering, is provided.

The policy is not applicable to the proposed project.

(4) Major Facility Siting: In evaluating the consistency of proposed major facilities with the goals, policies and standards of the Comprehensive Development and Coastal Management Plans, the territory shall recognize the national interest in the siting of such facilities, including those associated with electric power production and transmission, petroleum refining and transmission, port and air installations, solid waste disposal, sewage treatment and major reservoir sites.

The proposed project at any of the alternative sites can be considered a major facility. It is vital to the national security of the United States.

(5) Hazardous Areas: Identified hazardous lands including flood plains, erosion-prone areas, air installation crash and sound zones and major fault lines shall be developed only to the extent that such development does not pose unreasonable risks to the health, safety, or welfare of the people of Guam, and complies with land-use regulations.

The Pugua Fault, a major fault in northwestern Guam, lies south of the northern sites and extends offshore. It is south of the northern site for Project P-225 and about 3.5 miles away from the Area of Consideration for Project P-002. The project will be designed to comply with applicable DOD requirements for structures located in this area of Guam. Any hazard from an earthquake will be confined to the project site.

Similarly, the antennas on the former FAA site will meet DOD construction criteria.

> (6) Housing: The government shall encourage efficient design of residential areas, restrict such development in areas highly susceptible to natural and man-made hazards, and recognize the limitations of the island's resources to support historical patterns residential development.

This policy is not applicable to the proposed project.

> (7) Transportation: The Territory shall develop an efficient and safe transportation system while limiting adverse environmental impacts on primary aquifers, beaches, estuaries, and other coastal resources.

This policy is not applicable to the proposed project.

> (8) Erosion and Siltation: Development shall be limited in areas of 15% or greater slopes by requiring strict compliance with erosion, sedimentation, and land-use district guidelines, as well as other related land-use standards for such areas.

The northern site for Project P-225 and the Area of Consideration for Project p-002 have slopes of less than 5 percent. Since permeability of the soils is good on the northern sites, erosion is not anticipated to be a problem with these minimal slope conditions. All grading done on the project sites will be in compliance with applicable grading requirements established by GOVGUAM.

The former FAA site slopes from north to south and includes one large borrow pit on the northern end. Soils on the site are similar to the northern sites. Thus, erosion is not anticipated to be a problem.

RESOURCE POLICIES:

> (1) Conservation of Natural Resources - Overall Policy: The value of Guam's natural resources as recreational areas, critical marine and wildlife habitats, the major source of drinking water, and the foundation of the island's economy, shall be protected through policies and programs affecting such resources.

The northern sites and the former FAA site are located within the area which has been proposed as essential habitat by the forest birds and bats recovery plans prepared by the GOVGUAM Division of Aquatic Resources in cooperation with the U.S. Fish and Wildlife Service. The project design and performance criteria have been established to confine all vegetation removal to the designated antenna area. There will be no removal of vegetation outside of the designated project areas. This will minimize impacts to surrounding areas and retain the maximum amount of habitat for native forest birds.

The drinking water resource on northern Guam will be protected from accidental spills or leaks by a containment area constructed around and beneath any fuel tanks used by the project. The antennas and support equipment used by the receivers will not contain any hazardous substances.

> (2) Air Quality: All activities and uses shall comply with all air pollution regulations and all appropriate Federal quality standards in order to ensure the maintenance of Guam's relatively high air quality.

The operation of the proposed project would not have a significant affect on air quality, regardless of the sites. Construction would have a short-term effect from dust and exhaust emissions from construction equipment. Mitigation measures during construction such as frequent watering of the area will be used to minimize effects on surrounding areas.

> (3) Water Quality: Safe drinking water shall be assured and aquatic recreation sites shall be protected through the regulation of uses and discharges that pose a pollution threat to Guam's waters particularly in estuarine, reef and aquifer areas.

None of the alternative sites would affect drinking water resources or aquatic recreation sites.

> (4) Fragile Areas: Development in the following types of fragile areas shall be regulated to protect their unique character: historic and archaeologic sites, wildlife habitats, pristine marine and terrestrial communities, limestone forests, and mangrove stands and other wetlands.

Construction of the antenna arrays and ground screens on the northern site for Project P-225 and the former FAA site would not result in loss of limestone forest land. The Area of Consideration for Project P-002 includes some undisturbed limestone forest land which would be loss with construction of the receiver.

None of the alternative sites contain mangrove stands or wetlands.

> (5) Living Marine Resources: All living resources within the territorial waters on Guam, particularly corals and fish, shall be protected from over-harvesting and, in the case of marine mammals, from any taking whatsoever.

This policy is not applicable to the proposed project.

> (6) Visual Quality: Preservation and enhancement of, and respect for the island's scenic resources shall be encouraged through increased enforcement of and compliance with sign, litter, zoning, subdivision, building and related land-use laws; visually objectionable uses shall be located to the maximum extent practicable so as not to degrade significantly views from scenic overlooks, highways, and trails.

The northern sites are located within established DOD facilities and not visible from public roads or residential areas. The northern sites are located in areas not accessible to the public without permission. Thus, construction of the RCVR on the northern sites would not degrade public views from nearby locations.

The former FAA site is located west of Route 3, the main roadway to northwestern Guam. The antenna array would clearly be visible to travelers along Route 3 and to visitors of the family housing area to the west.

> (7) Recreational Areas: The Government of Guam shall encourage development of varied types of recreation facilities located and maintained as to be compatible with the surrounding environment and land uses; adequately serve community centers and urban areas, and protect beaches and such passive recreational areas as wildlife and marine conservation areas, scenic overlooks, parks and historic sites.

Portions of Northwest Field, including the areas designated for the northern site for Project P-225 and the Area of Consideration for Project P-002, have been used for hunting under a permit procedure established by the AAFB and NAVCAMS WESTPAC. Once constructed, portions of these project sites would be closed to hunting. Limitation of hunting in these areas will decrease the available hunting areas on Guam.

> (8) Public Access: The public's right of unrestricted access shall be ensured to all non-federally-owned beach areas and all Territorial recreation areas, parks, scenic overlooks, designated conservation areas and other public lands; and agreements shall be encouraged with the owners of private and Federal property for the provision of reasonable access to, and use of, resources of public nature located on such land.

The northern sites and the former FAA site are located on existing military installations not open to the public.

> (9) Agricultural Lands: Critical agricultural lands shall be preserved and maintained for agricultural use.

There are no agricultural lands within the northern site for Project P-225, the Area of Consideration for Project P-002, or the former FAA site.

Federal Land Use Policies and Controls: Executive Order 11990, "Protection of Wetlands", does not apply to the proposed project, since there are no wetlands within any of the alternative sites. (The western portion of the Dandan site contains vegetation typically found in wetlands. The area has not been designated as a wetland by the Department of the Army Corps of Engineers.) Executive Order 11988, "Floodplain Management", does not apply to the proposed project, since none of the alternative sites are in designated floodplain areas.

AAFB does not have plans for development in the areas designated as the northern sites. Thus, the proposed RCVRs would not conflict with AAFB land use plans. However, site approval from the Air Force will be required for construction of the RCVRs in Northwest Field.

8.4.18 Energy Requirements and Conservation Potential of Various Alternatives and Mitigation Measures

See Section 4.2.18 for this discussion.

8.4.19 Irretrievable and Irreversible Resource Commitments

See Section 4.2.19 for this discussion.

8.4.20 Short-Term Use Versus Long-Term Productivity

See Section 4.2.10 for this discussion.

8.4.21 Urban Quality, Historic and Cultural Resources

The northern sites are located within established DOD installations and not visible from public roads or residential areas. Thus, construction of the antennas on the northern sites will not be a visible intrusion into the urban environment of Guam.

None of the project sites contain any significant archaeological resources. A portion of the northern site for Project P-225 and the all of the Area of Consideration for Project P-002 are located in Northwest Field, portions of which have been nominated for a National Historic Landmark.

8.4.22 Means of Mitigating Potentially Adverse Effects

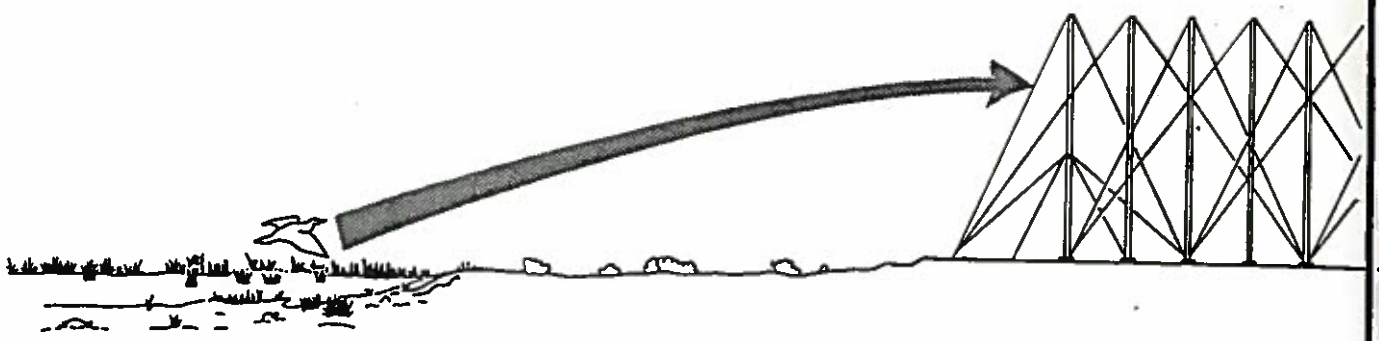
See Sections 4.4 and 8.5 for this discussion.

8.5 MEANS OF MITIGATING POTENTIALLY ADVERSE EFFECTS

8.5.1 Tinian

8.5.1.1 Bird Strikes and Collisions. A number of measures have been examined to mitigate the potential adverse effects of bird strikes and collisions with wires and towers. Of these mitigation measures, the most promising for the transmitter towers appears to be the use of shielding obstacles, especially nearby trees. If tall trees were left in-place, where practicable, near the edges of the antenna array, a shield or obstacle would be created for birds to fly over. Normally, birds gain altitude well ahead of an obstacle in their path. Trees left in-place would provide an obstacle that birds must fly over prior to nearing the transmitter antenna towers. See Figure 8.5.1.

Prior to final design of the grading plan, the U.S. Navy will work with the design contractor to devise a plan that would retain as many tall trees as practicable near the northern site and the western site. This



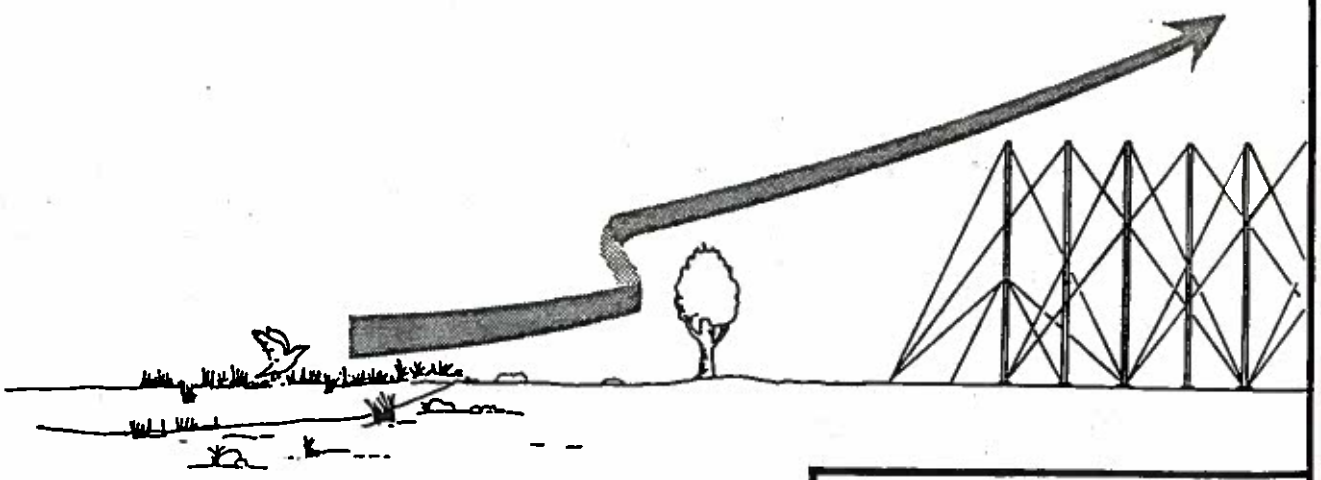


FIGURE 8.5.1

POTENTIAL ANTENNA MITIGATION MEASURE

tree plan would identify areas where tall trees would be retained so that an effective shield can be maintained to protect flying birds.

The USFWS in their Section 7 biological opinion has also recommended that any tall trees which remain should be maintained through fertilization, watering, pruning, and other standard techniques to ensure retention of the trees. The USFWS has further recommended that a tall species of tree, such as the ironwood, be planted at close spacing along the side boundaries of the antenna site, perpendicular to the direction moorhens may fly. The usefulness of these trees will increase as they grow.

The increase in antenna wire visibility will increase detection by resident bird species and may prevent the occurrence of bird/wire collisions. Wire visibility may be enhanced by marking antenna wires with permanent, highly visible strips, tape or flagging. The extent of use of the tape or flagging will be coordinated with the USFWS to ensure proper usage.

The prevention of access to waterbird or forestbird habitats adjacent to ROTHR antennas would prevent the disturbance of birds which are likely to flee recklessly away from intruders and into nearby antenna wires. Access to areas in front of bird habitat adjacent to ROTHR antennas should be prevented to ensure that birds are not flushed towards the opposite direction into antenna wires at the edge of their habitat.

To protect the waterbird habitat, the USFWS Section 7 biological opinion recommended that no water be taken from Lake Hagoi during the construction of the transmitter. The U.S. Navy will include this provision in the construction contract.

No lighting that could disorient birds will be installed on the towers and ground lighting will be kept to the minimum required for operations and security. The USFWS has recommended the judicious use of lights, employing strobes or other mechanisms which are not attractive to birds, to aid avoidance of collisions with the transmitter antenna towers.

8.5.1.2 Habitat Loss. If all three ROTHR transmitters were constructed, the loss of vegetation will amount to about 1.2 percent of the total undeveloped area within the military lease area. The USFWS Section 7 biological opinion for Project P-223 contained no mitigation measures addressing vegetation removal and displacement of fauna other than to recommend that vegetation removal be kept to a minimum. (See Appendix K)

The U.S. Navy has agreed to implement all recommendations provided by the USFWS in that opinion and will site the Project P-223 transmitter in a manner to minimize habitat loss. Further advice from the USFWS regarding the additional transmitters on Tinian will be sought at the appropriate time in the planning process.

8.5.1.3 Affect on the Leaseback Area. All of the alternative transmitter sites on Tinian are located in the military lease area. The northern sites are within the proposed exclusive use area for military operations. The western sites and the eastern site are within the area which could be

leased back to CNMI. Use of either the western sites or the eastern site would mean that the transmitter sites would not be leased back to CNMI. Use of these sites would not affect the leaseback of all other areas currently under discussion for return to CNMI control.

8.5.1.4 Access to the Memorial Cross. The siting of Projects P-223 and P-002 would not preclude access to the memorial cross located at the northern tip of Tinian. The existing access road would be retained.

8.5.1.5 Radio Frequency Interference. The ROTHR system has been authorized by the Federal Communications Commission (FCC) and the Joint Chiefs of Staff to operate strictly on a not-to-interfere basis within the fixed broadcast bands of the HF spectrum. A list of prohibited frequencies will be prepared and coordinated with the FCC to ensure that all frequencies prohibited will not be used. In the event that harmonic interference is experienced, it should be reported to the FCC so that, if caused by the ROTHR, the fundamental frequency will be added to the ROTHR prohibited list.

8.5.1.6 National Historic Landmark. The ROTHR transmitters for Projects P-223 and P-002 and the facilities necessary to support all three transmitter, except the water well, have been sited outside of the North Field National Historic Landmark. The U.S. Navy has consulted with CNMI Historic Preservation Officer and the Tinian Preservation Representative to develop appropriate mitigative measures which are responsive to the historic values of the North Field National Historic Landmark. These mitigative measures will include: (1) additional archival data gathering, especially focusing on the identification and locations of facilities and activities associated with the two atomic bombs dropped on Japan; (2) photographic documentation of significant historical resources likely to be impacted by construction of Project P-223, including a representative sample of those runways, hardstands, taxiways, building foundations and other such features that are most amenable to photography. This photographic work will follow guidelines Historic American Buildings Survey, Historic American Engineering Record (HABS/HAER) established by the National Park Service; (3) a complete set of collected archival documents copies and negatives and prints of all HABS/HAER photographs will be deposited with the CNMI Historic Preservation Office.

A Memorandum of Agreement (MOA) is currently being prepared by the U.S. Navy to ensure that the proposed mitigative measures will be satisfactorily implemented, and to ensure that the public will have continued access to the North Field National Historic Landmark. Signatory parties will the U.S. Navy, CNMI Historic Preservation Office, and the Advisory Council on Historic Preservation.

8.5.2. Guam

8.5.2.1 Habitat Loss. As previously discussed, Section 7(a)(1) of the Endangered Species Act has established procedures whereby a Federal agency which proposes an action which may affect an endangered species must enter into consultation with the USFWS. The Department of the Navy has initiated the required consultation and a biological opinion has been

issued for the construction and operation of the ROTHR receiver at the Runway site. (See Appendix K)

The proposed site for Project P-225 on Northwest Field and NAVCAMS WESTPAC has been located to minimize the amount of vegetation removal required. Most of this site is in the previously cleared antenna field on NAVCAMS WESTPAC property. Use of this will require the relocation of existing antennas and cables.

The mitigation measures which have been incorporated into the design of the receiver antennas include the following:

1. Siting the Project P-223 receiver array on the Runway site at Northwest Field will decrease removal of forest vegetation from approximately 172 acres to 110 acres, although this Runway site will not have optimum clear line of sight with Mount Machano in the foreground.

2. Accept a smaller reflecting area for the receiver. The basic ROTHR receiver footprint is 1,100 feet wide by 8,800 feet long. The receiver systems to be constructed on Guam will use a footprint of 850 feet by 8,700 feet, a reduction of 52 acres.

3. Waive the requirement to cut trees that protrude above the 1^0 slope in front of the transmitter and receiver forward boundary. This waiver eliminates 350 acres from earlier computations of additional areas that would be affected for the Northern site for the Project P-223 receiver located north of the North runway at Northwest Field, Guam.

4. Control development in the Northwest Field area by requiring land uses that are compatible with ROTHR receivers for the design life of the system. Minimum development in front of the ROTHR receiver would benefit wildlife.

5. Provide military security to the ROTHR system to ensure that access to Northwest Field area and wildlife habitat will continue to be controlled.

These mitigation measures are consistent with the recommendations set forth by the USWFS Section 7 biological opinion. Items 1,2, and 3 will all minimize the amount of forest clearing required.

8.5.2.2 National Historic Landmark. Based on the assessment of impacts to the proposed National Historic Landmark, a mitigative program will be implemented which will entail: (1) the collection of additional archival documents regarding the identification and locations of facilities and activities at Northwest Field; (2) photographic documentation of existing runways, taxiways, hardstands, and other existing airfield remnants; (3) the deposition of copies of archival documents and photographs into suitable repositories for curation and future interpretation or research. These repositories will include the War in the Pacific National Historical Park and the GOVGUAM main library. A Memorandum of Agreement (MOA) to ensure the implementation of these mitigation measures is presently being prepared for signature by the Guam Historic Preservation Officer, the War

in the Pacific National Historical Park, the U.S. Navy, Andersen AFB, and the Advisory Council on Historic Preservation.

8.6 COMPARISON OF ALTERNATIVES

8.6.1 Tinian

The following table presents a comparison of the environmental factors for each site described in Section 8.1 and analyzed in Section 8.3.

8.6.2 Guam

The following table presents a comparison of the environmental factors for each site described in Section 8.2 and analyzed in Section 8.4.

TINIAN ALTERNATIVE SITES COMPARISON MATRIX

FACTOR	NORTHERN SITES		WESTERN SITE	EASTERN SITE
	Project P-225	Project P-002	P-225	P-002
Physiography/Topography	Site Altered	Site Altered	Site Altered	Site Altered
(Earthwork/cut/fill)	(360,000 cu yd)	(450,000 cu yd)	(400,000 cu yd)	(600,000 cu yd)
Soil Characteristics	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact
Geologic Characteristics	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact
Meteorology	No Adverse Impact	Major Stationary Source (1)	No Adverse Impact	No Adverse Impact (1)
Hydrology	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact
Fauna	Potential Bird Collisions with Towers	Potential Bird Collisions with Towers (2)	Lower Potential Collisions with Towers	Lower Potential Collisions with Towers
Flora	No Adverse Impact	No Adverse Impact (2)	No Adverse Impact	No Adverse Impact
Social/Economic Characteristics	No Adverse Impact	No Adverse Impact	Reduce Lease Back Area	Reduce Lease Back Area
Infrastructure	No Adverse Impact	No Adverse Impact	No Adverse Impact	No Adverse Impact
Archaeological/ Historic	Adverse Impact to NH Landmark	No Adverse Impact (2)	No Adverse Impact	No Adverse Impact
Aesthetics	No Adverse Impact to Tinian/Potential Effects to Views from Saipan	No Adverse Impact to Tinian/Potential Effects to Views from Saipan	No Adverse Impacts to Tinian or Saipan	No Adverse Impact to Tinian or Saipan
Electromagnetic Radiation	No Adverse Impact to Humans/Animal/ Birds; No Impact to Aircraft Approaching Runway 7	No Adverse Impact to Humans/Animal/ Birds; No Impact to Aircraft Approaching Runway 7	No Adverse Impact Humans/Animal/ Birds; No Impact to Aircraft	No Adverse Impact Humans/Animal/ Birds; No Impact to Aircraft

Notes: (1) Possible Major Stationary Source if third project. (2) Based on half-day walk-through survey.

GUAM ALTERNATIVE SITES COMPARISON MATRIX

FACTOR	NORTHERN SITES		FORMER FAA SITE
	Project P-225	Project P-002	
Physiography/Topography	Site Altered	Site Altered	Site Altered
(Earthwork/cut/fill)	(2.0 mil cu yd)	(3.3 mil cu yd)	(1.7 mil cu yd)
Soil Characteristics	No Adverse Impact	No Adverse Impact	No Adverse Impact
Geologic Characteristics	No Adverse Impact	No Adverse Impact	No Adverse Impact
Meteorology	No Adverse Impact	No Adverse Impact	No Adverse Impact
Hydrology	No Adverse Impact	No Adverse Impact	No Adverse Impact
Fauna	Reduce Proposed Essential Habitat	Reduce Proposed Essential Habitat (3)	Reduce Proposed Essential Habitat
Habitat	65 acres cleared (1)	172 acres cleared	172 acres cleared (2)
Flora	No Adverse Impact	Removal of Native Forest (3)	No Adverse Impact
Social/Economic Characteristics	No Adverse Impact	No Adverse Impact	No Adverse Impact
Infrastructure	No Adverse Impact	No Adverse Impact	No Adverse Impact
Archaeological/Historic Resources	No Adverse Impact	Potential Impact (3)	No Adverse Impact
Aesthetics	No Adverse Impact	No Adverse Impact	Adverse Impact to Nearby Views
Conflicts With Land Use Plans	No Adverse Impact	No Adverse Impact	No Adverse Impact
Potential RFI	No Adverse Impact	No Adverse Impact	Potential Adverse Impact

(1) Remainder currently cleared. (2) Only portion proposed essential habitat. (3) Based on half-day walk-through survey.

PART III

ENGINEERING SURVEYS

9.0 TOPOGRAPHIC AND SOIL SURVEYS

9.1 INTRODUCTION

Preliminary topographic and soil surveys on Tinian and Guam are required to determine the engineering feasibility and constraints associated with constructing the ROTHR antennas for Project P-225 at three sites and to define the scope of work for site specific items such as earthwork and special foundations. Engineering field survey data will be used to refine planning concepts and will add engineering data to other available site information.

The purpose of the proposed work is to allow the Navy to further refine planning concepts under consideration for design should the decision be made to eventually construct the ROTHR antennas. The survey work will not irreversibly or irretrievably commit the U.S. Navy to construction of the ROTHR antennas.

In June 1988, the U.S. Navy prepared an Environmental Assessment (EA) for similar topographic and soil surveys on Tinian and Guam for ROTHR antennas. [Ref 72] The EA was reviewed by the U.S. Department of Interior Fish and Wildlife Service, the Government of Guam Department of Agriculture Division of Aquatic and Wildlife Resources, and the Commonwealth of the Northern Mariana Islands, Fish and Wildlife Division. After this review, the U.S. Navy issued a Finding of No Significant Impact (FONSI) on 1 July 1988. [Ref 73]

9.2 PROPOSED SURVEYS

9.2.1 Tinian Surveys

The sites to be surveyed are the northern site as shown in Figure 8.1.2 and the western site as shown in Figure 8.1.4. The proposed surveys will be essentially the same at both sites.

Topographic survey work will be based on taking ground surface elevations for a 25-FT grid system. Bulldozer trails approximately 10 FT wide and totaling about 4,500 FT will also be required for access and control lines. The bulldozer trails will require an area of about 1 acre to be cleared. Hand clearing of vegetation with machetes, axes, chainsaws, or other hand tools will be required to provide line-of-sight clearing for the survey. The area to be hand cleared is approximately 10 acres. Thus, a total of 11 acres will be cleared for the engineering surveys. It is estimated that a four-man topographic survey crew will complete this survey in approximately six weeks.

Soil survey work will consist of borings, bulldozer trenches, seismic refraction survey, and resistivity. The soil borings will be located on the 10-FT wide access and control lines used for the topographic surveys and will include approximately 18 borings with a maximum depth of 15 FT. A bulldozer trench, approximately 50 FT long, 15 FT wide, and 10 to 15 FT deep is proposed to provide data from which the rippability of the rock

will be determined. The bulldozer test trench site will be located along the cleared trails. The trench will be backfilled following the test. It is estimated that the soil survey work will be completed in 2 weeks by a five-man survey crew.

The 3,200 FT of seismic refraction survey will be conducted between borings to determine whether the soils condition between borings is the same as that at the boring location. The six resistivity tests, each approximately 30 FT deep, will be required to determine soil resistivity.

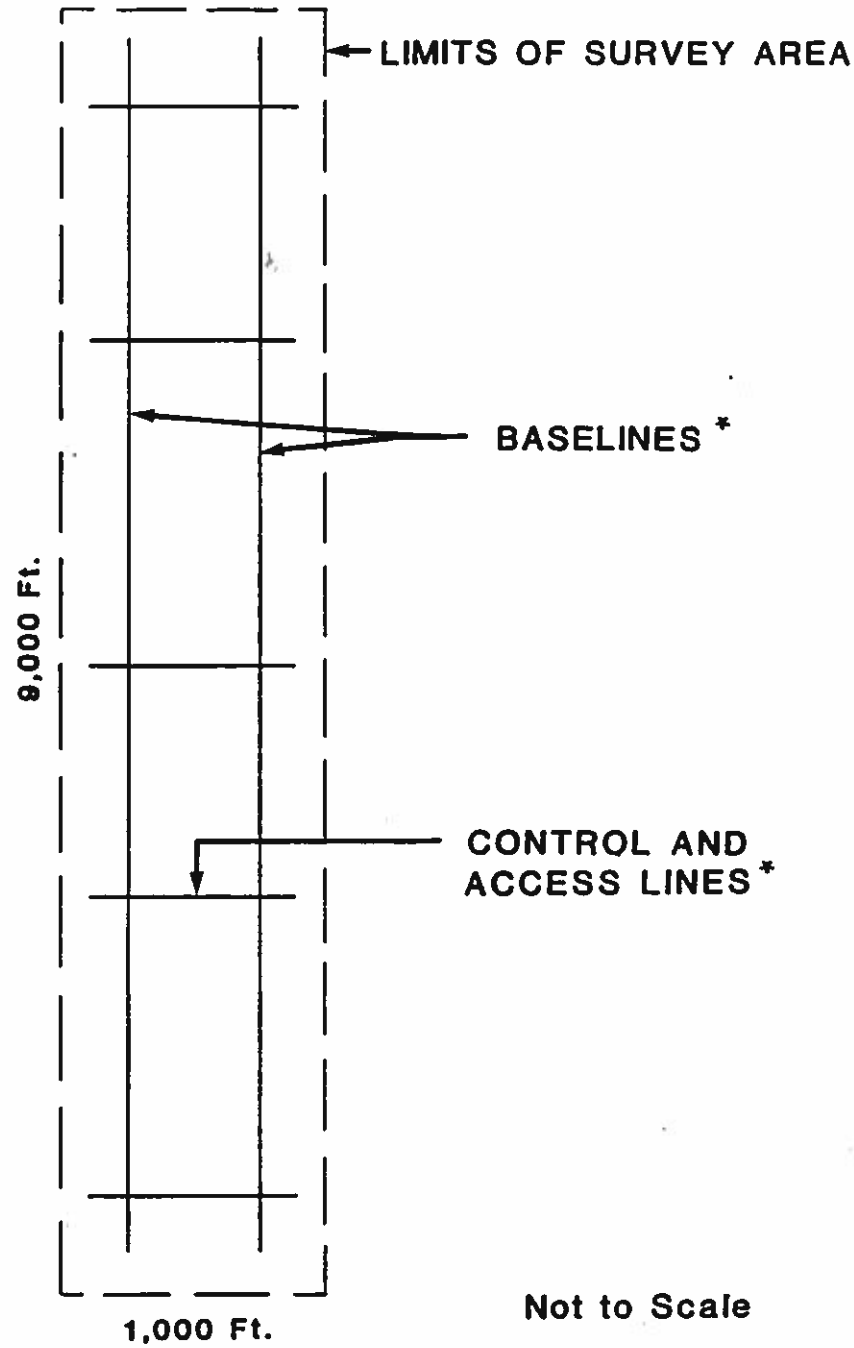
9.2.2 Guam Surveys

The topographic and soil surveys will be required at the northern site for Project P-225 shown in Figure 8.2.2 and the former FAA site for Project P-225 shown in Figure 8.2.4. A portion of the northern site is located within Northwest Field, Andersen Air Force Base, and a portion within NAVCAMS WESTPAC. A portion of the former FAA site is also located within NAVCAMS WESTPAC and a portion within land formerly occupied by the FAA, and now under the control of the U.S. Navy.

Topographic survey work will be based on taking ground surface elevations for a 25-FT grid system. Bulldozer trails approximately 10 FT wide and totaling about 23,000 LF will also be required for access and control lines. The area to be cleared for bulldozer trails is about 5.5 acres. Hand clearing of vegetation with machetes, axes, chainsaws, or other hand tools will be required to provide line-of-sight clearing for the survey. The area to be hand cleared is about 30 acres. Thus, approximately 35.5 acres will be cleared for the engineering surveys. It is estimated that a four-man topographic survey crew will complete this survey in approximately 24 weeks. See Figure 9.2.1

Soil survey work will consist of borings, bulldozer trenches, seismic refraction surveys, and resistivity tests. The soil borings will be located on the 10-FT wide access and control lines used for the topographic surveys and will include approximately 50 borings with a maximum depth of 35 FT. A bulldozer trench, approximately 50 FT long, 15 FT wide, and 10 to 15 FT deep is proposed to provide data from which the rippability of the rock will be determined. The bulldozer test trench site will be located on the cleared trails. The trench will be backfilled following the test. It is estimated that the soil survey work will be completed in six weeks by five-man survey crew.

The 13,600 FT of seismic refraction survey will be conducted between borings to determine whether the soils condition between borings is the same as that at the boring location. The ten resistivity tests, each approximately 30 FT deep, will be required to determine soil resistivity. The seismic survey and vertical soundings will also be located on the cleared trails. No additional clearing will be required.



* APPROXIMATELY 10 FT. WIDE CLEARED BY BULLDOZER

FIGURE 9.2.1

TYPICAL SURVEY PLAN - RECEIVER

9.3 AFFECTED ENVIRONMENT

9.3.1 Tinian Site

The Tinian sites to be surveyed cover an area of about 200 acres. The total bulldozer clearing at both sites is about 2 acres and the total hand clearing about 20 acres, for a total area of 22 acres.

9.3.1.1. Northern Site. The northern site for Project P-225 lies on the northwest coastal area of Tinian. It lies at an elevation of around 100 FT above Mean Sea Level and has a gradual slope to the south and west.

Fauna. A bird survey of the northern site for Project P-225 was conducted in August 1986. The survey found a number of species on the site including the Tinian Monarch, a Federally listed threatened species. None of the species found on the site are thought to be concentrated in the northern site.

The Common moorhen, Mariana mallard, and Island swiftlet were not seen or heard during the survey. This finding is consistent with other surveys conducted during 1984.

Flora. A botanical survey of the northern site was conducted in August 1986. The survey found tangantangan to be the primary canopy tree. Other tree species found included the Formosan koa and ironwood. No Federally-listed or candidate threatened or endangered species were found on the northern site for Project P-225.

Archaeological/Historic Resources. An archaeological/historic field survey of the northern site for Project P-225 was conducted in September 1986. The site lies entirely within the North Field National Historic Landmark. The field survey found 13 archaeological/historic sites which ranged from small scatters of pottery to beverage cans and pieces of U.S. military equipment. None of these sites were considered significant.

9.3.1.2 Western Site. The western site for Project P-225 lies and at elevation of about 210-215 FT, and has a slope to the west. The underlying structure is porous fossil bearing and recrystallized limestone conglomerate.

Fauna. A bird survey for the site was conducted in February 1989. The Tinian Monarch was common throughout the site and was the only Federally listed threatened species detected. A number of other native species of birds were also observed on the site. This finding is consistent with other bird surveys on Tinian which found the Tinian Monarch to be a common species on the island.

The Common moorhen, Mariana mallard, and Island swiftlet were not seen or heard during the survey of the western site for Project P-225. This finding is also consistent with other surveys conducted during 1984 when the entire military lease area was surveyed.

Flora. A botanical survey of the site for Project P-225 was conducted in February 1989. The vegetation was primarily composed of introduced trees, shrubs, and herbs. The native species on the site were also found on the other sites surveyed on Tinian. No Federally listed or candidate threatened or endangered plant species were found on the site for Project P-225.

Archaeological/Historic Resources. The western site for Project P-225 was surveyed in February 1989. One prehistoric pottery site and three areas formerly used by the U.S. Military were identified in the survey. None of the sites require further data collection.

9.3.2 Guam Sites

The total survey area at both sites covers about 412 acres. The total area requiring bulldozer clearing is about 8.5 acres and hand clearing about 45 acres.

9.3.2.1 Northern Site. The northern site for Project P-225 lies on the northern plateau and western coast of Guam, a single broad surface that slopes from north to south. The site is relatively flat, with approximate elevations of between 440 FT above MSL on the south to about 515 FT above MSL on the north end.

Soils on the site are generally less than 12 inches thick and permeability of these soils is good and erosion potential slight.

Fauna. A bird survey was conducted during June 1988 on the northern site for Project P-225. Vocalizations were heard of at least two different individuals of the Mariana crow on two occasions within the site. In addition, vocalizations of one Micronesian Kingfisher and Guam Broadbill were heard. Both of these species are Federal and GOVGUAM listed as endangered. The Guam Broadbill was last detected in Northwest Field in March 1984 and in Barrigada in central Guam in September 1984. (See Appendix E)

Most of northern Guam, including the site for Project P-225, have been identified as essential habitat (not critical habitat) in the native birds draft recovery plans prepared by the U.S. Department of Interior Fish and Wildlife Service. Most of the area identified as essential habitat is being considered for designation as critical habitat by the Fish and Wildlife Service as defined by the Endangered Species Act. The schedule for this designation is not established at this time.

Flora. A botanical survey was conducted during July 1988 on the northern site for Project P-225. According to the findings of the survey, this site contains four major and three minor vegetation types. Vegetation on the site represent regrowth forest as a result of human disturbance or the high winds which affect this area of Guam. No Federal or GOVGUAM listed or candidate endangered or threatened plant species were found in the survey of the site for Project P-225. (See Appendix F)

Archaeological/Historic Resources. An archaeological/historic resources survey was conducted during July 1988 for the northern site for Project P-225. The survey identified a total on nine sites which consisted of isolated artifacts and scatters of prehistoric pottery. No further work is necessary at five of the sites as they have been measured, mapped, described, photographed, and plotted. For the remaining four sites, further data collection is recommended which would primarily consist of areal excavations. Upon completion of adequate excavations, continued physical preservation of the sites would no longer be essential.

9.3.2.2 Former FAA Site. The former FAA site is also located on the northern plateau of Guam. It slopes from north to south and includes one large borrow pit in the northern portion. The northern portion of the site lies at an elevation of about 400 FT above MSL and slopes to about 360 FT above MSL on the southern edge.

The soil on the site is primarily Guam cobbly clay loam. This soil type is similar to the soils found in most areas of northern Guam.

Fauna. The former FAA site was surveyed during February 1989. During this survey, no native birds were detected on the site. The former FAA site is included in the area proposed as essential habitat in the Forest Bird, Swiftlets and Fruit Bat Recovery Plans.

Archaeological/Historic Resources. The former FAA site was surveyed in February 1989. According to this survey, one very sparse prehistoric pottery scatter was identified during the survey near the northern edge of the site. The scatter was confined to the surface and no further data collection is necessary at the site. (See Appendix G)

9.4 ENVIRONMENTAL CONSEQUENCES

9.4.1 Tinian Site

9.4.1.1 Northern Site. The topographic and soil surveys will require bulldozer clearing of about 1 acre and hand clearing of approximately 10 acres. This mechanical and hand clearing will not affect the topograhic conditions of the northern site.

Fauna. The clearing will remove habitat used by bird species occupying the site. These resident birds, unless able to relocate to other habitat, will be lost. However, the 1984 survey of the military lease area showed most species of birds found on the northern site to be widespread on the island. Thus, although some species will be lost, this should not be a significant adverse affect to bird population on the island.

The accidental introduction of the Brown Tree Snake from Guam is of special concern, as the snake is known to be the cause of the decline of birds on Guam. Major equipment to be used during the surveys, which will include a bulldozer and truck-mounted drill rig, will not be shipped from Guam. A bulldozer already located on Tinian will be used for the clearing work. A drilling rig is available on Saipan and will be shipped to Tinian for the survey.

In October of 1989, the U.S. Navy entered Section 7 consultation with the USFWS regarding the impacts of conducting the field survey work for Project P-225. The USFWS issued its biological opinion on May 4, 1990, concluding that the effort is not likely to jeopardize the continued existence of any threatened or endangered species. The U.S. Navy has agreed to implement the terms and conditions and conservation measures offered by the USFWS in its opinion. Appendix L contains the final biological opinion.

Flora. The clearing will remove a total of about 11 acres on the northern site. The botanical survey found the northern site to be similar to other areas on Tinian. The loss of vegetation from mechanical clearing should not be a significant adverse affect to the botanical species on the island.

Archaeological/Historic Resources. The northern site for Project P-225 lies entirely within the North Field National Historic Landmark. The mechanical and hand clearing will remove about 11 acres of vegetation. This clearance should not create a significant long-term adversely affect to the National Landmark.

9.4.1.2 Western Site. The topographic and soil surveys will require bulldozer clearing of approximately 1 acre of vegetation for access and control lines at this site. Additionally, the topographic survey will require hand clearing of 10 acres of similar vegetation for line-of-sight. This clearing will not affect the topographic conditions of the site.

Fauna. The mechanical and hand clearing will mean the loss of habitat to the bird species presently occupying the site. This loss of habitat will be temporary, and have minimal impact on the overall population of birds on Tinian. The 1984 survey of the military lease area showed most species of birds found on the site, including the Tinian Monarch, to be widespread on the island. Based on the numbers and variety of native birds observed in the 1984 survey of the military lease area and the 1989 survey of the western site, the resident birds on Tinian have survived the extreme changes in land use that has occurred on the island over the years.

Flora. The survey will require mechanical and hand clearing of vegetation. The hand cut vegetation will regenerate in a short period of time. The mechanical clearing of an additional acre of vegetation for access to the 18 boring sites, the bulldozer trenches, seismic refraction surveys and resistivity test will have a longer lasting impact. However, eventual regeneration of the cleared area can be expected. Hand and mechanically cleared vegetation will be pushed aside and left on the site. All excavations will be backfilled using the excavated material.

Vegetation found on the site is primarily composed of introduced trees, shrubs, and herbs. No Federally listed or candidate endangered or threatened plant species were found on the site.

Archaeological/Historic Resources. The archaeological/historic survey of the western site found one prehistoric pottery scatter and three areas

formerly used by the U.S. Military. None of the sites require further data collection or are considered significant.

9.4.2 Guam Sites

9.4.2.1 Northern Site. The topographic survey will require hand clearing of vegetation with machetes, axes, chainsaws, or other hand tools to provide line-of-sight trails for the measurements. Bulldozer trails approximately 10 FT wide will also be required for access and control lines. The bulldozer clearing will be about 3 acres since a portion of the site is on an existing cleared antenna field. In addition, there will be the need to hand clear about 15 acres for topographic surveys.

Fauna. The bird survey conducted on the site for Project P-225 identified vocalizations of at least two different individuals of the Mariana crow on two occasions. In addition, vocalizations of the Micronesian Kingfisher and Guam Broadbill were heard. All of these species are Federal and GOVGUAM listed as endangered. Most of northern Guam, including the site for Project P-225, is thought to be the habitat for the remaining native forest birds on Guam.

The hand clearing will result in the temporary loss of some habitat. However, the revegetation of habitat should occur relatively rapidly in this area of Guam. The 50 boring holes and bulldozer trench will also cause temporary loss of habitat. Revegetation should quickly follow the backfilling of the excavations.

In October of 1989, the U.S. Navy entered Section 7 consultation with the USFWS regarding the impacts of conducting the field survey work for Project P-225. The USFWS issued its biological opinion on May 4, 1990, concluding that the effort is not likely to jeopardize the continued existence of any threatened or endangered species. The U.S. Navy has agreed to implement the terms and conditions and conservation measures offered by the USFWS in its opinion. Within the opinion, the USFWS noted that the site is under consideration for designation as critical habitat. The U.S. Navy has requested that the USFWS provide technical assistance in developing further conservation recommendations which could reduce or eliminate the impact to habitat which may later be proposed as critical habitat. The final biological opinion from the USFWS is shown as Appendix L.

Flora. The surveys will require hand and mechanical clearing of vegetation. The site is composed primarily of regrowth forest as a result of human disturbance or the high winds which affect this area of Guam. Revegetation is expected in the hand cleared areas and the mechanically cleared areas after the borings and bulldozer trench are backfilled. The botanical survey found no Federal or GOVGUAM listed or candidate endangered or threatened plant species were found on the site.

Archaeological/Historic Resources. The archaeological and historic survey found nine sites consisting of isolated artifacts and scatters of prehistoric pottery. Five of the sites require no further work. The remaining sites will be avoided in the topographic and soil survey work.

9.4.2.2 Former FAA Site. The topographic survey will require hand and mechanical clearing of vegetation. The soil survey will require borings and a bulldozer trenches to collect samples for analysis, seismic refractory surveys, and resistivity tests. These excavations will be backfilled upon completion of the work. The bulldozer clearing will amount to about 5.5 acres and the hand clearing an additional 30 acres, for a total clearing of 35.5 acres. The survey work will not affect the topographic conditions of the site.

Fauna. The bird survey of the site did not show the presence of native bird species. However, the site is identified as proposed essential habitat in the forest bird recovery plans prepared by the U.S. Fish and Wildlife Service. This essential habitat would be used by native forest birds should they be reintroduced to Guam.

Flora. The topographic and soil surveys would require hand clearing of trails, bulldozer clearing of access and control lines, and borings for subsurface tests. Once the excavations have been completed, the borings would be backfilled. Vegetation in the hand cleared trails should rapidly regenerate. Although the bulldozer cleared areas will require a longer period of growth, vegetation is the areas should regenerate after the backfilling has been completed.

Archaeological/Historic Resources. According to the archaeological and historic resources survey, one prehistoric pottery scatter was identified within the site. The topographic and soil surveys should not affect archaeological and historic resources of the site.

9.5 CUMULATIVE ENVIRONMENTAL CONSEQUENCES

9.5.1 Tinian

If the engineering surveys are undertaken after site clearing had been completed for Project P-223 at the preferred northern site, the cumulative clearing area to be cleared on Tinian is shown below:

Project	Site	Function	Area (Acres)
P-223	Northern	Transmitter	69
P-223	Northern	Support facilities	10
P-225	Northern	Bulldozer	1
P-225	Northern	Hand clearing	10
P-225	Western	Bulldozer	1
P-225	Western	Hand clearing	10
		Total	101

9.5.2 Guam

If the engineering surveys are undertaken after site clearing had been completed for Project P-223 at the preferred Runway site, the cumulative clearing be cleared on Guam is shown below:

Project	Site	Function	Area (Acres)
P-223	Runway	Receiver	110
P-225	Northern	Bulldozer	3
P-225	Northern	Hand clearing	15
P-225	FAA	Bulldozer	5
P-225	FAA	Hand clearing	30
		Total	163

SECTION 10.0

Response to Public Testimony and DEIS Questions and Comments

10.0 RESPONSE TO PUBLIC TESTIMONY AND DEIS QUESTIONS AND COMMENTS

INTRODUCTION

This section contains responses to the questions and comments raised during the public hearings held on Saipan (August 16, 1989), Tinian (August 17, 1989), and Guam (August 18, 1989), and the comment letters to the Draft EIS (DEIS). The comments and questions and responses are presented side-by-side. Supporting studies regarding biological effects of the ROTHR are in Appendix I. The Review/Evaluation of Alternative Sites is in Appendix J.

PUBLIC HEARING COMMENTS

Name	Organization/ Location	Comment Nos.
1. Bert Thompson	Saipan	1-2
2. Ken Govendo	Saipan	3-4
3. Leonard Kaufer	Saipan	5-8
4. S. Delacruz	Tinian	9-11
5. E. Hocog	Tinian, Hist. Prev. Ofcr.	12
6. E. King	Tinian	13
7. Lino Lizama	Tinian	14-15
8. S. Delacruz	Tinian	16
9. G. Cepeda	Tinian	17
10. S. Delacruz	Tinian	18
11. E. King	Tinian	19
12. A. Artero	Guam	20
13. L. Martindale	Guam	21-24
14. James Castro	Guam	25
15. C. Kasperbauer	Guam	26
16. M. Cruz	Guam, Bur. of Planning	27-31
17. Ralph Frew	Guam, Marianas Aud. Soc.	32-40
18. Paul Conry	Guam, Marianas Aud. Soc.	41

PUBLIC HEARING COMMENTS

Name	Organization/ Location	Comment Nos.
19. Tony Sablan	Guam	42-43
20. Alice Hadley	Guam	44
21. Bruce Best	Guam	45

COMMENT LETTERS

1. Ralph Frew	Marianas Audubon Society	46-51
2. Maile Huvar Bruce	CMNI, CRM	52-55
3. Mark Burns	Wisconsin	56-59
4. Roberta Rons	Agana, Guam	60-62
5. Kimberly Young	Int. Cl. Bird Presev.	63-69
6. Arnold I. Palacios	CNMI, Ofc of Governor	67-80
7. Leonard Kaufer	Saipan	81-91
8. Deanna Wieman	U.S. EPA, Region IX	92-96
9. L. Martindale, Jr.	GURC	97-101
10. James Reichel	CNMI, Ofc. of Governor	102-103
11. A. Quitugua	GOVGUAM, Dept of Agric.	104-182
12. Charles Sanders	Sacramento Audubon Soc.	183-184
13. S.D. Ripley	Smithsonian Institution	185-188
14. Ellen Rice	Saipan	189
15. M. Sherwood	Sierra Club Legal Defense	190-195
16. Susan Haig	Seneca, SC	196
16. C. Kasperbauer	Guam	197
17. Ralph Frew	Marianas Audubon Soc.	198-243
18. Governor P. Tenorio	CNMI	244-249
19. Lt. Gov. F. Blas	Guam	250

COMMENT LETTERS

Name	Organization/ Location	Comment Nos.
20. T. Nelson	Vice Speaker, Guam Leg.	251
21. Don Strachan	Save the World	252-254
22. Lt. Gov. F. Blas	Guam	255
23. A. Mariano	Dept Parks and Rec. GOVGUAM	256
24. C. Castro-Gaskero	Coal. Conc. Citizens, CNMI	257
25. P. L. Guerrero	GOVGUAM	258-266
26. James P. Castro	Guam	267
27. Leonard Kaufer	Saipan	268-270

COMMENT LETTERS WITH NO RESPONSE REQUIRED

1. Charles Sanders	Sacramento Audubon Soc
2. Robert/Ruth Zeller	Maryland
3. Stan Renfro	New Mexico
4. James Reichel	Saipan
5. M. Sherwood	Sierra Club Legal Defense
6. Jennifer Goren	Micro Wave News
7. E. Woodyard	Agana, Guam
8. Shari Sujka	Florida
9. Russell Meecham	Dept of Environment, CNMI
10. R. Solvino	Envir. Protect Ag. GOVGUAM
11. S. Wohlgemuth	Los Angeles Audubon Society
12. Michael Bean	Environmental Defense Fund
13. Jesus Castro	Guam

COMMENT

Bert Thompson
#1. Will there be any benefit to the people here in such things as search and rescue?... Will there be any possibility of aiding people, aiding the government and citizens of the Northern Marianas, or is it strictly for military use?

Bert Thompson
#2. Are there any other benefits to the civilian citizens in the Northern Marianas? ...Community service, maybe similar to the PACBAR things where we have, I believe, some bird habitat that were a result of it.

Ken Govendo
#3. Has it taken into consideration P-223, P-225, P-002 all at the same time, the amount of radio waves and the exposure to the human body to those radio waves?

RESPONSE

#1. Yes. The U.S. Navy is always interested in assisting search and rescue efforts whenever possible. However, the ROTHR system is primarily an air tracking system and is not generally capable of detecting small, slow surface craft. Over-the-horizon radars have already proven to be useful in assisting aircraft in trouble. On January 28, 1990, the U.S. Air Force OTH-B Radar located a missing aircraft in distress for the Gander oceanic air traffic control. A Cuban airline jet aircraft had developed serious engine trouble and had flown off course in order to make an emergency landing.

It is likely that ROTHR assistance would be beneficial in similar situations in CNMI. The operators can review stored track data to localize the area where an incident may have occurred, thereby providing a starting point for search and rescue operations.

#2. See #1.

#3. In the event that the three ROTHR transmitter subsystems are eventually located on the northern tip of Tinian, their physical arrangement will be such that each fenced personnel hazard zone will not overlap. Although the presence of additional transmitter antenna arrays may influence the pattern of field strength around each antenna, the fenced radiation hazard areas are very conservatively drawn and will be separated such that there will be no significant or harmful accumulative field strengths outside of the currently defined area. Using methods outlined in the ROTHR E^3 Study to estimate field strengths of adjacent transmitters (as shown on Page 3-4 of the DEIS), it is shown that no electromagnetic radiation hazard to personnel will exist outside of the personnel exclusion fence boundaries.

When actual field strength measurements are taken around the first installed transmitter, a more refined analysis will be conducted in connection with the sitting of any subsequent transmitters. (This issue of overlap will be included in the EIS tier for the next project.)

COMMENT

RESPONSE

Ken Govendo
#4. Has there been any adverse effects on human health from the Virginia facility?

#4. No. There have been no reported adverse effects of electromagnetic radiation from the ROTHR prototype system in New Kent, Virginia. This includes the general area population and the transmitter maintenance and operations personnel. The biological effects of continuous wave electromagnetic radiation in the High Frequency (HF) range of the spectrum are well documented and defined. Standards which were created based on this knowledge are taken very seriously by site personnel. Safety procedures are observed (and will be observed) at all ROTHR transmitter sites with regard to exposure of personnel to hazardous electromagnetic fields. Periodic measurements are regularly performed to ensure that field strengths are below ANSI recommended exposure levels. Also, before any programed maintenance is performed within the fenced personnel exclusion area, safety precautions are observed to neutralize RF generating components of the transmitter system.

Actual measurements of the electromagnetic field around the prototype system during transmitter operations are a key part of the analysis which defines safe distances from the radiating elements. Reference of these Virginia site measurements can be found in the study titled "A Study Of Electromagnetic Environmental Effects Associated With The Relocatable Over The Horizon Radar" (short title, "ROTHR E^3 Study"). Also, subsequent full power measurements at the Virginia site were recorded after the 1 August 1989 release of the ROTHR E^3 Study. The result of these measurements confirm the analysis presented in the ROTHR E^3 Study.

Ken Govendo
#5. Page 5-23 refers to the a COMSPAWAR analysis. Who complied it, and where it is? ... What guarantee is there that there is no hazard to living organisms existing outside the safe zone other than the statement that it is safe beyond that? ... What actions will be taken if hazards to organisms, for instance, to people, are discovered after the ROTHR is operating?

#5. The COMSPAWAR analysis which is referenced several times in the DEIS is titled, "A Study of Electromagnetic Environmental Effects Associated With The Relocatable Over The Horizon Radar", short title ROTHR E^3 Study. The document was first released in draft form on 7 March 1989. The final version was released as Volume I, subtitled "Hazardous Electromagnetic Radiation" dated 1 August 1989.

The contents of the ROTHR E^3 Study are a presentation of the recognized standards concerning harmful levels of Electromagnetic Radiation (EMR) at ROTHR operating frequencies and an analysis of the functional characteristics of the ROTHR transmitter to describe safe distances from the transmitting elements for the various categories of radiation hazard.

The ROTHR E^3 study was written and assembled by the engineers at the Department of Navy, Space And Naval Warfare Systems Command in Washington, D.C. with supporting preparation and analysis by the scientists of Raytheon Company, Boston, Mass., Scientific Research International Inc., Arlington, Va., Ball Corporation System Engineering Division, Arlington, Va., Telecommunications International, Mountain View, Ca. and the Naval Research Laboratory, Washington, D.C. Prior to the 1 August 1989 release date, the study was reviewed for technical content by the IIT Research Institute (IITRI) under a contract with the Department of Defense, Electromagnetic Compatibility Analysis Center (ECAC) in Annapolis, Md.

COMMENT

RESPONSE

Since release of this document the antenna gain distribution patterns have been confirmed through direct measurement by the Department of Air Force, 84th Radar Evaluation Squadron. Also confirmed were the full power ground level radiated power measurements with respect to personnel and public safety. The results of these measurements will be included and referenced in a later revision to the ROTHR E^3 Study.

Regretfully the ROTHR E^3 Study was not available for public reference upon release of the DEIS. This situation has since been rectified. Those who originally requested copies have had copies delivered and local government offices have been provided a copy for public inquiries.

Established standards are continually being reassessed as future scientific research might reveal a different understanding of the interactions between non-ionizing EMR and biological organisms. However, with regard to EMR at High Frequency (HF, 3 to 30 MHz) and specifically Frequency Modulated Continuous Wave (FMCW) signals, much experimental research has been conducted over the past several decades which continues to support the existing understandings that form the basis for current recommended radiation protection standards. The ANSI subcommittee responsible for the recommendations of C95.1 have concluded in a recent unpublished critical review of the current available scientific research that no adverse biological effects are observed, whether physical or behavioral, for Specific Absorption Rates (SAR) of less than 4 Watts/ Kilogram. This fact plus the established criteria for human exposure at 0.4 Watts/ Kilogram is recognized by all the following U.S. and International recommended standards:

International Radiation Protection Association (IRPA), guidelines on limits of exposure to radio frequency electromagnetic fields in the frequency range 100kHz to 300GHz. Developed in cooperation with the Environmental Health Organization of the World Health Organization (WHO). Health Physics, 54, 115 (1988) (occupational exposure).

National Radiological Protection Board (NRPB) United Kingdom, Guidance as to restrictions on exposure to time varying electromagnetic fields and the recommendations of the International Non-ionizing Radiation Committee. NRPB-GS11, 1988 (occupational exposure).

American National Standards Institute (ANSI), Safety Levels With Respect To Human Exposure To Radio Frequency Electromagnetic Fields, 300kHz To 100GHz, ANSI C95.1, 1982.

COMMENT

RESPONSE

During the initial transmitter start up, the system is brought on line in progressive steps of transmitted power. As power is increased, field strength measurements are taken at locations around the personnel exclusion fence to insure that field strengths outside of the personnel area remain, as predicted, below the levels recommended by ANSI C95.1. In the unlikely event that EMR power levels exceed the recommended levels, immediate action will be taken to identify the extent of the violation and, because such an occurrence would be completely unexpected, further investigation would be necessary to determine the cause of the event. To further explain, the antenna arrays for all the ROTHR systems will have duplicate physical characteristics of the antenna arrays developed for the prototype system in New Kent, Va. The radiating patterns for these arrays are well documented and verified by direct measurement. Having these fixed parameters and using very conservative analysis allows a generic application of the personnel radiation hazard fence and no modifications pertaining to it's location are expected.

If this question refers to some unforeseen effect of EMR beyond that which is recognized, it is important to note, no verified reports exist of injury to human beings or of adverse effects on the health of human beings who have been exposed to RFEM fields within the limits of frequency and SAR as specified by all previous ANSI guides including the current ANSI 1982, C95.1.

Ken Govendo
#6. Page 5-37 says that the ROTHR will not transmit on any frequencies reserved for dedicated services, and I want to be sure that included in that are the new frequencies which have been given to the Department of the Interior and FCC to Micronet.

#6. ROTHR is approved by the FCC and Joint Chiefs of Staff to operate strictly on a not-to-interfere basis within the fixed and broadcast bands of the HF spectrum. A list of prohibited frequencies will be prepared. This list will be coordinated with the FCC to ensure that all frequencies prohibited will indeed be entered into the non-transmitter control software. The ROTHR continuously monitors the HF electromagnetic spectrum, and avoids using any frequency found to be in use by others. In the event that harmonic interference is experienced it should be reported to the FCC Honolulu Field Office, telephone (808) 677-3318 so that if caused by the ROTHR, the fundamental frequency will be added to the prohibited list.

Ken Govendo
#7. I would like to know if harmonic interference is experienced, the operators will actually put those in? ... If it is found that interference does occur, that front ends are overloaded will the operators of ROTHR correct the interference? ... What means of communicating on any such problems will be available to those who might experience such interference or overloading?

#7. See #6.

Ken Govendo
#8. Why not include other officially licensed radio services in the survey?

#8. See #6.

Serafin Delacruz, Tinian Health Center
#9. Is there any health problems that will be posed by installation of the ROTHR?

#9. See #4.

COMMENT

Serafin Delacruz, Tinian Health Center
#10. Why not the use of satellite instead of surface transmitter and receiver? Is the cost tremendous or is it the technology is not possible?

Serafin Delacruz, Tinian Health Center
#11. Why can't we use space transmitter and receiver instead of surface transmitter and receiver? ... Is the ROTHR going to affect the future of general aviation?

Estanislao Hocog
#12. Isn't there enough land space for three transmitter facilities within North Field out of the National Historic Landmark boundary?

Esteven King
#13. Is there any possibility that these projects can be installed in an area with no population? Like Goat Island ... and the islands north of here. ... Why is the system located here?

Lino Lizama
#14. Is the radar company bringing aliens in connection with the operation?

RESPONSE

#10. See Section 2.6 of the DEIS. The ROTHR is the most cost effective means that is presently available to provide continuous surveillance of such a large area of the earth's surface. A satellite with a geosynchronous orbit is 22,500 miles from the earth. No technology is presently available that can provide the resolution necessary to discern planes in the atmosphere, day and night, in any weather from this distance. Multiple satellites would be required at closer distances to provide continuous coverage over the same portion of the earth.

As stated in Section 2.6 of the DEIS, aircraft surveillance providing the coverage comparable to the ROTHR would require far greater amounts of land based facilities to support its around the clock operations.

#11. No. The Navy has conducted studies in cooperation with the Federal Aviation Administration (FAA) to determine the affect of the ROTHR on general aviation aircraft. The findings indicate there will be no affect. However, prior to proceeding with the ROTHR, there will have to be confirmation and concurrence with the FAA. Experience with the prototype system at New Kent, Virginia indicates that no restrictions need be imposed on the operation of general aviation aircraft other than those placed by the FAA for operating under visual or instrument flight rules.

#12. Only two transmitters could be sited in area north of the NHL, P-223 and P-002, as shown in Review/Evaluation of Alternative Sites,"Review/Evaluation" in Appendix J.

#13. See Section 2.4 and 2.5 of the DEIS which discusses the review of islands for sitting the ROTHR projects. See also Appendix J.

#14. The contractor will not be prohibited from hiring aliens. However, a clause containing the substance of the following paragraph will be included in the operations and maintenance contract for the ROTHR systems proposed for the CNMI:

(A) Preference for hiring shall be given to the residents of the Mariana Islands for employment positions covering the operation and maintenance of the ROTHR systems. The contractor shall employ, for the purposes of performing that portion of the contract work in the Mariana Islands, individuals who are residents of the Mariana Islands, and who, in the case of any craft or trade, possess or would be able to acquire promptly, the necessary skills to perform the contract.

(B) The contractor shall assign personnel to operate and maintain the ROTHR systems in the Mariana Islands who possess, at minimum, a secret level clearance. No O&M personnel shall be permitted on-site until proper clearances are obtained.

(C) The contractor shall be required to insert the substance of this clause, including this paragraph (C) in each contract. (See also Section 5.1.11. of the DEIS.)

COMMENT

RESPONSE

Lino Lizama
#15. Will personnel be staying on the site proposed for the radar? ... Roughly how many are coming over per site?

#15. Quarters for 60 Operations and Maintenance personnel will be provided by the projects to house essential personnel for Project P-223, Project P-225, and Project P-002 who need to be in the proximity of the radar at all times. A total of 32 personnel will use facilities in the town of San Jose . Minimal dining facilities will be provided in the personnel quarters. It is expected that personnel will spend leisure time in the town of San Jose.

Serafin Delacruz
#16. Instead of putting those people in quarters, let them rent houses out here from new developers.

#16. See #15.

Gullermina Cepeda
#17. Do you have the requirements as to the qualifications or for a person to be eligible to work? ... Do you have the list of requirements that an applicant should meet in order to be qualified for that hiring? ... Will you also employ women or just men?

#17. The personnel for the transmitters are expected to be provided by the Prime Equipment Contractor, Raytheon Corporation, under contract with the Space and Naval Warfare Systems Command. The personnel positions will not be civil service positions. The contract to operate, maintain, and provide base operations support will be governed by the Armed Services Procurement Act and by those applicable Federal Acquisition Regulations (FARs) that are included in Department of Defense contracts. It will also comply with all those regulations that ensure equal employment opportunities, employment openings for veterans, minimum wages, hours, age, and working conditions; Davis-Bacon Act provisions, and other measure required by Federal law.

Serafin Delacruz
#18. Will the employees be under the U.S. Civil Service system if they are nonmilitary?

#18. See #17.

Esteven King
#19. What guarantee is there that we will have access to into the monument? ... Will the fence prohibit people from going there? What's the guarantee?

#19. The site plan for the transmitter and support facilities would not restrict access to the cross. Access to the Memorial Cross would be allowed to continue as it is now. If the plan for access should change, the revision would receive an appropriate level of public review and comment before the change will be made.

Antonio Artero
#20. How relocatable is this relocatable radar system?

#20. See Section 1.0 of the DEIS. One ROTHR system has already been relocated from Virginia to Amchitka Island, Alaska. However, the antennas and concrete van foundations are stationary, and must be prepared in advance at each site. If constructed on Tinian and Guam, there are no plans to move the systems.

COMMENT

Lowell C. Martindale (See letter submitted following questions and comments.)
#21. The EIS does not address the prospective development of Uruano Beach and to address the impacts of the development of the proposed facilities on the Uruano Beach development. ... The EIS does address the compatibility of the proposed ROTHR facilities with the development of Uruano Beach. ... The EIS does not address the potential electromagnetic interference and other impacts from traffic along the roadway and reasonable mitigation measures to avoid such EMI.

Lowell C. Martindale
#22. We do not know what types of development at Uruano Beach will adversely affect operation of the ROTHR. We don't know whether customary hotel, resort, and residential development below the cliffline can produce radio frequency or electromagnetic interference with the ROTHR facilities.

Lowell C. Martindale
#23. The Artero family has not evidenced any willingness to sell any portion of its property to the military, including the dump site.

Lowell C. Martindale
#24. Alternative locations which may not have such a severe impact on the development of private property should be addressed in the balancing of the military interests in the selection of the final site and the interests of the government and the people of Guam in the development of Uruano Beach.

James P. Castro
#25. Is the Navy ready to deny the private property owners, the Artero and Castro families, the opportunity to develop their beachfront properties?

Carmen Artero Kasperbauer
#26. How will this proposal affect future use of may land and my present use of my land in Uruano?

RESPONSE

#21. Siting of the ROTHR receivers at Northwest Field will not preclude the grant of an access easement to Urunao Beach for development purposes. However, any easements will likely place certain restrictions on the uses of the property (both Urunao and Jinapsan beaches) to ensure that development is compatible with DOD operations in the northern area of Guam. It is not expected that the restrictions will have a large effect on the proposed development at Urunao and Jinapsan beaches. Any easement grant would also likely require that the developers install various improvements to protect military operations and security in the area. These include fencing, earthern berms, underground utilities and various road relocations. This should not be a serious constraint as buildings could still be 250-300 feet in height above the beach.

#22. Under the conditions stated in Response #21, construction of customary hotel, resort, and residential structures at Urunao Beach will not adversely affect ROTHR operations. The term "customary" is assumed to include standard construction techniques including the national electrical code. Also, customary satellite, microwave and television communications 200 feet below the cliffline at Urunao will not affect the ROTHR operations. The types of communications termed "customary" include satellite television and cable service, microwave telephone links (line-of-sight from points 200 feet below the cliffline) and standard UHF/VHF television reception. Construction of the earthen berms and underground utilities, as previously described, will likely be required to protect ROTHR reception in the Northwest Field area as well as down to an elevation 200 feet below the cliffline at Urunao Beach.

#23. See DEIS Section 4.2.10.1. The DEIS indicated the preferred alternative of the U.S. Air Force for disposition of the dump site. Artero family members have indicated a desire to retain ownership of Urunao Beach for development purposes. In connection with the request by the Guam Urunao Resort Corporation (GURC) for access rights across Northwest Field, various alternatives to the dump site issue are being considered. Any negotiated settlement of the issue will have to be acceptable to the Artero family, GURC, and the U.S.

#24. See #22 and Appendix J Review/Evaluation.

#25. No. The Navy does not intend to deny access to the development of Artero and Castro property owners. Requests have been received from the Castro family and GURC for access across Northwest Field to Jinapsan and Urunao beaches. These requests are currently being reviewed by the Navy and Air Force to determine the conditions under which access may be granted. See #21 and #22.

#26. See #21 and #22.

COMMENT

Mike Cruz, Government of Guam, Bureau of Planning
#27. The EIS should address the impacts on not only private lands that are located in that area but also Government of Guam lands. ... What types of uses would be restricted through implementation of this project.

Mike Cruz, Government of Guam, Bureau of Planning
#28. Why was Orote Point eliminated as a site?

Mike Cruz, Government of Guam, Bureau of Planning
#29. The draft does not address the clear zone requirements of the Navy through its air installation compatible use zone regulations and the accident potential zone requirements.

Mike Cruz, Government of Guam, Bureau of Planning
#30. The analysis or discussion of alternate technologies is not sufficient to come to any sort of decision as what technology would be best.

Mike Cruz, Government of Guam, Bureau of Planning
#31. We don't understand the relationship between the existing facilities and the ROTHR, especially in terms of the RFI free zone requirements.

RESPONSE

#27. The only GOVGUAM land in the vicinity of the proposed ROTHR sites at Northwest Field is located to the south of the Artero family property. It is "landlocked" in the same manner as the Artero property. GOVGUAM has not to date requested access rights across Northwest Field for development of the property. Restrictions on GOVGUAM's use of the land would have to be determined in response to a specific proposal. Also, the planned access route would be important in determining necessary restrictions. However, generally speaking, it is likely restrictions and construction similar to that described in Responses #21 and #22 would be required for development of the GOVGUAM property.

#28. The ESQD (Explosive Safety Quantity Distance) hazard area from the new ammunition wharf at Adotgan Point extends to the family housing area at Orote Peninsula. All open undeveloped areas on the peninsula are in the ESQD hazard area. The ROTHR receiver for Project P-002, the only alignment that could fit on the peninsula, would be totally within the explosive danger zone. Manned facilities such as the ROTHR operating vans and van support building would be in the ESQD zone. DOD regulations prohibit the construction on inhabited buildings or structures within a hazard area. At Northwest Field the ESQD hazard area from the Air Force ordnance storage facilities extends only partially onto the runway site for Project P-223 and covers a portion of the site for Project P-002. The ROTHR manned facilities, which are positioned at the center of the 8,600 foot antenna array, would be outside of the ESQD hazard area. Only the antenna poles, equipment shelters, supporting service roads and reflecting ground screen would be in the ESQD area. Therefore, at Northwest Field no person working in the ROTHR vans and buildings would be exposed to the explosive hazard zone. See Appendix J Review/Evaluation.

#29. There are no Navy AICUZ or Air Force prescribed accident potential zones associated with the Andersen Air Force Base Northwest Field runways, which have been classified as inactive since 1949.

#30. See #10.

#31. The RFI-Free Zones established around sensitive receivers such as the CDAA or the ROTHR receiver are intended to keep locally produced RF noise below certain levels. Certain activities which produce such noise will be restricted in these areas. Each receiver has its own designated RFI zone, and is unrelated to any zones nearby. If two zones overlap, the more restrictive applies. The ROTHR receiver operations will not violate ant RFI zone restrictions from nearby receivers.

COMMENT

Ralph Frew, Marianas Audubon Society
#32. Construction of the receivers at the Northern sites of Northwest Field and NAVCAMS will likely result in severe, unacceptable impacts on endangered species and their habitat.

Ralph Frew, Marianas Audubon Society
#33. The Draft EIS understates the impacts of construction at the proposed transmitter sites in northern Tinian. We are concerned that the 125-foot tall, massive towers and cables poses a threat to Mariana common moorhens flying between the marshes at Lake Hagoi on Tinian and Lake Susupe on Saipan.

Ralph Frew, Marianas Audubon Society
#34. An alternative that was dismissed but appears feasible is the location of transmitters on Guam and the receivers on Tinian.

Ralph Frew, Marianas Audubon Society
#35. The alternative to locating the transmitters on Guam should be given serious consideration.

RESPONSE

#32. The receiver sites proposed for Guam would affect the minimum possible forested areas. Clearing for the proposed receiver sites would represent less than 1% of the available forest habitat on Guam and would not negatively impact habitat requirements needed to sustain, or permit the recovery of, Guam's endangered species. In addition, radio frequency interference (RFI) zones associated with the receivers may actually benefit endangered species and their preferred habitat areas located behind, on the sides of, and in front of the receivers. Development within RFI-free zones will be prohibited to prevent interference with the receiving capabilities of the antenna. Because of this constraint, construction of the receivers will afford added protection to species and habitats existing within the RFI-free zones.

The effects of the proposed action on habitat, flora, fauna, and specifically endangered species have been discussed throughout the DEIS and the FEIS in Section 3.2.7; 6.2.7; 7.2.9; and 9.4.2. See Appendix K and Appendix L.

#33. The Navy has considered the possibility of moorhen mortality caused by antenna and tower strikes and has been thorough in collecting and researching available literature and information regarding this matter. Findings and recommendations resulting from consultations with various electronic experts/engineers, Fish and Wildlife Service biologists, Government of Guam biologists, ROTHR engineers, Hawaii Electric engineers, Coast Guard LORAN Station personnel and others, are incorporated throughout the DEIS. Such discussions and suggested means of mitigating chances for antenna collisions can be found in the DEIS on page v, and in Section 4.4 of the FEIS.

#34. U.S. Navy and U.S. Air Force communication receiver facilities are located at NAVCAMS Finegayan and Northwest Field. These existing facilities require various minimum isolation distances from electromagnetic noise sources such as the ROTHR transmitter. The required separation is primarily dependent on the power level and frequency of the noise, and distances have been established by the DOD as follows:

o One and two mile isolation distances for low level, unintentionally produced noise sources, such as that generated by high voltage above ground power lines, two cycle gasoline engines, electric discharge vapor lamps, etc. See Figure 4.2.5 of the DEIS.

o A minimum isolation distance of 15 miles is required from a standard high frequency transmitter. However, select receivers require a minimum isolation distance from the high power ROTHR transmitter of 100 miles. [Ref. 74] Since Guam is only 30 miles long, this requirement, alone, precludes locating the ROTHR transmitter anywhere on Guam. See Appendix J, Review/Evaluation.

#35. See #34.

COMMENT

Ralph Frew, Marianas Audubon Society
#36. The receiver for Project P-002 could be located on Orote Point, if inhabited buildings were located outside the ESQD arc near the existing Navy housing.

Ralph Frew, Marianas Audubon Society
#37. Could the Project P-225 receiver be moved further south into South Finegayan and Harmon Annex area with a reduced loss of forest?

Ralph Frew, Marianas Audubon Society
#38. We are opposed to construction of the proposed radar site in any location currently used by Guam's endangered species because the resulting habitat loss and harassment would drastically reduce the chances of their continued survival and recovery. We feel this requirement should eliminate from consideration the northern P-223 , P-225 and P-002 sites because the Marian crows, Guam flycatchers, Micronesian kingfishers, and Mariana fruit bat reside at these sites.

Ralph Frew, Marianas Audubon Society
#39. The Draft EIS does not take into consideration the fact that the U.S. Fish and Wildlife Service is in the process of proposing critical habitat for Guam's endangered wildlife. The next version of the Draft EIS should treat those areas being considered as critical habitat.

RESPONSE

#36 . The operational support buildings and electronic vans for the transmitter and receiver must be located near the approximate center of the their respective arrays. This is required because the length of the cables carrying signals from the antennas to the manned support facilities must be kept to a minimum. The signal loss on a cable which had to extend beyond the ESQD hazard area would be unacceptable. The cable lengths are also precisely calibrated for a balanced length between the extreme ends of the array.

Additionally, the transmitter has a Hazard of Electromagnetic Radiation to Ordnance (HERO) exclusion zone. No "HERO Susceptible" ordnance is permitted within this zone. the ordnance stored near Orote Point is within this zone and may be suspectable during transport to and from the storage areas.

#37. South Finegayan (former FAA area) and Harmon Annex are alternatives discussed in the DEIS. However, only one receiver can fit in either area since the arrays cannot overlap or cross each other, and the arrays must be aligned in a predetermined direction. See Section 3.4.2 of the DEIS.

#38. The DEIS discusses Guam's flora, fauna, endangered species, and likely impacts on page vii, and in Section II, pages 3-7, 3-16, 4-21 through 4-31, 5-56 through 5-62, 5-80, and 5-81, and in Appendices E and F. See #32.

#39. Discussions concerning the U.S. Fish and Wildlife Service's proposal to consider designating certain areas on Guam as critical habitat for endangered species can be found in the DEIS on page viii and in Section II, pages 4-23 through 4-27 and 5-56. Until the process of proposing critical habitat is formalized via publication in the Federal Register, areas under consideration for such designation are not legally afforded the special classification or protection assigned critical habitat under the Endangered Species Act. (See Appendix K for a discussion of actions when critical habitat is proposed.)

COMMENT

Ralph Frew, Marianas Audubon Society
#40. The EIS should cover the cumulative effects of all three sets of transmitter and receiver pairs.

Paul Conry, Marianas Audubon Society
#41. An EIS is required to address cumulative effects of a project and all foreseeable future segments of the project.

Tony Sablan
#42. What effects would the ROTHR project have on our (Artero) property? ... Would the ROTHR project prohibit development above the cliffline?

Tony Sablan
#43. Is the project really for National defense?

RESPONSE

#40. As stated in Section 2.1 of the DEIS, each system operates independently of the others. Data coordination between systems is desirable, but not essential for successful detection of aircraft over the coverage area of each system. Indeed the ROTHR systems in Virginia and the United Kingdom are single stand-alone ROTHRs and will operate independently, just as Project P-223 can. Each coverage area has its own strategic importance, as determined by the DOD, and the islands of Tinian and Guam provide a central location from which to base three strategically important ROTHR coverage areas. While there is no certainty that all three ROTHR systems will be constructed, the cumulative impacts of the potential construction of all three ROTHR systems are identified to the extent possible and addressed in the Section I of the DEIS and further discussed in Section II of the FEIS. If Projects P-225 and P-002 are pursued, additional project-specific documents may be prepared to supplement the existing assessment of impacts.

#41. See FEIS Sections 8.3 and 8.4.

#42. See #21 and #22.

#43. Yes. The DOD has determined for cost reasons that the ROTHR system is necessary for the national defense. It is an early warning and battle group coordination device that is beneficial to the U.S. and its allies. Much historical evidence exists indicating the importance of early detection of enemy attack in providing for the national defense. An approved Mission Essential Statement (MENS) is the formal basis for the ROTHR program. The MENS grew out of a major study of the Nation's surveillance and command and control needs performed during the first half of the 1980's. Its implementation is governed by a classified Decision Coordinating Paper which is regularly reviewed and confirmed at the highest levels of the DOD. The most recent review was conducted in November 1989 when the ROTHR program received its first approval for production. See FEIS Section 1.0.

COMMENT	RESPONSE
Ralph Frew, Marianas Audubon Society #40. The EIS should cover the cumulative effects of all three sets of transmitter and receiver pairs.	#40. As stated in Section 2.1 of the DEIS, each system operates independently of the others. Data coordination between systems is desirable, but not essential for successful detection of aircraft over the coverage area of each system. Indeed the ROTHR systems in Virginia and the United Kingdom are single stand-alone ROTHRs and will operate independently, just as Project P-223 can. Each coverage area has its own strategic importance, as determined by the DOD, and the islands of Tinian and Guam provide a central location from which to base three strategically important ROTHR coverage areas. While there is no certainty that all three ROTHR systems will be constructed, the cumulative impacts of the potential construction of all three ROTHR systems are identified to the extent possible and addressed in the Section I of the DEIS and further discussed in Section II of the FEIS. If Projects P-225 and P-002 are pursued, additional project-specific documents may be prepared to supplement the existing assessment of impacts.
Paul Conry, Marianas Audubon Society #41. An EIS is required to address cumulative effects of a project and all foreseeable future segments of the project.	#41. See FEIS Sections 8.3 and 8.4.
Tony Sablan #42. What effects would the ROTHR project have on our (Artero) property? ... Would the ROTHR project prohibit development above the cliffline?	#42. See #21 and #22.
Tony Sablan #43. Is the project really for National defense?	#43. Yes. The DOD has determined for cost reasons that the ROTHR system is necessary for the national defense. It is an early warning and battle group coordination device that is beneficial to the U.S. and its allies. Much historical evidence exists indicating the importance of early detection of enemy attack in providing for the national defense. An approved Mission Essential Statement (MENS) is the formal basis for the ROTHR program. The MENS grew out of a major study of the Nation's surveillance and command and control needs performed during the first half of the 1980's. Its implementation is governed by a classified Decision Coordinating Paper which is regularly reviewed and confirmed at the highest levels of the DOD. The most recent review was conducted in November 1989 when the ROTHR program received its first approval for production. See FEIS Section 1.0.

COMMENT

Alice Hadley
#44. Since you are going to build all three sites you should talk about all three.

Bruce Best (See submittal following questions and comments.)
#45. We are worried about harmonic interference.

RESPONSE

#44. As stated in the DEIS, three ROTHR projects are under consideration for location in the Western Pacific and are called collectively for NEPA purposes as the Western Pacific ROTHR program. Each ROTHR project will operate independently and each provides an area of coverage which has its own strategic importance. There is no certainty that one, two, or three ROTHR systems will be constructed. However, the impacts of the potential construction of all three ROTHR systems considered for the Western Pacific are addressed in Section I of the DEIS.

The cumulative effects of the potential construction of up to three systems (Projects P-223, P-225 and P-002) were noted in the DEIS, but for ease of reading, this cumulative analysis has been consolidated into separate section in the Final EIS (FEIS). Separate cumulative impact sections have been added to Section 4.3 and 8.3 of the FEIS. If Projects P-225 and P-002 are pursued, additional project- specific documents will be prepared to supplement the assessment of impacts.

#45. ROTHR signal harmonics have been demonstrated to be 70 dB or more below the power on the main beam. In addition, receivers located on Tinian will be located behind or to the side of the ROTHR transmitter further reducing the transmitted power. Transmitted harmonic signal power levels would therefore be approximately 110 dB down in power from the main beam, a factor of 100 billion. This is equivalent to a noise transmitter at the ROTHR site transmitting at the harmonic frequency with one millionth of a watt of power or less. Signals of this level are well below the noise level and are not likely to affect any receiver operating on the harmonic frequencies.

COMMENT

RESPONSE

MARIANAS AUDUBON SOCIETY
P. O. BOX 4425, AGANA, GUAM 96910

August 18, 1989

Mr. M. N. Kaku
Acting Head, Facilities Planning Department
Pacific Division
Naval Facilities Engineering Command
Pearl Harbor, Hawaii 96860-7300

Dear Mr. Kaku:

I am Dr. Ralph Frew, Chairman of the Conservation Committee of the Marianas Audubon Society. I am here today representing the 90 local members of the Marianas Audubon Society and the one-half million members of the National Audubon Society. The Marianas Audubon Society is a conservation organization interested in preserving the natural and historical resources unique to the Mariana Islands. We are particularly concerned with the preservation of endangered species and their habitat. The National Audubon Society is an international conservation organization dedicated to wildlife conservation and environmental protection.

10 - 17

Because of the large size of the Draft EIS and the complexity of the issues addressed, I hereby request that the comment period be extended an additional 45 days to October 20, 1989 to allow us to adequately review this document of over 900 pages. (I think there are about 921 pages excluding the covers, dividers, and an occassional blank page.) We require this additional time to consult with the different people and organizations working on this issue with us. Because most of our communication with colleagues must be done by mail, we feel the added time is justified.

The comments I submit today are based on our initial review of the Draft EIS and will pertain primarily to the adequacy and scope of the document. Additional comments ~~may~~ will be submitted in writing at a later date.

1. Based on the information presented in the Draft EIS, our knowledge of the distribution of endangered species and the quality of habitat at the various sites considered for the receivers here on Guam, construction of the receivers at the northern sites on Northwest Field and NAVCAMS will likely result in severe, unacceptable impacts on endangered species and their habitat. We believe that alternate locations are available that would not have the environmental impacts of the northern sites. Of the sites considered for P-223, the Harmon site should be the preferred site because it is primarily mixed grass and shrubs and is outside the current range of endangered species and will result in little environmental impact. In comparing the proposed sites for the P-225 receiver, the FAA site appears to have fewer impacts than the NAVCAMS site because the FAA site is outside the range of endangered species, but there remain serious concerns about habitat loss at this site which deserve further study.

2. The Draft EIS understates the impacts of construction at the proposed transmitter sites in northern Tinian. We are concerned that the 125-foot tall mass of towers and cables

COMMENT

poses a threat to Mariana Common Moorhens flying between the marshes at Lake Hagoi on Tinian and Lake Susupe on Saipan. We are doubtful that the Navy's plan to leave tall trees around the transmitters would significantly reduce this hazard. Most trees on the site are only 30 feet tall and we doubt that they would deflect birds over the 125-foot transmitters as stated. The western and eastern alternative sites do not appear to have this problem because they do not intersect the moorhen flyway. Contrary to what is suggested in the Draft EIS, location of the transmitters at the proposed alternative sites, which will require a total of about 178 acres, should not be a substantial impediment to the leaseback agreement between the Navy and CNMI government for over 12,000 acres. 46

3. The Draft EIS did not adequately address alternative sites and approaches that seem practicable to us. An alternative that was summarily dismissed but appears feasible is the location of transmitters on Guam and the receivers on Tinian. This approach may resolve environmental problems on both islands. Because transmitters require less land, they will have fewer impacts on endangered species habitat on Guam. Appropriate locations may be more easily located on Tinian for the land intensive receivers. Additionally, the smaller stature, passive receivers would not pose a radiation threat or barrier to flying moorhens. Transmitters could be located on Guam in the FAA, South Finegayan, and Harmon areas. Apparently, this alternative of locating transmitters in northern Guam was excluded because of an unsubstantiated statement that communication receivers at NAYCAMS requires a 15 mile isolation distance from high power, high frequency transmitters. Contrary to this claim, Figure 5.2.2. in the document indicates a 2 mile RFI free zone is acceptable for communication operations at NAYCAMS. This alternative should be given serious consideration. Likewise, Orote Point seems an appropriate location for transmitters, yet it was excluded because of safety requirements associated with the Orote Point ammunition wharf. However, we believe that two transmitters could be built there while satisfying requirements for personnel safety if the inhabited buildings were located next to the Navy housing outside the ESQD arc. Likewise, a receiver for P-002 could be located on Orote Point if inhabited buildings were located outside the ESQD arc near the existing Navy housing. This may require equipping the receiver with a RFI barrier or shield. Additionally, there are a number of alternative receiver sites that seem practicable to us but were not considered. For instance, P-225 could be moved further south and accomodated in the South Finegayan and Harmon Annex area with a reduced loss of forest. These and other alternatives need to be given serious consideration in rewriting this document. 47 48 49

4. We are opposed to the construction of the proposed radar sites at any locations currently used by Guam's endangered species because the resulting habitat loss and harassment would drastically reduce the chances for their continued survival and recovery. We feel this requirement should eliminate from consideration the northern P-223, P-225, and P-002 sites because Mariana Crows, Guam Flycather, Micronesian Kingfisher, and Mariana Fruit Bats reside at these sites.

5. The Draft EIS does not take into consideration the fact that the U. S. Fish and Wildlife Service is in the process of proposing critical habitat for Guam's endangered wildlife. The next version of the Draft EIS should treat those areas being so considered as critical habitat. Because it is necessary to preserve an adequate quantity of habitat, we are against the construction of the proposed radar sites in areas that involve significant 50

RESPONSE

#46. See #33.

#47A. See #34.

#47B . Navy criteria for communications sites are provided in NAVELEXSYSCOM Publication 0101,104. The criteria establishes distances that communications facilities must be separated from facilities that are possible sources of interference. The mentioned 15 miles isolation distance applies to high, medium and low frequency receiver site from high power, low frequency and high frequency transmitter stations. The 2 mile RFI free zone is a specific determined requirement for the ROTHR receiver system operations, and is referring to interference from low level unintentionally produced noise sources such as that generated by high voltage aboveground power lines, automobile ignition systems and electric discharge vapor lamps. The NAVELEXSYSCOM publication also covers these sources of interference in its criteria which states that the communication receiver site should be 1 mile from habitable areas, 3 miles from light industrial areas, 5 miles from heavy industrial areas, 3,000 feet from main highways, and 2 miles from overhead high power lines (over 100KV).

#48. The high power ROTHR transmitters cannot be located at Orote Point due to the electromagnetic radiation impact to ordnance at the new ammunition wharf as well as to ordnance aboard warships in Apra Harbor. The wharf and warships would be less than two miles from Orote Point. See Appendix J Review/Evaluation.

#49. These locations have been given serious consideration. However, these locations are not as desirable as Northwest Field due to potential electromagnetic interference from future urban development of the surrounding areas. The current plan is for the U.S. Government to return the South Finegayan and Harmon Annex parcels to GOVGUAM under the Guam Land Use Plan (GLUP).

#50. See #39.

COMMENT

losses of critical habitat. However, we would not oppose selection of a site involving only minor losses of critical habitat, provided the site was outside the current range of endangered species and the loss of critical habitat was adequately mitigated. Construction at the Harmon P-223 site and similar sites in the South Finegayan and FAA areas may involve only minor mitigatable losses of critical habitat that would be acceptable to us. However, this will require further study.

6. The description of the purpose and need for this radar system clearly depict the interrelatedness of the entire system. Its role as an early warning system to detect both ships and particularly aircraft requires a coordinated, interconnected and interdependent system. A single unit could not satisfactorily function as an early warning system as stated. Aircraft could easily fly around its perimeter without detection. It is clear to us The EIS should cover cummulative effects of all three sets of transmitter and receiver pairs.

Our initial review of the Draft EIS as discussed above found that the document was incomplete in that it did not address a number of viable alternatives that deserve serious consideration, it did not address the scope of the whole project, i.e. three sites within one functional system, and it did not correctly assess the impacts on endangered species and their habitat and the cummulative impacts of all three sites. We therefore request that these deficiencies be corrected by rewriting and circulating a second draft of this document prior to proceeding to the Final Draft stage in this environmental review process.

Thank you for the opportunity to provide these comments.

Sincerely,

Ralph Frew
Chairman Conservation Committee
Marianas Audubon Society

51

RESPONSE

#51. See #40.

COMMENT

RESPONSE

Commonwealth of the Northern Mariana Islands
Coastal Resources Management
Office of the Governor
Saipan, Mariana Islands 96950

CABLE ADDRESS
GOV. NMI SAIPAN
TELS. [illegible]

FN:SCT08NAV

August 25, 1989

Commander E.C. Rushing, Jr., CEC, Head
Facilities Planning Department
U.S. Navy, Pacific Division
Naval Facilities Engineering Command
Pearl Harbor, HI, 96860-7300

Dear Commander Rushing:

10 - 20

Thank you for providing the Coastal Resources Management Office (CRMO) with the opportunity to review the Draft Environmental Impact Statement for the proposed Relocatable Over-The-Horizon Radar (ROTHR) system to be located in Guam and Tinian. Although several issues in the Draft EIS are common between both sites, this review has concentrated on the Tinian facility and impacts.

As you may know, pursuant to the "Federal consistency" provisions of Section 307 of the Federal Coastal Zone Management Act of 21972, 16 U.S.C. 1451, all federal activities in the CNMI are required to be "consistent to the maximum extent practicable" with the CNMI Coastal Resources Management Program [Section 307 (c) (1), CZMA]. The Draft EIS reviewed by this office has several issues which are not consistent with the CRMO program policies. We hope that by bringing these inconsistencies to your attention at this early stage you will be able to modify your proposal accordingly.

CNMI Public Law 3-47 Section 1511 (11) states that the CRMO policy is to "[r]ecognize and respect locations and properties of historical significance throughout the Commonwealth, and ensure that development which would disrupt, alter, or destroy these, is subject to Commonwealth and any applicable federal laws and regulations". The North Field transmitters will be located entirely within the North Field Historic Landmark, a site listed on the National Register of Places. It is CRM's determination that development in this area could detract from its historical value. The CRMO advises that you coordinate with the Historic

COMMENT

RESPONSE

Preservation Office (HPO) in the CNMI prior to the issuance of the Final EIS. Plans for the ROTHR transmitter station should be compatable with HPO concerns. | 52

CNMI Public Law 3-47 Section 1511 (17) provides that the CRMO policy shall "[p]rotect all coastal resources, particularly sand, corals and fish from taking beyond sustainable levels and in the case of marine mammals and any species on the Commonwealth and Federal Endangered Species List, from any taking whatsoever". The CNMI Division of Fish and Wildlife has expressed concerns regarding mortality to birds from hitting antennas as well as significant loss of habitat. Both the Federal Endangered Tinian Monarch and the Mariana Common Moorhen are found on the Tinian site. The proposed use of lighting at night increases the threat to these bird species. More information including scientific studies needs to be provided which will back up assertions in the DEIS that impacts to bird life will be minor. Should impacts to bird life be found to be significant, mitigation acceptable to the Division of Fish and Wildlife must be coordinated before CRMO can issue a consistency determination. | 53

The most critical issue needing more clarification is the effect of electromagnetic radiation on humans and other animal species. Article I, Section 9 of the Constitution of the CNMI, which grants each citizen the right to a clean and healthful environment, is part of the CRMO enforceable policies. Under the "Federal consistency" provision, this policy is also enforceable in making consistency determinations. | 54

Details in the DEIS regarding the effects of electromagnetic radiation (ER) appear very limited. It was represented in the DEIS, as well as at the public hearing in Saipan, that the primary effect of radiation is merely heat. Dr. Mike Kenney, Doctor of Public Health, has done some preliminary research on recent studies on the risks of low frequency ER and it appears that there are more risks than indicated in the DEIS. The DEIS refers to "A study of Electromagnetic Environmental Effects Associated with the Relocatable Over-the-Horizon Radar" written by the Department of the Navy, Space and Naval Warfare Systems Command. The scientific and medical references provided in Dr. Kenney's comments and the above mentioned Navy document need to be reviewed by this office before a determination as to the safety of this technology can be made. | 55

This office is prepared to lend assistance in meeting the above requests for further information and analysis. Please do not hesitate to contact the CRMO office should you need information

#52. The Historic Preservation Officer (HPO) has been provided a copy of the DEIS for review. In addition, the U.S. Navy has consulted with the CNMI HPO regarding the impact of ROTHR project construction on the historic values of the North Field National Historic Landmark. A mitigation plan has been developed for Project P-223 which includes: (1) additional archival documentation; (2) field photography of selected features; (3) the creation of management base maps; (4) the deposition of collected documents and photographs in a suitable repository for future research and interpretive purposes; and (5) a reassessment of the Landmark boundaries, especially as pertains to the quarters and work compound of the 509th Composite Group. Some additional data recovery and in-place preservation of selected features will also be considered.

Consultation with the HPO concerning the ROTHR project will continue in compliance with Sections 106 and 110 and other parts of the National Historic Preservation Act of 1966, as amended, as well as other historic preservation statutes.

#53. Potential affects of the proposed transmitter sites in northern Tinian on the Mariana common moorhen are discussed in the DEIS on page v, and in Section II, pages 3-7, 5-10 through 5-13, and 5-49 through 5-51. See also response provided to Comment #33. The Tinian monarch is a diurnally active species with keen eye sight. The chance of a monarch colliding with a tower, pole or support wire is extremely remote.

Construction of the transmitters will result in the loss of about 1.09 percent of the total undeveloped area within the military lease area. This commitment of resources is not considered significant or expected to negatively impact habitat requirements needed to sustain, or permit recovery of, any Tinian endangered species.

No lighting that could disorient birds will be installed on the towers, and the ground lighting will be kept to the minimum required for operations and security. In addition, the U.S. Navy will implement measures to lessen the impact on threatened and endangered species as set forth in the USFWS biological opinion. See Appendix M.

Extensive biological studies have been conducted on Tinian to identify potential conflicts between the proposed transmitters facilities and any CNMI or federally listed species, and to satisfy biological assessment requirements under Section 7 of the Endangered Species Act. The results of these studies are discussed throughout the DEIS on pages, v, and vi, and in Section II, pages 3-7, 3-15, 4-5 through 4-8, 5-10 through 5-16, and 5-46 through 5-51. No additional biological studies or surveys on Tinian are considered warranted.

The U.S. Fish and Wildlife Service formal Section 7 Endangered Species Act consultation determination covering this action has been coordinated with CNMI. See Appendix K.

#54. See #244 through #249.

#55. See #244 through #249.

COMMENT

RESPONSE

regarding our regulations or our concerns. Enclosed please find copies of the CRMO regulations, codes and a guide to the Federal consistency provision of the CZMA.

Sincerely,

Maile Huvar Bruce
Administrator
Coastal Resource Management Office

cc. Governor Pedro P. Tenorio

Michael Fleming, Chief
Historical Preservation Office

Arnold Palacios, Chief
Division of Fish and Wildlife

Enclosures

COMMENT

RESPONSE

PO #545
Barabco, Wi
53913
August 26, 1989

FACILITYLICENSCOM
Dear Gentleman,

Thank you for sending me the Draft Environmental Impact Statement for Electronic Installations in the Western Pacific. I have reviewed the document and have the following comments to make.

First I would like to question the over-all appropriateness of the ROTR project. Is this project indeed necessary, or are there more viable alternatives in the near future? Will our tax-payer dollars be well spent on this project? Or will it soon be out-dated by better detection methods? If there is any question of the longevity and capabilities of ROTR technology, saving our tax money seems the best approach. 56 57

If the project is to be built, I have the following comments. The size and extent of the project should be minimized to save money and native habitat. Any undisturbed native 58

#56. Yes. Tax dollars will actually be saved by this radar system. ROTHR will fill a need for wide area surveillance until technology advances far enough to make satellite or some other method a more cost efficient means. Alternate surveillance methods are not now or forseeably capable of being as cost efficient as the ROTHR.

#57. See #56.

#58. The Navy has made significant efforts to minimize the habitat disturbed by each antenna by choice of site and by making the best tradeoffs possible between performance, cost, and environmental impact at each site. The acreage disturbed by Project P-223 was reduced from 200 to 172 acres by such efforts.

COMMENT

vegetation patches should not be destroyed or altered by ROTR construction. U.S. Fish & Wildlife "essential habitat" for endangered species should be left untouched. Recovery projects for endangered species should be respected in this project (ROTR). In general, all vegetation removal, especially in undisturbed native habitat, should be minimized or avoided. 59

Since many species on Guam and other islands have been extirpated or endangered, the ROTR project could have significant impact indirectly on sensitive species. Problems such as Brown Tree Snake introduction and bird-flight accidents could be exacerbated by ROTR construction. Many other indirect impacts could be present in the ROTR project. If indeed ROTR does get constructed, close work with the USFWS and other agencies is necessary. Carelessness could destroy other endangered species. I urge great caution in such projects. 10-24

Thank you for your time and efforts.

Sincerely,

Mark A. Bruns

RESPONSE

#59. Most of the vegetation of the northern plateau of Guam has been disturbed, over time, by both man-made and natural influences. All but one of the receiver sites proposed for northern Guam consist primarily of mixed vegetation and regrowth limestone forest. These sites are comprised of seedlings and trees of native species, and an equal number of weedy, introduced plants. One proposed project site contains modified limestone forest with little recent disturbance. Overall, the proposed project sites are believed to offer the least environmental impact in terms of area to be cleared, and none is known to contain any Federal or Government of Guam listed or candidate endangered or threatened species. The floral resources of the proposed project areas and project impacts likely to affect these resources are discussed in the DEIS on pages v, vii, and viii, and in Section II, pages 3-7, 4-27 through 4-30, 5-51, 5-61 through 5-62, 5-81, and in Appendix F.

Endangered Species Act recovery plans recommending specific projects and actions to insure the conservation and recovery of Guam's forest birds and bats have not been finalized. See page 4-23 of the DEIS.

Essential habitat is a designation used in recovery plans to designate important habitat areas. Essential habitat is neither defined in the Endangered Species Act nor afforded the Federal protection established for critical habitat. See page 4-23 of the DEIS.

COMMENT

RESPONSE

29 August 1989

Mr. James Chun (Code 2012)
Pac Div
Naval Facilities Engineering Command
(PACNAVFACENGCOM)
Pearl Harbor, Hawaii 96860-7300

RE: Draft EIS - Navy Over the Horizon Radar Project

Dear Mr. Chun:

I am a resident of the Territory of Guam and submit these comments in response to the Navy Draft EIS. Due to the length of the document, I have not had an opportunity to study it in depth.

I am opposed to the construction of the receivers at the northern sites on Northwest Field and NAVCAMS. As you should know, the U.S. Fish & Wildlife is in the process of proposing significant portions of those areas as critical habitat. The draft EIS does not seem to take this fact into consideration whatsoever. 60

#60. Refer to DEIS page viii, and Section II, pages 4-23 through 4-27 and 5-56. See #39, FEIS 3.2.7; 6.2.7; 7.2.9; 9.4.2 and Appendix K.

Construction of the receivers at those sites will, with certainty, have a negative, i.e., devastating effect on the endangered species of Marianas crows, Guam flycatcher, Micronesian kingfisher and Marianas fruit bats. Most if not all of these species only exist in the areas the Navy currently proposes for the receivers.

Wherever development has not occurred on Guam, it is primarily jungle and forests. Presumably when you are out and about in the forests of Hawaii, you hear birds. When one is out and about in the jungles and forests of Guam, there is mostly silence. The reason for that is that Guam's bird population (and fruitbats) has been pretty much eliminated by the brown tree snake.

It is CRITICAL to Guam that the proposed critical habitat be preserved, so that the above four named species have some hope of concomitantly being preserved. Likewise, it is critical for the survival of those four endangered species, that the Navy not locate its receivers in Northwest Field and NAVCAMS.

What's wrong with the Navy locating the receivers at the Harmon site, which would result in little environmental impact? What's wrong with the other alternative sites? The EIS does not appear to answer these questions. 61

#61. See #37.

COMMENT

RESPONSE

Why doesn't the Navy consider locating the transmitters on Guam, and the receivers on Tinian? 62

It further does not appear that the EIS addressed the scope of the project as a whole; that is, three sites within one system. The impact on the environment here will certainly not be piecemeal, but rather cumulative.

Given that the jungles and forests of Guam are nearly silent of birdlife now; given that there are viable site alternatives; given that the alternatives of locating the transmitters on Guam would have significantly less impact on the environment; and given the Navy's frequent touting of good will to the people of Guam - why is the Navy pushing so hard for the ROTHR project to be located on Northwest field and NAVCAMS?

In sum, I am totally opposed to the radar sites being located in any place on Guam currently inhabited by the above four named species.

Thank you for your consideration of these comments.

Sincerely,

Roberta H. Rons

Roberta Happy Rons
Suite 701 - PDN Bldg.
238 Archbishop F.C. Flores Street
Agana, Guam 96910
"Personal Mail"

#62. See #34.

COMMENT

RESPONSE

INTERNATIONAL COUNCIL FOR BIRD PRESERVATION
UNITED STATES SECTION, INC.

STANLEY E. SENNER, Chairman
Hawk Mountain Sanctuary Assn.
Route 2, Box 191
Kempton, PA 19529

RON NAVEEN, Vice Chairman
2378 Route 97
Cookeville, MD 21723

FRANCES SPIVY-WEBER, Treasurer
National Audubon Society
801 Pennsylvania Avenue, SE
Washington, DC 20003

KATHLEEN S. ANDERSON, Secretary
22 Winter Street
Middleboro, MA 02346

29 August 1989

Mr. James Chun
(Code 2012)
Pacific Division
Naval Facilities Engineering Command
Pearl Harbor, Hawaii 96860-7300

Dear Mr. Chun,

The International Council for Bird Preservation is the longest-established world-wide conservation organization. It is devoted entirely to the protection of wild birds and their habitats. ICBP has had a long standing interest in the Pacific region and many of our delegates have specific experience on Guam's avifauna.

10 - 27

The following comments are offered in behalf of the U.S. Section of ICBP on the Navy's Draft Environmental Impact Statement, issued on July 12, 1989, concerning the installation of the Navy's Relocatable Over the Horizon Radar Project (ROTHR) to be built on Guam and Tinian in the Marianas Islands.

The International Council for Bird Preservation is opposed to the current proposal for construction of this radar project, which would destroy habitat on Guam that is being considered for designation as "Critical Habitat" by the U.S. Fish and Wildlife Service. In addition this habitat contains the last known populations of the Guam Micronesian Kingfisher, Mariana Crow, Guam Broadbill and Mariana Fruit Bat. We believe that the construction and operation of the ROTHR facilities may jeopardize the continued existence and greatly impede the recovery of these federally listed endangered species.

In addition we believe that the Navy has inadequately addressed the endangered species concerns for this project. The following are some deficiencies in the DEIS.

1. The proposed "Northern Sites" for the receivers will destroy a major portion of the remaining range of the federally listed 63

MEMBER SOCIETIES OF THE UNITED STATES SECTION

American Museum of Natural History • American Ornithologists' Union • Association of Field Ornithologists • Chicago Zoological Society • Colonial Waterbird Society • Cooper Ornithological Society • Cornell Laboratory of Ornithology • Florida Audubon Society • Hawk Mountain Sanctuary Association • The Humane Society of the United States • Field Museum of Natural History • International Crane Foundation • Los Angeles County Museum of Natural History • Monument Bird Observatory • Massachusetts Audubon Society • Maine Audubon Society • National Audubon Society • National Wildlife Federation • The Nature Conservancy • New Jersey Audubon Society • New York Zoological Society • Pacific Seabird Group • The Peregrine Fund • Point Reyes Bird Observatory • Raptor Research Foundation, Inc. • Smithsonian Institution • Vermont Institute of Natural Sciences • Western Foundation of Vertebrate Zoology • The Wildlife Society • Wilson Ornithological Society • World Pheasant Association-USA • World Wildlife Fund

#63. See response provided to Comment #32. It should be noted for the record that the historic range for the above-mentioned Guam forest birds covered much of the forests of northern Guam within the last decade, and that the primary cause for the decline of these species has been the result of the establishment and spread of the brown tree snake, Boiga irregularis.

Potential effects of the proposed transmitter sites in northern Tinian on the Mariana Common Moorhen are discussed in the DEIS on page v, and in Section II, pages 3-7, 5-10 through 5-13, and 5-49 through 5-51. See also response provided to Comment #33.

COMMENT

endangered Guam Micronesian Kingfisher, Halcyon c. cinnamomina, Mariana Crow, Corvus kubaryi, Guam Broadbill, Myiagra freycineti, and the Mariana Fruit Bat, Pteropus marianus. The Northern Sites for the transmitters on Tinian will adversely affect the Mariana Common Moorhen, Gallinula chlorpus guami. | 63

2. Northern Sites for the receivers will destroy a significant proportion of habitat that is being considered for "Critical Habitat" designation under the Endangered Species Act for the above mentioned species. The Draft EIS does not take into consideration the fact that the U.S. Fish and Wildlife Service is in the process of proposing critical habitat for Guam's endangered wildlife. | 64

3. Contrary to the approach of the DEIS, the three receiver-transmitter pairs need to be considered as a single project in a single EIS in order to evaluate the cumulative impacts of the entire project as required by the National Environmental Policy Act. | 65

4. The Navy has not seriously considered other reasonable alternatives suggested by the Government of Guam and the Marianas Audubon Society that would have far fewer impacts. | 66

We hope that you will reconsider the location of the ROTHR project on Guam and Tinian.

Sincerely,

Kimberley Young

Kimberley Young
U.S. Representative
International Council for Bird Preservation
c/o World Wildlife Fund
1250 24th Street, NW
Washington, D.C. 20037

RESPONSE

#64. Proposed receiver locations in northern Guam have been carefully chosen to minimize environmental impacts. Only a very small percentage of the existing forest habitat in northern Guam which is known to support endangered species would be affected by the receivers. See #32.

See DEIS page viii and Section II, pages 4-23 through 4-27 and 5-56 which discuss the Fish and Wildlife Service's proposal to consider designating certain areas on Guam as critical habitat. See also reply to Comment #39.

#65. See #44.

#66. See Appendix J Review/Evaluation.

COMMENT

RESPONSE

Commonwealth of the Northern Mariana Islands
Office of the Governor
Saipan, Mariana Islands 96950

FOR OFFICIAL US
CABLE ADDRESS
GOV, NMI SAIPAN
REPLY TO:

22 August 1989

Mr. James Chun (Code 2012)
U.S. Navy, Pacific Division
Naval Facilities Engineering Command
Pearl Harbor, HI 96860-7300

Dear Mr. Chun:

Enclosed are comments on the Navy Draft EIS for the ROTHR project from the Division of Fish and Wildlife primarily prepared by our Senior Wildlife Biologist, Dr. James D. Reichel. We feel that the Draft EIS has not fairly and adequately dealt with wildlife concerns in three major areas. First, mortality due to antenna collisions is understated using non-information from 5 sources who have never carried out research, instead of the vast body of scientific literature which deals with the subject. Second, habitat loss and subsequent population declines have not be fairly addressed, and cumulative impacts with prior Naval actions have not been considered. Third, electromagnetic effects have not been dealt with in any detail, some effects have not been discussed, and none give supporting data or allow independent evaluation. Please note that we will have additional comments on electromagnetic radiation effects at such time as the publication we have requested from your office is received. Thank you for the opportunity to comment on the Draft EIS.

Sincerely,

Arnold I. Palacios
Chief
Division of Fish and Wildlife

cc: CNMI Coastal Resources Management Office
Mr. Alan Marmelstein, USFWS Honolulu
Mr. Ernie Kosaka, USFWS Honolulu
Guam Division Aquatic and Wildlife Resources
Marianas Audubon Society, Saipan and Guam

10 - 29

COMMENT

RESPONSE

Commonwealth of the Northern Mariana Islands
Office of the Governor
Saipan, Mariana Islands 96950

FOR OFFICIAL US
CABLE ADDRESS
GOV. NMI SAIPAN
REPLY TO:

DEPT. or ACTIVITY

22 August 1989

Mr. James Chun (Code 2012)
U.S. Navy, Pacific Division
Naval Facilities Engineering Command
Pearl Harbor, HI 96860-7300

Dear Mr. Chun:

We received the Draft EIS for ROTHR program on 26 July 1989. We began reviewing it and found that it states that electromagnetic radiation should not be a problem for birds flying in the area. This is not explained other than to cite the following report: Department of the Navy, Space and Naval Warfare Systems Command, A study of Electromagnetic Environmental Effects Associated with the Relocatable Over-the Horizon Radar, March 7, 1989. We have expressed concern over this factor in previous comments and asked for additional information. We have never received any. We asked for a copy of the report from Commander Rushing on 8 August 1989 and have not yet received one. 67

Many of our concerns stem from these possible effects. To see how these have been examined we will need to have a copy of the cited report. Until such time as we see the report and are satisfied that it has answered our questions about effects of the radiation on Endangered and other bird species in the area, our concerns remain. Please send us a copy of the study so we can complete our evaluation of the EIS. The sooner we receive the report the sooner our final EIS comments can be sent to your office. I suspect they will not reach you by the 4 September 1989 date mentioned in your letter due to our not having access at this time to the previously mentioned study. Additionally, expecting us to review a detailed EIS of nearly 1000 pages in one month (we would have to mail our comments by 24 August to reach you) seems unreasonable. Comments concerning problems other than electromagnetic radiation are covered below.

Sincerely,

James D. Reichel

Dr. James D. Reichel
Wildlife Biologist 3

#67. Copies of the Study were mailed to GOVGUAM, CNMI Department of Agriculture and Mayor of Tinian. Individuals who requested review of the study were notified where the study was available. See #5.

(Enclosure to CNMI Division of Fish and Wildlife of 22 Aug 1989)

COMMENT

1. Antenna mortality. The comments on possible mortality from antenna strikes (5.1.9.1) are misleading. You state that 5 people were contacted and "None of these personnel reported incidents with bird strikes and collisions with antennas and towers." However, we also interviewed one of your listed experts, Bob Beck, and he indicated that he has never conducted systematic searches in antenna or tower sites at any location. None of the experts apparently has, as your statement "Although, detailed on-site investigations have not been conducted..." indicates; I believe that statement says it all. You have no evidence that the towers will not be significant threats to fauna in the area. On the other hand, we provided you with a long list of scientific publications documenting significant mortalities caused by tower collisions in our 29 June 1988 letter. Locations which tend to funnel migratory birds, such as small tropical islands, are especially vulnerable to high mortality. While collisions for most resident species may not be a problem, the Endangered Mariana Common Moorhen, as a rallid, is particularly susceptible (Avery et al. 1976; Cornwall and Hochbaum 1971). This is particularly true since it flies at night, probably between Tinian and Saipan, as indicated in previous comments. On Guam at least two Moorhens are known to have been killed by collisions (wires and buildings) (Paul Conry pers. comm.). Given the low numbers and endangered status of this bird, even low mortality would be unacceptable. If this project is approved, we certainly believe that a systematic study by independent observers should be done on the first site, which you say is "a stand-alone system," not connected to later tower sitings, prior to approval of any additional tower sitings. 68

1.1. What lighting will be used at night? It has been shown in Hawaii that artificial lighting attracts burrow-nesting seabirds which are leaving from, or returning to, their burrows, often many miles distant. Possibly one-half the fledglings of Newell's Shearwater suffer collisions (Harrison et al. 1984). There is a colony of Wedge-tailed Shearwaters on Naftan Rock, about 7 miles SSW of Tinian, which could be impacted. If lights are present they will also increase the chance of mortality to night-flying Endangered Common Moorhens between Tinian and Saipan (Avery et al. 1976); the proposed western and eastern sites would be preferred for this species. 69

1.2. Mitigation Measures are discussed in section 3.5.1 and elsewhere. If lights are to be used as we questioned in our section 1.1 above, "highly visible strips, tape, or flagging" could increase the probability of night-time collisions. This would be especially true if such markers were reflective, as mentioned in other sections of the DEIS.

1.3. Mitigation Measures are discussed in section 3.5.1 regarding "...retaining trees would divert birds from flying in the direction of the antenna array." The majority of trees in the area are relatively short, introduced tangantangan (4.1.8). The Navy should 70

RESPONSE

#68. The USFWS biological opinion contains measures to discourage birds from flying into antennas or cables. Daily surveys as required by the biological opinion will be made of the site to inspect for dead or injured birds. See Appendix K.

It should be noted for the record that data demonstrating moorhen flight movements which might occur between Commonwealth islands are not available.

#69. Lighting of the transmitters will be kept to the minimum required for security and safety purposes. See #53.

#70. The idea of planting a buffer of tall, fast-growing trees such as ironwoods (Casurina equisetifolia) as an additional "diverting" screen to prevent moorhen collisions with antenna towers or wires is included in the USFWS biological opinion. The U.S. Navy intends to implement this mitigation measure and has included this requirement in the contract plans.

COMMENT

plant and maintain a strip of taller-growing native forest trees for this "diverting" function. This would be actual mitigation, not just leaving alone some area not needed for the installation. Not destroying additional habitat is NOT mitigation for other destruction. | 70

2. Habitat destruction and decrease in population numbers (5.1.9.1). Again the DEIS wording was misleading. It stated "Clearing the project site would displace all resident birds." What was not stated was that, almost invariably, displaced birds will die; certainly the population will decline by the proportion of habitat that is removed (58 acres for phase 1). Loss of 58 acres will result in a decrease in the Federally Threatened Tinian Monarch population by about 130 (north site) to 177 (west site). The east site has less monarchs, due to previous habitat alteration, so the loss would equal about 68 birds. Population density figures used in our calculations are from Engbring et al. (1986). These numbers are not large, but should be considered in the light of previous Navy actions described below. | 71

2.1. Cumulative impact with leaseback of 12,500 acres (4.1.10) was not considered. Leaseback is for grazing and agricultural uses. These leasebacked lands will result in severe habitat changes. Engbring et al. 1986 found lowest Federally Threatened Tinian Monarch densities in the Masalog area; low densities here were also found in fieldwork for this DEIS (4.1.7.2). Engbring et al. (1984) attributed this to "large amounts of pasturage in this area." The leaseback will decrease Tinian Monarch populations by the difference between the densities in the leaseback (Diablo) and current pasturage area (Masalog) or about 1.9 birds/acre (due to habitat changes). This will reduce the actual population of monarchs in the world by about 23,600 birds or 60% of the world population. Certainly this cumulative impact should be considered. This population reduction may be an underestimate as more intensive agriculture and grazing come into practice, as is already happening. | 72

2.2. Bird populations. You stated in the DEIS (5.1.9.1) that "... the resident avifauna has survived the extreme changes in land use that has occurred on the island over the years." This statement was misleading in that populations of native birds were very severely depressed under the vast agricultural use during the Japanese and following WWII period (Coultas 1931, Downs 1946). It also seems likely that birds went extinct which we have no record of, such as has been shown on Hawaii. Certainly the Marianas Mallard and Island Swiftlet have become extinct historically on Tinian (DEIS 4.1.7). Other possible bird extinctions (based on current range and historic documents) might include the Golden White-eye, Nightingale Reed-Warbler, Micronesian Megapode, and Short-eared Owl. | 73

3. Electromagnetic radiation. The DEIS does not adequately | 74

RESPONSE

#71. It is recognized that clearing now increased to 69 acres from 58 acres will result in the loss of resident species. In the case of the Tinian monarchs, which number approximately 40,000 (USFWS 1984), the loss of monarchs in relation to the amount of habitat to be cleared would not negatively impact habitat requirements needed to sustain, or permit the recovery of, the species. The Section 7 final biological opinion contains a discussion on the number of individuals lost from habitat clearing. See Appendix K and Appendix L.

#72. The issue on leaseback remains open as no resolution has been achieved as to the status of CNMI's title to 3,900 acres; therefore, the leaseback by U.S. Government to CNMI has not occurred. However, uses such as agriculture and grazing have been proposed for the leaseback areas. No final decision on the issue has been made. Negotiations on this matter have been ongoing since 1983 and remain open.

#73. The Hawaiian Agronomics Inc. survey document referenced in the above comment seems to have been misinterpreted as stating that the avifauna of Tinian is immune to environmental changes resulting from land use. Extinction of species have occurred on Tinian as stated in the DEIS.

#74. Section 5.2.2 of the ROTHR E^3 Study addresses the potential effects of ROTHR electromagnetic fields on animals likely to penetrate the boundaries of the personnel exclusion fence. The Study indicated that animals smaller than a beagle-sized dog are in no danger at any point around the antenna arrays because the smaller animals have very low Specific Absorption Rates (SAR) with respect to the wavelength of ROTHR operating frequencies. The rationale given in the ROTHR E^3 Study which supports this statement is summarized in the following:

COMMENT

RESPONSE

a) Independent organizations publishing exposure standards in western Europe and the United States have concluded, through the review of scientific research on numerous animals and over a broad range of frequencies, that an organism (man, mouse, dog, and others) experiencing a SAR or "dose rate" of less than 4.0 Watts/kilogram (W/kg) does not experience an adverse effect.

b) The U.S. Air Force School of Aerospace Medicine has provided analyses which describe SAR verses wavelength for several different mammals including humans. Their work constitutes the most comprehensive analysis and experimental data available on specific absorption rates.
[Ref. 75 and Ref. 76]

c) Referencing the Air Force analysis, Table II on page 17 of the ROTHR E^3 Study shows the power level of an incident 28 MHz field which would be required to produce a SAR of 4.0 W/kg in a dog, a rabbit, and a mouse.

d) Table III on page 18 and Appendix B of the ROTHR E^3 Study shows the calculated near field power levels of a transmitted 28 MHz field around the antenna arrays.

e) Comparing the required power levels from Table II and the maximum available power levels from Table III and Appendix B clearly show that there in not sufficient power available to produce SARs greater than 4.0 W/kg in the kind of animals which are likely to access the area within the personnel exclusion fence.

An equation or matrix to describe a rise in body temperature of various species over the variables of exposure time, mass, dimension and distance from the transmitter cannot be solely used to determine adverse effect. Currently researchers have established that SAR provides the best measure upon which to correlate the occurrence of adverse effects in biological systems. All of the published standards limiting human exposure are based upon this criterion. In developing the ANSI standard, a thorough review of all the available pertinent literature revealed that no adverse effects to a large variety of species studied were recorded at SARs below 4.0 W/kg. This is the basis upon which the ROTHR E^3 Study establishes 4.0 W/kg as criteria for adverse effects to animals and by analysis has determined that species smaller than the size of a dog are in no danger from ROTHR operations.

Stating that bird species may be more sensitive than mammals to radio frequency electromagnetic fields cannot be supported given the understandings of how energy from an incident field is coupled to an organism. The argument that some seabirds have wing spans of up to two meters will not likely change the comparison of the standing body size of such birds to an equivalent mammal body size. As explained in the ROTHR E^3 Study, polarization of the body plays a significant part of the specific in the SAR of an organism. The ROTHR signal is vertically polarized (the direction of the electric field vector is perpendicular to the ground) and typically birds in flight hold their wing span near horizontal. The effective receive aperture of the bird is therefore not increased and may even decrease given the wings hollow bone structure.

COMMENT

address this important effect to bird/bat mortality. We raised this point in previous comments but have not yet been provided with the Navy report on the effects of ROTHR electromagnetic radiation. The simple statement that birds and small mammals will be in "no danger" due to their small size relative to the wave length signal does not reduce our concern, nor provide substantive answers to our original questions regarding this in our 29 June 1988 letter. Birds may be more sensitive that mammals due to their typically higher normal body temperatures and less developed heat dissipating mechanisms. We wish to have a mathematical matrix (or equation) describing body temperature rise as a function of 1) time exposed; 2) weight of organism; and 3) distance to transmitter. With that information an informed decision on effects can be made for the organisms concerned while considering their typical behavior in the area. Lary et al. (1983) found birth defects in rats caused by radio-frequency fields via thermal effects; no mention is made of this, nor is this type of effect addressed. Yet the frequency used by Lary et al. was 27.12 M-Hz, well within the range of the ROTHR transmitter at 5-32 M-Hz (2.2.1).

In section 5.1.15.2 the DEIS states that the "primary effect" of the radiation is heat. We believe that other effects not discussed may be significant and should be addressed. These are listed for humans (and pertinent literature cited) in the comments of Dr. Michael Kenney, but include such things as increased cancer hazards for people living near radio transmitting towers or high tension wires (which would have similar electromagnetic wave effects). What are the effects of these processes on wildlife living in the area? Research has shown acceleration of carcinogenic effects due to exposure to electromagnetic waves such as ROTHR (Szudzinski et al. 1982). Additionally, Sikov et al. (1987) found a significant association between chronic exposure to a strong electric field and birth defects in pigs. These types of possible effects have not been explored in the DEIS, nor have their additive effects on mortality.

Additionally, you fail to discuss what effects the transmitter would have on possible future Tinian Airport improvements and increased usage. While the transmitter will, the DEIS states, "have no adverse impact to aircraft operations" that conclusion is based on the current circumstances of the field being "not equipped with navigational aids and primarily accommodates single engine air taxi operations to and from Saipan International Airport." Will the transmitter preclude future uses including (but not limited to) installation of navigational aids, use by other types of aircraft, or other destinations (such as Guam or Rota)?

4. Brown Tree Snake introduction prevention. In various locations in the DEIS it is stated that measures such as those used in the PACBAR radar site on Saipan will be used. A minor addition to these is construction and maintenance of a snake detection device as outlined below. We are currently requiring all major projects (public and private) to follow a prevention and detection plan such as outlined in the following. The permit conditions should include

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RESPONSE

Reference to several technical papers and literature concerning biological exposure to electromagnetic fields were included in comments #74 and #102. These same documents were also referenced in the comments of Dr. Michael Kenney (see comments #244 through #249) to which a response was prepared by the Navy Bureau of Medicine and Surgery. (See Appendix I) However, specific response is appropriate here to the report of Lary et al, 1983 concerning exposure of rats to 27.12 MHz electromagnetic fields. The literature reports teratogenic and embriotoxic effects due to elevation of colonic temperature over various exposure times. The incident near field strengths during exposure were reported as 300 V/M for the electric field and 55 A/M for the magnetic field. These values of the exposure field are nearly five times greater than the maximum attainable ROTHR near field strength of 63 V/M (given in Appendix B of the ROTHR E^3 Study). Although it has not been determined whether this report is a peer reviewed document, it does provide an example of the known thermal effects which are created by exposure to very high levels of electromagnetic fields.

In summary, the electromagnetic fields created by the ROTHR transmitter system are not strong enough to cause thermal effects in species smaller than the size of a dog. Larger species which are suspectible will reasonably be protected by the personnel exclusion fence.

#75. See #244 through #249.

#76. Based on tests which have been completed, the U.S. Navy believes that the ROTHR transmitters are compatible with the Instrument Landing System (ILS) at Saipan Airport and communication systems at Saipan and Tinian airports. These studies were undertaken, as requested by the FAA, to evaluate the impact the ROTHR transmitters would have to aircraft navigational aids on Saipan and other airports. The U.S. Navy will comply with all regulations and requests from the FAA to ensure that navigational aids are not adversely impacted by the ROTHR transmitters. The FAA is responsible for maintaining safe and efficient control of air traffic in the U.S. airspace, and will make the final decision as to the compatibility of ROTHR with the navigational aids at Saipan Airport.

Aircraft carrying military ordnance suspectable to RFEM will not be permitted to land at Saipan Airport, nor will they be permitted to fly within the zones specified in Figures 5.1.7, 5.1.8, and 5.1.9 in the DEIS without prior coordination with military authorities. However, it should be noted, the U.S. military does not fly aircraft loaded with such ordnance as a rule (HERO Susceptible ordnance is usually old and in the process of being phased out). When aircraft do fly with such ordnance, it is incumbent upon the aircraft commander carrying such ordnance to be aware of the transmitters which pose a hazard to the specific munitions onboard and remain clear at all times. Moreover, since Saipan Airport is a civilian airport, there is no reason for military aircraft loaded with any ordnance to land there. If a requirement to fly HERO Susceptible ordnance, missiles, bombs, etc. into Saipan Airport ever does materialize, prior coordination will ensure that ROTHR transmitters are deactivated for the event.

COMMENT

brown tree snake prevention and control measures to prevent accidental introduction of the pest into the CNMI. Specific plans by developers must be approved in advance by the Division of Fish and Wildlife. These should include 1) The construction company discussing the problem with all workers and detailing to them the problem and what to do in case of a snake sighting; 2) placing brown tree snake alert posters in an office where workers check in or gather each day; 3) construction personnel being detailed to the dock to check all non-containerized material brought in by ship for snakes during unloading; and 4) establishment and maintenance of a snake detection device (detailed below and in Figures 1 & 2) within 50 m of stored material most likely to contain snakes, ie. lumber, pipes, and other non-container, irregularly shaped material and equipment, particularly that coming from Guam. If possible, it should also be placed adjoining the outside fence, and be as tall as, or taller than, the fence. This detection device should be a cage with live birds (chickens) at least 6X6X6 feet in size with several snake funnel traps built into the walls and ceiling. The design should be approved by CNMI-DFW and the device should be in operation and available to DFW personnel for inspection prior to construction beginning and continuing through completion of the project, including final installation of machinery and equipment. 6) Immediate notification of any snake trapping or sighting be given to DFW and the snake immediately killed, if possible, and turned over to DFW. 7) DFW personnel must be allowed to talk to construction workers and examine the poster and detection device locations at any time, to assure compliance with items listed above. 77

4.1. We believe that brown tree snake protocols should be established in the EIS, not later between the contractor and CNMI-DFW (5.1.22). We have no way to estimate the effectiveness of such procedures until they are established, hence no Environmental Impact Assessment can be made. Such procedures can then be made a part of the contract specifications, costs of which can be estimated by the contractor. 78

5. <u>Aesthetics</u>. In section 5.1.14.1 you state the towers etc. will be clearly visible to visitors to the Historic site on North Field. This seems totally at odds with the site comparison matrix (p. 3-15) which says under Aesthetics "No adverse impact to Tinian." I think most visitors to a Historic site would consider the installation to be aesthetically unpleasant.

6. In the public hearing on Saipan in August 1989 the ROTHR was described as protecting the national interest by giving longer response times for enemy missile attack and will be the primary device for early warning. The DEIS states "The proposed Navy ROTHR system is not designed to detect Intercontinental Ballistic Missiles (ICBM)." These statements seem diametrically opposed. Which is true? 79

RESPONSE

#77. The recommendations indicated will be included in the Contractor's Brown Tree Snake prevention plan which will be submitted to CNMI for review and approval before materials and equipment arrive on Tinian.

#78. A snake protection protocol, as least as stringent as the one prepared by the Black Micro Construction plan previously approved by the CNMI, will be required by the construction contractor for the ROTHR project, once selected. The prevention plan will be subject to approval by the Fish and Wildlife Service as well as Government of Guam and Commonwealth wildlife agencies. See Section 4.4.1 of the FEIS.

#79. Both of these statements are true. First, the difference between ICBMs and air launched missiles should be understood. ROTHR defends against air launched missiles primarily by detecting the launch platform, usually an aircraft. Due to the limited range of an air launched missile, and the large area of coverage of the ROTHR, most aircraft must enter the coverage area in order to attack targets within the coverage area. The Platform is thus detectable. An ICBM has a flight profile which is normally outside the ROTHR coverage area.

COMMENT

7. We also wonder why no cooperative agreement has ever been initiated by the Navy as required by various federal laws (e.g. Sikes Act) and Naval Regulations (e.g. OPNAVINST 5090.1). Our office encourages such cooperation in the future on all military installations in the CNMI.

CITATIONS

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Harrison, C.S., M.B. Naughton and S.I. Fefer. 1984. The status and conservation of seabirds in the Hawaiian archipelago and Johnson Atoll. ICBP Tech. Publ. 2:513-526.

Lary, J.M., D.L. Conover, P.H. Johnson and J.R. Burg. 1983. Teratogenicity of 27.12-MHz radiation in rats is related to duration of hyperthermic exposure. Bioelectromagnetics 4:249-255.

Sikov, M.R., D.N. Rommereim, J.L. Beamer, R.L. Bouschbom, W.T. Kaune, and R.D. Phillips. 1987. Developmental studies of Hanford miniature swine exposure to 60-Hz electric fields. Bioelectromagnetics 8:229-242.

Szudzinski, A., A. Pietraszek, M. Janiak, J. Wrembel, M. Kalczak, and S. Szmigielski. 1982. Acceleration of the development of benzopyrene-induced skin cancer in mice by microwave radiation. Arch. Dermatol. Res. 1982:274.

80

RESPONSE

#80. When the Navy establishes the ROTHR activity on Tinian, it would be an appropriate time to enter into a natural resources cooperative agreement, if deemed applicable.

COMMENT

RESPONSE

Box 66, Capitol Hill
Saipan, MP 96950
August 23, 1989

Pacific Division
Naval Facilities Engineering Command
ATTN: 09P2
Pearl Harbor, Hawaii 96960

Gentlemen:

I have the following comments and questions on the Draft Environmental Impact Statement (DEIS) for the proposed Relocatable Over the Horizon Radar transmitter proposed for Tinian Island in the Commonwealth of the Northern Mariana Islands. I will appreciate having each comment specifically addressed in writing, and each question individually answered in writing.

1. On page 5-23 of the DEIS the following statement is made.

> "Based upon the detailed analysis reported in the COMSPAWAR analysis, the ROTHR Personnel Radiation Hazard Zone has been developed. A radiation hazard exclusion fence will be constructed . . . on the perimeter of the 58-acre cleared [transmitter] area. No hazard to living organisms exists outside the limits of this zone."

Basis for this statement is given as Reference 3: "Department of the Navy, Space and Naval Warfare Systems Command. A study of Electromagnetic Environmental Effects Associated with the Relocatable Over-the-Horizon Radar. March 7, 1989".

QUESTIONS

1.1 Other than this assertion, what assurance is there that no hazard to living organisms exists outside this zone? | 81

#81. See #4.

1.2 What actions will be taken if it is discovered that ROTHR does cause hazards to organisms, e.g. people? | 82

#82. See #4.

2. The following statement is made on page 5-37 of the DEIS.

> "The ROTHR transmitter will no[t] transmit on any frequencies in the 5-28 Mhz band that are reserved for dedicated us[e] by others (e.g. Ham radio bands, search and rescue, land and sea mobile, etc.)."

COMMENT

RESPONSE

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Saipan, MP 96950
August 23, 1989

Pacific Division
Naval Facilities Engineering Command
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QUESTION

2.1 Does this include the frequencies recently assigned by Dept. of Interior and the FCC to the "Micronet" used by colleges and departments of education in Micronesia and Hawaii? [3975.5, 5331.5, 7409.5, 9169.5, 12164.5, 13430.5, and 18359.5 kHz] | 83

#83. See #6.

3. The following statement is found on page 5-37 of the DEIS.

". . . in the unlikely event that any harmonic interference is experienced, the fundamental ROTHR frequency that generates the interference can be added to the ROTHR's list of prohibited frequencies to correct the problem." [Underscoring added.]

QUESTIONS

3.1 If interference is experienced by someone using a frequency authorized to him/her, will the problem be corrected by the operators of ROTHR? | 84

#84. See #6.

3.2 What medium of communication for resolving such possible problems will be available to the affected public? | 85

#85. See #6.

4. On page 5-38 of the DEIS the following statement is found.

"Based upon the finding in the COMSPAWAR analysis, no evidence exists to indicate that the ROTHR transmitter will overload the from [front] end of any receivers anticipated to be operated in its vicinity."

QUESTIONS

4.1 If the ROTHR does interfere with receivers in its vicinity, will the operators of ROTHR correct the interference? | 86

#86. See #6.

4.2 What means of communicating any such problems to ROTHR will be available to anyone experiencing interference? | 87

#87. See #6.

5. The following statement is found on page 5-38 of the DEIS.

"These predictions [of non-interference to airport/aircraft radio communications] will be confirmed by a comprehensive RADHAZ survey to be conducted before each sector is placed in operation."

QUESTIONS

5.1 Why are other officially licensed radio services in the vicinity of Tinian not included in this survey, e.g. CNMI outer-island communications, search and rescue operations, land and sea mobile services, ham radio stations, local AM and FM radio stations, etc.?

88

#88. See #6.

5.2 Shouldn't they be?

OVERALL COMMENTS on DEIS

In my letter of 2/12/89 on this same proposed ROTHR project I expressed two principal environmental concerns: (1) potential danger to the health of people, especially those living on the island of Saipan, from electromagnetic energy emitted by the the Tinian ROTHR transmitters, and (2) possibility of severe interference to radio communications such as civil defense, HAM radio operations, etc.

The DEIS states categorically that the ROTHR transmitters on Tinian will cause no danger to people beyond the immediate fenced in transmitter area on Tinian, and will cause no interference to radio communications on Tinian or Saipan. The authority cited for these assurances is a study done by the Navy, Space and Naval Warfare Command, and referred to as "Reference 3" in the DEIS. Several other studies done by independent persons and agencies are quoted at considerable length in the DEIS. But this study, which is cited in the DEIS as the basis for assuring that people and communications in the CNMI will not suffer, is not quoted in the DEIS, and has not been otherwise made available to the public, as far as we can tell.

What makes this omission even more troubling in a major environmental impact statement is the fact that the study being cited was done by the agency which is the foremost advocate for the project, viz. the U.S. Navy. One would expect firmer assurance of objectivity in a matter of such importance.

I have read the comments on the DEIS prepared by Dr. Michael Kenney (copy enclosed), and I agree with him that the Navy should make available copies of Reference 3 for thorough review in the CNMI, and should extend the deadline for comments at least 90 days in order to allow the government and concerned citizens time to evaluate it, or to have it evaluated by qualified, independent experts if need be.

Sincerely,

L. J. Kaufer

Leonard J. Kaufer, Ph.D.

COMMENT

RESPONSE

RESPONSE TO THE DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR THE OVER-THE- HORIZON RADAR INSTALLATION PROPOSED FOR TINIAN: POTENTIAL HUMAN HEALTH IMPACTS OF THE ROTHR INSTALLATION

Michael L. Kenney, Dr. P.H., M.C.P.

Introduction

The proposed ROTHR transmitter facility for Tinian will generate non-ionizing electromagnetic radiation operating in the range of 5 to 32 mH according to the "Draft Evinronmental Impact Statement for Electronic Installations In the Western Pacific", Department of the Navy, Naval Space Command, July, 1989. Each system will produce up to 200 kW of electrical power. (Draft EIS, page 2-4). The draft EIS asserts that the primary biological effects of the "quantum energies from RF radiation" are thermal (Section 5.1.15.2, pp. 5-22 to 5-23). The draft EIS states that "such effects do not constitute a hazard." The section goes on to state that a radiation hazard exclusion fence will be constructed along the perimeter of the 58 acre site to protect personnel near the transmitters. The name of this fence implies a radiation hazard, if only thermal. No distinction is made between potential hazards to employees of the facility inside the radiation hazard fence and to persons excluded by the hazard exclusion fence.

Although there is an assertion on pages 5-22 and 5-23 that non-ionizing electromagnetic radiation (ER) poses no human health hazards, there is a body of credible scientific evidence which indicates that in addition to the stipulated thermal effects, there are potential carcinogenic, teratogenic, and perhaps mutagenic effects from ER. These risks were not identified in the draft EIS. Evidence of these potential biological effects of non-ionizing electromagnetic radiation or the uncertainty surrounding them has been presented in the literature for humans and animal models. There is even evidence that the thermal effects of non-ionizing electromagnetic radiation cause birth defects in laboratory animals.

(Enclosure to Leonard J. Kaufer letter of Aug 23, 1989)

Potential to Damage Human Health

Following other studies which raised concerns over the possible cancer causing effects of low frequency magnetic fields (50-60 Hz) for both children and adults, Savitz and colleagues [1] investigated the possible relationship between residential exposure to magnetic fields and the development of childhood cancers. This study was designed to overcome many of the identified weaknesses in six earlier studies cited by the authors. Savitz and colleagues found some statistically significant association between childhood cancer incidence and magnetic field exposure.

The findings are not conclusive evidence of a causal relationship since it was a retrospective, case-control study rather than a prospective longitudinal study. However, the results of this study were consistent with, and lent credibility to, the earlier studies cited reporting similar associations between exposure to electromagnetic radiation and human cancers. This is precisely the pattern of initial evidence which ultimately led to conclusive evidence of the carcinogenic effects of tobacco smoking and exposure to benzine and arsenic. The study indicates that the potential carcinogenic effects of human exposure to non-ionizing electromagnetic radiation must be taken seriously.

Samuel Milham, Jr., studied the mortality experience of workers exposed to electromagnetic radiation from 1950 to 1982. [2] In assessing mortality data for 486,000 deaths during the study period, Milham found increased proportionate mortality ratios for leukemia and non-Hodgkin's lymphomas in men employed in occupations with intuitive exposures to electromagnetic radiation. In addition, Milham cited studies in a summary of findings from occupational literature which indicates "that non-ionizing radiation is a human carcinogen." He went on to summarize findings indicating that non-ionizing radiation has biological effects on non-human species including teratogenic effects on developing chickens.

In a separate study investigating the potential cancer effects of electromagnetic radiation on amateur radio operators, Milham found elevated standardized mortality ratios involving lymphatic tissues including multiple-myeloma and non-Hodgkin's lymphomas as well as acute myeloid leukemia. [3] He concluded by stating: "Avocational and/or occupational exposures to electric and magnetic fields should be among the possible etiologies considered in explaining this excess mortality."

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[1] Savitz, D.A.; Wachtel, H; Barnes, F.A.; John, E.M.; and Tvrdik, J.G., "Case-Control Study of Childhood Cancer and Exposure to 60-HZ Magnetic Fields", American Journal of Epidemiology, Volume 128, No. 1, July, 1988, pp. 21-38.

[2] Milham, Jr. S., "Mortality in Workers Exposed to Electromagnetic Fields", Environmental Health Perspectives, Vol 62, pp. 297-300, 1985.

[3] Milham, Jr. Samuel, "Increased Mortality in Amateur Radio

COMMENT

Spitz and Johnson conducted a population based case-control study in Texas covering the years 1964-1978 which investigated the possibility that children with fathers employed in occupations exposing them to electromagnetic radiation were at increased risk of dying from neuroblastoma. [4] They found that, "Children of fathers employed in occupations with electromagnetic field exposure were at significantly increased risk [for neuroblastoma]."

Young and Young, surveying reports of electromagnetic radiation effects on humans in the Bulletin of Atomic Scientists state that there is a strong suggestion that long-term damage to humans occurs from exposure to "high electric fields", call for prudence in the face of the evidence, and note that the USSR has established rules of exposure of personnel to such electric fields. [5]

Brown and Chattopadhyay investigated the potential relationship between electromagnetic-field exposure and cancer. [6] The authors cite data which indicate that exposure to non-ionizing radiation is a potential carcinogen.

Animal Models

Animals (particularly mammals) are often used as models for human biology.

Szudzinski and colleagues investigated the co-effects of exposure to a chemical carcinogen and microwave irradiation in mice. [7] They found that all levels of microwave exposure of the mice painted with 3,4-benzopyrene to induce skin cancer significantly accelerated the development of skin cancer and reduced the life of the animals with tumors.

Sikov and colleagues investigated the effects of exposure to 60-Hz electric fields on Hanford miniature swine. [8] They report that while a direct cause and effect relationship cannot be unequivocally stated, there does appear to be a significant association between chronic exposure of a strong electric field and teratogenic effects in the litters of the exposed animals.

Lary and colleagues studied the potential for radiofrequency fields to cause birth defects in rats through increases in thermal effects of the radiation. [9]

Operators Due to Lymphatic and Hematopoietic Malignancies", American Journal of Epidemiology, Vol 172, No. 1, 1988.

[4] Spitz, M.R., Johnson, C.C., "Neuroblastoma and paternal occupation. A case-control analysis", American Journal of Epidemiology, June 1985, Volume 121, No. 6, pp. 924-929.

[5] Young, L.B., Young, H.P.; "Pollution by Electrical Transmission", Bulletin of Atomic Scientists, December, 1974, Volume 30, Number 10, pg. 34.

RESPONSE

Worker Exposure

The draft EIS states that there will be no human health hazards from the transmitter facility in Tinian. It does not discuss the evidence cited above which was gathered during a brief literature search in Saipan. A brief search was necessitated by the short amount of time available for comments on the Draft EIS. A more extensive literature search could be expected to produce additional evidence of the potential of the electromagnetic radiation of the proposed Tinian transmitter facility to cause cancer among all workers, and birth defects in the fetuses of pregnant workers exposed in sufficient doses. Based upon the literature search done for these comments, it is not possible to assess the possibility of mutagenic effects of the electromagnetic radiation from the Tinian transmitter.

Given the evidence presented above, one must assume some human health risk from exposure to electromagnetic radiation at this facility, and one may assume that workers inside the fenced ROTHR facility will be at greatest risk. If female workers are recruited to operate the station, fetuses of pregnant workers will be at the highest risks among those exposed on the job-site (e.g., inside the fenced hazard perimeter.) No worker should be involuntarily exposed to potentially harmful non-ionizing electromagnetic radiation. Full disclosure and informed consent must be the rule. 89

#89. See #244 through #249.

In addition, there may be risk to persons outside the fenced perimeter to an as yet undetermined distance from the transmitter. Such risk, if identified, may vary according to the direction and strength of signals. Such risk, if any, should also be disclosed. 90

#90. See #244 through #249.

Recommendations

The Draft EIS relies upon reference 3 (page 5-23) to support its assertion that there will be no adverse human health effects of the transmitter facility. Reference 3 is given as: "Department of the Navy, Space and Naval Warfare Systems Command. A study of Electromagnetic Environmental Effects Associated with the Relocatable Over-the-Horizon Radar. March 7, 1989." A copy of this reference document was not provided with the draft EIS; therefore, it is impossible for this community to assess its validity.

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[6] Brown, H.D., Chattopadhyay, S.K., "Electromagnetic-field exposure and cancer", Cancer, Biochemistry, Biophyics, Volume 9, No. 4, May, 1988, pp. 295-342.

[7] Szudzinski, A; Pietraszek, A; Janiak, M; Wrembel, J; KaLczak, M; Szmigielski, S; "Acceleration of the development of banzopyrene-induced skin cancer in mice by microwave radiation", Archives of Dermatological Research, 1982, 274 (3-4) pp. 303-12.

COMMENT

On the assumption that reference 3 did not include the studies cited here, it is recommended that before proceeding with this project the Navy undertake a more extensive study of the potential human health hazards of the electromagnetic radiation from the Tinian transmitter site on workers inside the 58 acre perimeter, and determine the maximum distances from the transmitter which could involve harmful doses of non-ionizing electromagnetic radiation. A non-biased, qualified epidemiologist should be commissioned to lead the research team.

If reference 3 did include the studies cited here, the Navy should justify exclusion of this evidence from the draft EIS. The studies presented above center on risks from low frequency ER. One issue to be discussed is the potential risk from high frequency transmitters as proposed for the ROTHR.

It would be helpful if the Navy would make available copies of reference 3 for review in the CNMI, and extend the deadline for comments until after the public has received reference 3 and has had sufficient time to evaluate it -- a minimum of 90 days from receipt of reference 3.

91

RESPONSE

#91. See #244 through #249.

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[8] Sikov, M.R.; Rommereim, D.N.; Beamer, J.L.; Buschbom, R.L.; Kaune, W.T., Phillips, R.D., "Developmental studies of Hanford miniature swine exposure to 60-Hz electric fields", Bioelectromagnetics, 1987, Volume 8, No. 3, pp. 229-42.

[9] Lary, J.M.; Conover, D.L.; Johnson, P.H., Burg, J.R., "Teratogenicity of 27.12-MHz radiation in rats is related to duration of hyperthermic exposure", Bioelectromagnetics, 1983, Volume 4, No. 3, pp. 249-55.

COMMENT

RESPONSE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
215 Fremont Street
San Francisco, Ca. 94105

06 SEP 1989

Commander, Pacific Division
Civil Engineer Corps
Naval Facilities Engineering Command
ATTN: Scott D. Hamilton, Code: 09P2
U.S. Navy
Pearl Harbor, Hawaii
96860-7300

10 - 45

Dear Mr. Hamilton:

The Environmental Protection Agency (EPA) has reviewed the Draft Environmental Impact Statement (DEIS) titled Electronic Installations in the Western Pacific. Under the National Environmental Policy Act (NEPA) and Section 309 of the Clean Air Act, EPA is required to review and comment on this DEIS. Our detailed comments on this document are enclosed.

The DEIS analyzes a project consisting of three radar units, each requiring the construction of a radio transmission station on Tinian and a receiver station on Guam. Each unit is capable of operating separately. Presently, only one has received Congressional approval. If all three projects were to be constructed, a total of roughly 520 acres would be cleared and graded on the two islands.

EPA would like to commend the Navy on its efforts to solicit public participation throughout the planning of the Relocatable Over the Horizon Radar system. Several public meetings were held and it appears that many concerns raised were addressed in the DEIS.

We have classified this DEIS as Category EC-2, Environmental Concerns - Insufficient Information (see attached "Summary of Rating Definitions and Follow-Up Action"). This DEIS is rated EC-2 because we believe that potential construction impacts and potential radiation hazards could have been treated more thoroughly. Also, the receiver planned for Guam appears to pose significant adverse impacts to endangered species.

COMMENT

RESPONSE

We appreciate the opportunity to review this DEIS. Please send four copies of the Final Environmental Impact Statement (FEIS) to this office at the same time it is officially filed with our Washington, D.C. office. If you have any questions, please call me at (415) 974-8083 (FTS 454-8083) or have your staff contact Elisabeth Micheli at (415) 974-8045 (FTS 454-8045).

Sincerely yours,

Deanna M. Wieman, Director
Office of External Affairs

Enclosure (2 pages)
cc: USFWS, Honolulu
CNMI DEQ
Guam EPA

COMMENT

RESPONSE

EPA Comments, September 1989
Electronic Installations
Guam and Tinian, U.S. Navy

The FEIS should respond to the following comments:

I. Potential Impacts Associated With Construction

A. Air Quality:
The DEIS indicates that potential impacts could result from proposed construction techniques, but does not specify how these will be mitigated. For example, it is stated that clearing and grading operations would create dust if conducted between December and June (p. 5-53). However, the document does not commit to either avoiding the dry season or mitigating the creation of fugitive dust through spraying the construction area with water. Prescribed burning of cleared vegetation should also be closely monitored. 92

#92. The DEIS has been modified to include mitigating measures for dust and burning during the construction. See Section 4.1.5 of the FEIS.

B. Water Quality:
The document asserts that most alternative construction sites are on soils that are considered well-drained with only a slight hazard of erosion, sedimentation, runoff or siltation. The Navy plans to establish erosion control measures with the construction contractor. The FEIS should summarize the erosion control plan and provide a description of means to ensure that control measures are enacted and efficient at preventing erosion. These measures would be important to enforce at the Guam Dan Dan site, as soil erosion there would potentially impact stream aquatic resources. 93

#93. The erosion control measures required of the project include management of borrow pit areas, protection of erodible soils, and temporary protection of erodible soils to include mechanical retardation/ control of runoff, establishing sediment basins and vegetation/ mulching/seeding of exposed slopes. These requirements are established in the project design and specifications which require the contractor to submit an erosion and sediment control plan prior to construction for review and approval. The erosion control measures are enforced by the Navy through review of the project design and review of the contractor's erosion control plan and verification of its implementation by on-site inspection during the construction stage.

C. Endangered Species:
The DEIS indicates that should all three units be approved a total of 525 acres of habitat would be subject to clearing. We understand that a large percentage this area comprises habitat for endangered species. We support the Navy's continued coordination with the U.S. Fish and Wildlife Service in order to avoid impacts to endangered species.

II. Potential Impacts Associated with Operation

A. Air Quality
Based on the DEIS it appears that should all three units be proposed for construction the transmitter power plants would be subject to Prevention of Significant Deterioration (PSD) standards pursuant to the Clean Air Act. If so, a PSD permit would be required from EPA, in addition to any permits required by local regulatory authorities. 94

#94. Comment noted. The DEIS in Section 5.1.5 stated this requirement.

COMMENT

EPA Comments, September 1989
Electronic Installations
Guam and Tinian, U.S. Navy

B. Radiation Hazard

The DEIS describes electromagnetic radiation (EMR) effects from radar and communications equipment as hazardous only when power levels and frequencies are capable of producing cellular heating (Section 5.1.15, pgs. 5-22, 5-23). Accordingly, a fence would be built to exclude personnel from entering the zone where intensities could produce body heating.

EPA believes that this standard for EMR risk is being drawn into question by new information. A growing body of literature indicates that significant biological effects and health hazards can be caused by EMR at levels below that necessary to cause cellular heating. A recent report by the Congressional Office of Technology Assessment (Biological Effects of Power Frequency Electri & Magnetic Fields - Background Paper, May, 1989) states that:

> ...the growing number of positive findings have now clearly demonstrated that under specific circumstances even weak low-frequency electromagnetic feilds can produce substantial changes at the cellular level, and in a few experimental settings, effects have also been demonstrated at the level of the whole animal. Epidemiological evidence, while controversial and subject to a variety of criticisms, is beginning to provide a basis for concern about risks from chronic exposure....In our view, the emerging evidence no longer allows one to categorically assert that there are no risks. But it does not provide a basis for asserting that there is a significant risk.

We believe that based on a current understanding of the effects of EMR the risks to health may extend beyond those which produce body heating. Therefore, the FEIS should remove the implication that body heating effects are the only potential health effects associated with EMR. For purposes of public disclosure the FEIS should explain that exposure to EMR at levels below those capable of creating body heating may constitute a health risk, but that field conditions associated with this risk are not clear and are not yet applicable to the creation of standards. | 95

C. Hazardous Wastes

The FEIS should briefly describe normal Navy procedures for disposal of hazardous wastes generated during the construction and operation of the proposed electronic installation. | 96

RESPONSE

#95. Based on scientific evidence which forms a basis for the current understanding of the effects of ROTHR frequency EMR and particularly non-pulsed frequency modulated continuous wave (FMCW), there is no credible information to support a belief that adverse affects to human health exist beyond those created by thermal absorption of energy. It was for the purpose of public disclosure that the DEIS and the ROTHR E^3 Study presented criteria which will preclude personnel from exposure to the known thermal effects of RFEMR. Beyond this there is no evidence to suggest or even imply that non-thermal effects may constitute a health risk. There is however evidence to suggest that exposure to ROTHR frequency, non-pulsed, FMCW EMR below the levels recommended by ANSI C95.1 is not likely to be hazardous to human health. This position is also expressed in a response prepared by the Navy Bureau of Medicine and Surgery. (See Appendix I)

#96. During construction, the contractor will comply with all federal, territorial, and local laws and regulations on hazardous waste management and disposal. See FEIS 4.1.6.

Any hazardous wastes generated in operations will be properly packaged, marked, and labeled for shipment to the Defense Reutilization and Marketing Office, Guam, for disposal by contract. The Navy Public Works Center in Guam will assist generators with packaging, laboratory analyses, and disposal to comply with applicable regulations.

COMMENT

RESPONSE

SUMMARY OF RATING DEFINITIONS AND FOLLOW-UP ACTION*

Environmental Impact of the Action

LO—Lack of Objections
The EPA review has not identified any potential environmental impacts requiring substantive changes to the proposal. The review may have disclosed opportunities for application of mitigation measures that could be accomplished with no more than minor changes to the proposal.

EC—Environmental Concerns
The EPA review has identified environmental impacts that should be avoided in order to fully protect the environment. Corrective measures may require changes to the preferred alternative or application of mitigation measures that can reduce the environmental impact. EPA would like to work with the lead agency to reduce these impacts.

EO—Environmental Objections
The EPA review has identified significant environmental impacts that must be avoided in order to provide adequate protection for the environment. Corrective measures may require substantial changes to the preferred alternative or consideration of some other project alternative (including the no action alternative or a new alternative). EPA intends to work with the lead agency to reduce these impacts.

EU—Environmentally Unsatisfactory
The EPA review has identified adverse environmental impacts that are of sufficient magnitude that they are unsatisfactory from the standpoint of environmental quality, public health or welfare. EPA intends to work with the lead agency to reduce these impacts. If the potential unsatisfactory impacts are not corrected at the final EIS stage, this proposal will be recommended for referral to the Council on Environmental Quality (CEQ).

10

Adequacy of the Impact Statement

49 Category 1—Adequate
EPA believes the draft EIS adequately sets forth the environmental impact(s) of the preferred alternative and those of the alternatives reasonably available to the project or action. No further analysis or data collection is necessary, but the reviewer may suggest the addition of clarifying language or information.

Category 2—Insufficient Information

The draft EIS does not contain sufficient information for EPA to fully assess environmental impacts that should be avoided in order to fully protect the environment, or the EPA reviewer has identified new reasonably available alternatives that are within the spectrum of alternatives analyzed in the draft EIS, which could reduce the environmental impacts of the action. The identified additional information, data, analyses, or discussion should be included in the final EIS.

Category 3—Inadequate
EPA does not believe that the draft EIS adequately assesses potentially significant environmental impacts of the action, or the EPA reviewer has identified new, reasonably available alternatives that are outside of the spectrum of alternatives analyzed in the draft EIS, which should be analyzed in order to reduce the potentially significant environmental impacts. EPA believes that the identified additional information, data, analyses, or discussions are of such a magnitude that they should have full public review at a draft stage. EPA does not believe that the draft EIS is adequate for the purposes of the NEPA and/or Section 309 review, and thus should be formally revised and made available for public comment in a supplemental or revised draft EIS. On the basis of the potential significant impacts involved, this proposal could be a candidate for referral to the CEQ.

*From: EPA Manual 1640, "Policy and Procedures for the Review of Federal Actions Impacting the Environment."

COMMENT

RESPONSE

O'MELVENY & MYERS

SUITE 1700

610 NEWPORT CENTER DRIVE

NEWPORT BEACH, CALIFORNIA 92660-6429

(714) 669-6911

September
5th
1 9 8 9

194,593-1

Pacific Division
Naval Facilities Engineering Command
PACNAVFACENGCOM
Pearl Harbor, Hawaii 96860

Attention: Code 09P2

Re: ROTHR Facilities - Guam

Gentlemen:

We are counsel to Guam Urunao Resort Corporation ("GURC") in connection with its development of Urunao Beach on Guam. In that capacity, and as special counsel to the Artero Family Income Trust, we appeared at the public hearings held on Guam for the purpose of commenting on the draft Environmental Impact Statement for the proposed ROTHR facilities at Anderson Air Force Base on Guam.

The Artero Family Trust, and other members of the Artero family, are the owners of Urunao Beach, which consists of over 400 acres located along the beach below an approximately 300 foot cliff, the cliff face itself, and approximately 20 acres above the cliff line, all adjacent to the site of one of the proposed ROTHR receiving facilities. GURC is under contract with the Artero Family Trust to develop the Urunao Beach property as a fully integrated resort complex containing several hotels, condominiums and related resort facilities.

The preliminary plan for development of Urunao Beach by GURC has been disclosed to and discussed with senior officials of the Naval Facilities Command (NAVFAC) in Guam, Hawaii and Washington, D.C., as well as with officials of the

10 - 50

Department of Defense and the U.S. Fish and Wildlife Department. The site has been zoned for the resort development by the Guam legislature for over two years, and the necessity of an access easement across the military base to Urunao Beach has been discussed with appropriate military authorities, U.S. Fish and Wildlife and the Government of Guam. A formal request for location and grant of the necessary access easement has been submitted to the designated Department of Defense representative.

We contend that the draft EIS fails to adequately acknowledge and address the impact of the siting of the ROTHR facilities on the development of Urunao Beach, including the location of access to the property. 97

#97. See #21 and #22.

The radio frequency interference (RFI) clear zones for Projects 223 and 225 indicate a need for a one mile zone from the boundary of the ROTHR facility below an elevation of fifteen degrees which must be clear of structures and vehicle traffic. This clear zone may preclude or limit development of a significant portion of the Artero family property above the cliff line, and may impact access along existing Route 3 adjacent to the proposed ROTHR facilities. The extent of the possible impact, and available mitigation measures, are not adequately addressed in the draft EIS, which simply acknowledges that such interference <u>may</u> exist and that acquisition of easements from private property owners <u>may</u> be necessary. The National Environmental Protection Act requires that you address the full scope of the potential interference with development of adjacent privately owned property, and that you discuss all reasonable mitigation measures which might ameliorate or eliminate such detrimental effects. 98

#98. See # 21 and #22.

Development of Urunao Beach may result in public access to the site along existing Route 3 from Potts Junction to Ritidian Point adjacent to the proposed ROTHR facilities. The draft EIS does not adequately address potential electromagnetic interference (EMI) or other impacts from traffic along the roadway, nor does it address reasonable mitigation measures to avoid such interference (such as berming or other screening devices). The issue is vaguely identified in the draft EIS, but there is no discussion of the volume and nature of traffic which may result in unacceptable EMI or the precise nature of shielding, berming or other mitigation measures which will be sufficient at specified traffic volumes to insure that the proposed ROTHR facilities will not impede development of Urunao Beach. 99

#99. See #21 and #22.

COMMENT

RESPONSE

Although it appears from the draft EIS that no development below the cliff line on Urunao Beach will affect or be affected by the proposed ROTHR facilities, this is not expressly acknowledged in the draft EIS. The EIS notes only that most residential and resort type land uses on Urunao Beach would not affect or be affected by the ROTHR facilities provided buildings do not extend above the cliff line. We contend that the EIS should address what types of development at Urunao Beach, if any, will adversely affect the operation of the proposed ROTHR facilities. Since the proposed development of Urunao Beach has been identified with considerable specificity to appropriate military and other governmental authorities, it is incumbent on you to address whether customary hotel, resort and residential development below the cliff line will produce RFI or EMI inconsistent with the operation of the ROTHR facilities, and whether customary satellite, microwave or cable television and communication facilities will adversely affect the ROTHR operations. 100

#100. See #21 and #22.

The precise location of the proposed ROTHR facilities are not specified and several alternative locations are identified. However, there is no comparison of the adverse impacts on, and reasonable mitigation measures available in connection with, development of Urunao Beach which will result from the selection of the final sites for location of the ROTHR facilities, including the Harmon Annex site at Tanguisson. We suggest that the economic interest of the Government and people of Guam derived from development of Urunao Beach has not been recognized in the draft EIS in the locating of the ROTHR facilities at Northwest Field when other alternative locations are available which may not have such a severe impact on development of privately owned property. We believe the EIS should address the balancing of the military objectives in the selection of the final site for the ROTHR facilities with the interests of the Government and people of Guam in the development of Urunao Beach. 101

#101. The purpose and need for the military objectives of the ROTHR project are set forth in Section 1.0. The EIS process is to provide decision makers with environmental, social and economic information about the project. Balancing the military objectives and the environmental, social and economic effects of the project are done by the decision makers in their final decision on how to proceed with the project. See #22.

In summary, we contend that the draft EIS has largely ignored a well defined plan for development of Urunao Beach which is supported by the Government of Guam, and which is known to military authorities in sufficient detail to require that the potential adverse impacts on that development be addressed in the EIS, including the identification of reasonable mitigation measures available to insure the compatibility of the location and operation of the proposed ROTHR facilities with the development of Urunao Beach. The

emphasis in the draft EIS is on military needs and objectives, and not at all on compatibility with the legitimate rights and objectives of others adversely affected by the proposed location and operation of the ROTHR facilities.

GURC believes that the development of Urunao Beach may be consistent with the construction and operation of the proposed ROTHR facilities, but we require the cooperation and assistance of the Navy in the identification of possible incompatibilities and mitigation measures which will insure that the U.S. military mission and the development of privately owned property can proceed in harmony.

Very truly yours,

LOWELL C. MARTINDALE, JR.

cc: Whitney Rich

COMMENT

RESPONSE

Commonwealth of the Northern Mariana Islands
Office of the Governor
Saipan, Mariana Islands 96950

FOR OFFICIAL USE
CABLE ADDRESS
GOV. NMI SAIPAN
REPLY TO:

DEPT. or ACTIVITY

6 September 1989

Mr. James Chun (Code 2012)
U.S. Navy, Pacific Division
Naval Facilities Engineering Command
Pearl Harbor, HI 96860-7300

Dear Mr Chun:

On 26 August 1989 we received pp.9-19 of Department of the Navy, Space and Naval Warfare Systems Command, A study of Electromagnetic Environmental Effects Associated with the Relocatable Over-the Horizon Radar, March 7, 1989. Enclosed are our comments on the Draft EIS for the ROTHR project regarding electromagnetic effects regarding wildlife; other comments (including some of these) were sent in our letter of 22 August 1989.

Sincerely,

Jim Reichel

Dr. James D. Reichel
Wildlife Biologist 3

COMMENT

RESPONSE

Electromagnetic radiation. The DEIS does not adequately address this potentially important effect to bird mortality. The referenced study (Department of the Navy, Space and Naval Warfare Systems Command, A study of Electromagnetic Environmental Effects Associated with the Relocatable Over-the Horizon Radar, March 7, 1989) stating no significant effects due to wildlife species small body size relative to the wave length signal does not reduce our concern, nor provide substantive answers to our original questions regarding this in our 29 June 1988 letter. Some seabirds in the area covered by the radar (2000+ feet out from the array) have wingspans of over 2 meters, which would be 1/4 wavelength and thus in the critical size. This may be aggravated by lighting in the site causing birds to circle for extended times in the area at night. Birds may be more sensitive that mammals due to their typically higher normal body temperatures and less developed heat dissipating mechanisms. We wish to have a mathematical matrix (or equation) describing both bird and mammal body temperature rise as a function of 1) time exposed; 2) length of organism; 3) length of the organism; 4) orientation relative to the array; and 5) distance to transmitter. With that information an informed decision on direct thermal effects can be made for the organisms concerned while considering their typical behavior in the area.

102

#102. See #74.

Lary et al. (1983) found birth defects in rats caused by radio-frequency fields via thermal effects; no mention is made of this, nor is this type of effect addressed. Yet the frequency used by Lary et al. was 27.12 M-Hz, well within the range of the ROTHR transmitter at 5-32 M-Hz (2.2.1).

In section 5.1.15.2 the DEIS states that the "primary effect" of the radiation is heat. We believe that other effects not discussed may be significant and should be addressed. These are listed for humans (and pertinent literature cited) in the comments of Dr. Michael Kenney, but include such things as increased cancer hazards for people living near radio transmitting towers or high tension wires (which would have similar electromagnetic wave effects). What are the effects of these processes on wildlife living in the area? Research has shown acceleration of carcinogenic effects due to exposure to electromagnetic waves such as ROTHR (Szudzinski et al. (1982). Additionally, Sikov et al. (1987) found a significant association between chronic exposure to a strong electric field and birth defects in pigs. These types of possible effects have not been explored in the DEIS, nor have their additive effects on mortality.

103

#103. See #74 and #244 through #249.

COMMENT

RESPONSE

CITATIONS

Lary, J.M., D.L. Conover, P.H. Johnson and J.R. Burg. 1983. Teratogenicity of 27.12-MHz radiation in rats is related to duration of hyperthermic exposure. Bioelectromagnetics 4:249-255.

Sikov, M.R., D.N. Rommereim, J.L. Beamer, R.L. Bouschbom, W.T. Kaune, and R.D. Phillips. 1987. Developmental studies of Hanford miniature swine exposure to 60-Hz electric fields. Bioelectromagnetics 8:229-242.

Szudzinski, A., A. Pietraszek, M. Janiak, J. Wrembel, M. Kalczak, and S. Szmigielski. 1982. Acceleration of the development of benzopyrene-induced skin cancer in mice by microwave radiation. Arch. Dermatol. Res. 1982:274.

COMMENT

RESPONSE

ANTONIO S. QUITUGUA
DIRECTOR

Director's Office 734-3942/43
Aquatic & Wildlife Resources 734-3944/45
Agricultural Development Services 734-3946/47
Forestry & Soil Resources 734-3948
Animal & Plant Industry 734-3940/49

AGANA, GUAM 96910

September 6, 1989

James Chun (Code 2012)
Pacific Division
Naval Facilities Engineering Command
(PACNAVFACENGCOM)
Pearl Harbor, Hawaii 96860-7300

Dear Mr. Chun:

Thank you for the opportunity to review the Draft Environmental Impact Statement (DEIS) for Electronic Installations in the Western Pacific on Guam, Mariana Islands.

10 - 57

I would like to preface these comments with an assurance that we do not necessarily oppose this project being built on Guam. However, we oppose siting the project in areas currently supporting populations of endangered species when there are alternative sites elsewhere that do not have endangered species concerns.

We believe that siting the various segments of the project at the four northern sites identified in the DEIS will jeopardize the continued existence in the wild of the federally listed endangered Micronesian Kingfisher, *Halcyon c. cinnamomina*, Guam Flycatcher, *Myiagra freycineti*, and the Guam population of the Mariana Crow, *Corvus kubaryi*. All three of these species have major surviving portions, if not all survivors, of their populations in the immediate vicinity of the proposed northern sites for the P-223 and P-225 receivers. Further, these sites are important areas for foraging and occasional roosting of the federally listed endangered Mariana fruit bat, *Pteropus m. mariannus*. The large, land intensive receivers proposed for the northern sites will destroy habitat needed for the recovery of these species plus the recovery of other native forest bird species such as the Guam Rail (*Rallus owstoni*), Mariana Fruit Dove (*Ptilinopus roseicapilla*), Micronesian Honeyeater (*Myzomela cardinalis saffordi*), and White-throated Ground-Dove (*Gallicolumba x. xanthonura*).

In addition, we oppose siting the ROTHR project in areas that will entail destruction of habitat being considered for designation as "Critical Habitat" [a description of areas under consideration is contained in a U.S. Fish & Wildlife Service (USFWS) briefing paper dated June 19, 1989 provided to GOVGUAM and COMNAVMAR]. The fact that this area is under consideration for designation as Critical Habitat by the USFWS is only mentioned in passing in the DEIS, while it frequently states that there is no Critical Habitat within the proposed project sites. We think that the Navy should evaluate the effects on this habitat as though it were Critical Habitat until a final determination is made. It is our understanding that if Critical Habitat is designated at any stage of construction of a project, the Critical Habitat in question will immediately receive the full protection of the Endangered Species

COMMENT

RESPONSE

Act, which could result in the complete cessation of the project if it is found to destroy or adversely modify Critical Habitat. We therefore, believe that it is in the Navy's best interest to find alternative sites for their project outside of habitat now proposed as Critical for Guam's native birds and fruit bats.

Many of the comments we make concerning the DEIS are similar in nature to those we made when we reviewed the Navy's Draft Environmental Assessment (DEA) for this same ROTHR project in September, 1987. We request that the Navy review these comments again and incorporate those suggestions. As was stated in our 1987 review, the present DEIS severely underestimates the negative environmental impacts to endangered species that this project will have if not sited properly. To date we have seen little evidence that the Navy is seriously considering the effects of this project on endangered species in its actual decision making process in selecting sites. We are left to conclude that the entire EA and EIS process thus far has been a thinly veiled attempt to justify decisions already made at high levels without environmental impact considerations. We draw this conclusion based on the fact that nowhere in the evaluation process have environmental considerations outweighed any other considerations. In fact, as is illustrated in Section 2.4, any other consideration seems to outweigh endangered species concerns when considering alternative sites. Many, if not all, of these considerations are not impossible to overcome. Extinction of an endangered species, however, is irreversible. 104

#104. See #101.

While the Navy has expanded its analysis of alternative sites, particularly as to sites found on islands other than Guam, we continue to believe that the analysis of preferred and alternative sites is superficial and incomplete. In particular, a number of alternatives that we consider viable and suggested for inclusion in the scoping hearing and via correspondence are not addressed or are dismissed on flimsy pretext. For example, an alternative not adequately addressed is placing some or all of the transmitters on Guam, an alternative that would require less land. 105

#105. See #34.

The document does not address other issues of concern to this Department and the public. We believe siting the ROTHR facilities in the existing hunting areas on Northwest Field and NAVCAMS will result in the closing down of virtually all gun hunting there. These recreational hunting programs are the most popular on the island and their cessation will significantly reduce the amount of hunting now available on the island. We do not think the quality and quantity of hunting now being provided can be duplicated elsewhere. Loss of this recreational resource will be irreplaceable. The document makes no mention of mitigating this loss. Likewise, the impact of the project on private property and planned development in the area has not been adequately addressed. 106

#106. Gun hunting will be allowed in Northwest Field with restrictions in the receiver area.

Finally we believe that all three sites (P-223, P-225, and P-002) must, according to the National Environmental Policy Act of 1969 (NEPA), as amended, and the Endangered Species Act of 1973, as amended, be considered together in order to evaluate cumulative effects. A reading of NEPA makes it clear that these sites cannot be considered as separate and independent projects for the purposes of environmental impact assessment because P-225 and P-002 are "reasonably foreseeable" developments that will follow P-223. 107

#107. See #44.

It is clear that the environmental review process for this project will require a great deal of additional work. A detailed analysis of the DEIS that discusses the specific deficiencies of the document is enclosed. We request that the present document be rewritten, incorporating impacts of all three sites into one document and include an adequate consideration and

selection of alternative sites that will not destroy forever irreplaceable parts of Guam's wildlife heritage. The people of Guam deserve the wise use of natural resources and expect nothing less.

Sincerely,.

ANTONIO S. QUITUGUA
Director of Agriculture

Enclosure

cc: COMNAVMAR, Guam
Base Commander, AAFB, Guam
CONAVCAMS, Guam
HQSAC, Omaha
COMPACAF, Honolulu
NAVFACENGCOM, Washington
USFWS, Honolulu
USEPA, San Francisco
Gov. Guam:
Attorney General
Bureau of Planning
Parks and Recreation
Guam EPA
Fish and Wildlife, CNMI

COMMENT

RESPONSE

Comments
on
Draft Environmental Impact Statement (DEIS)
for
Electronics Installations
in the
Western Pacific

Below are the comments of the Department of Agriculture, Government of Guam pertaining to the DEIS for the Relocatable Over the Horizon Radar Project (ROTHR) issued on July 12, 1989.

COMMENTS PERTAINING TO THE EIS IN GENERAL

1. We continue to believe that all three receiver-antenna segments should be considered together as a single project in a single Environmental Impact Statement in order to evaluate cumulative effects of the entire project as required by National Environmental Policy Act (NEPA) and Endangered Species Act (ESA). By considering the impacts of only the P-223 site alone, the DEIS is significantly flawed and must be redone. We reject the Navy's arguments that each project is separate under the meaning of NEPA. NEPA in Section 1508.7 defines "Cumulative impact" as "the impact on the environment which results from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other action. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time." Further, Section 1508.8 states that "Effects" includes: ...(b) Indirect effects, which are caused by the action and are later in time or farther removed in distance but are still reasonably foreseeable".

108

#108. See #44.

Further, one only has to look at Figure 1.1, the Pacific Region ROTHR Coverage Map, to understand the mission interrelatedness of the three sites. The Navy's own analysis of why no other sites but Guam are feasible for locating the three receiver antennas supports the view that they must build three sites on Guam. Constructing the radar by increments does not change this "connectiveness" of the project segments and the need for a cumulative impact analysis. The fact that all three segments are included in one "programmatic DEIS" is further support for this position.

109

2. As in the DEA, the consideration of alternative sites is clearly inadequate. While the Navy has expanded its consideration of alternatives, particularly as regards the selection of Guam as opposed to other islands, they have not adequately evaluated reasonable alternative sites on Guam. In our letter of September 8, 1987 and in other correspondence with the Navy since then up to the present, we have continued to suggest additional alternative sites, many of which were not included in this DEIS. We believe that more serious consideration should be given to placing transmitters on Guam as they would destroy considerably less land area. Other alternatives addressed have only been given a cursory examination, if any. This is clearly inadequate. The discussion of the alternatives should contain a disclosure of the environmental impacts expected from each so that the decision-maker can make an environmentally informed decision. In addition, mitigation measures must be suggested for all alternatives. We continue to believe that a thorough review of all possible alternative sites will find a site with less impact on endangered

#109. See #34.

species that is acceptable to the Navy. Attachment 1 details specific alternatives that should be considered.

3. On numerous occasions in the DEIS, reference is made to the August 27, 1984 listing of Guam's endangered species which indicated that at the time of designation, Critical Habitat was "not considered prudent". The fact that recently on February 27, 1989, the Director of the U.S. Fish and Wildlife Service (USFWS) in a letter to the Governor of Guam stated that the USFWS will now designate Critical Habitat for the area and has in fact now proposed areas including Northwest Field (NWF) and NAVCAMS for such designation is only briefly mentioned and discussed on pp 4-25 and 4-26. Failure to mention this elsewhere is misleading. The final EIS should openly and frankly discuss the Critical Habitat proposal and the ramifications that such a designation has for the project. Because, several of the Navy's proposed project sites are in areas being considered for Criticial Habitat, we believe that the DEIS should treat these areas as though they are Critical Habitat until a final determination is made. This means that no resources should be irretrievably committed or habitat destroyed. We recommend avoiding areas under consideration for Critical Habitat or delaying the final EIS until the Critical Habitat issue has been decided because this will have a major effect on any analysis of impacts to the habitat. Should the project be started and then Critical Habitat be designated, Section 7 Consultation would be required before work could proceed. 110

#110. The Navy is aware of its obligation, as directed by Section 7 of the Endangered Species Act, to confer with the U.S. Fish and Wildlife Service if and when a proposal for designation critical habitat is published. See #39, #60, #64, and Appendix K.

4. The DEIS fails to include significant amounts of biological data collected on the northern sites by the Division of Aquatic & Wildlife Resources (DAWR) and the USFWS. By reporting only on the findings of the Navy's own consultants or biologists, whose studies were limited to short surveys of one-half to ten days, the Navy fails to report on the true significance of this area, a matter that can best be ascertained after considerably longer surveys, such as those already done by the DAWR. The DAWR is a public agency and our data on this project is available for examination and use by the Navy at any time. In addition, much data collected for the DEA seems to have not been used in this DEIS. 111

#111. Recent and up-to-date biological information regarding species status on the proposed project sites has been openly solicited by both the U.S. Navy and the U.S. Fish and Wildlife Service (USFWS). Numerous surveys have been conducted by Navy biologists and consultants in order to provide up-to-date biological information. These surveys were intensive and often covered 100% of the areas proposed as potential project sites. USFWS has not indicated they require any additional biological data from the Navy to aid them in the formulation of their Section 7 biological opinion covering this action.

The Navy has no knowledge of recent comprehensive surveys already completed by the Guam Division of Aquatic and Wildlife Resources (DAWR). If not already done, the resulting documentation of any recently completed DAWR surveys should be provided to the USFWS for their consideration in evaluating the potential environmental effects of the proposed ROTHR action on Guam's endangered species.

5. The DEIS grossly understates the effects on endangered species at the proposed Northern Sites. It does this by not stating that the proposed Northern Sites will destroy habitat for as much as 10-20% of the remaining Mariana Crows still found on Guam. In addition how much surrounding habitat will be rendered unusable during construction and after by increased activities in the area is left undetermined. No mention is made that the majority of recent Micronesian Kingfisher observations occurred on proposed NWF project sites. Further, the DEIS attempts to show that the endangered species habitat to be destroyed by the project is a very small percentage of the remaining forest habitat left on the entire island of Guam. However, the endangered species, by already "voting" on their habitat preference by their presence almost exclusively on NWF, have indicated that these sites are the only habitat on Guam suitable for them at present. We would consider any action such as construction of the Navy's proposed project that forces these species out of this habitat where they still survive to be illegal take as defined under the ESA and supported by recent court interpretations in Hawaii. 112

#112. See #32 and #63. The receivers, once in place, will operate as passive systems and there are no "increased activities" planned for the sites.

6. The Bird and Mammal Survey (Guam) understates the value of the specific project sites to Guam's endangered species. In addition, the fruit bat surveys are inadequate to detect such a rare nocturnal species. 113

#113. Navy supported bird and mammal surveys were conducted in order to provide up-to-date biological information for use in the DEIS and Section 7 consultation with the U.S. Fish and Wildlife Service. They were conducted in order to collect objective biological information for incorporation into the DEIS and not to draw conclusions regarding habitat values as stand alone reports. Fruit bat surveys conducted by the Navy were carried out at dawn, dusk, and as early as 0430 hours and as late as 2300 hours on some occasions.

7. The document does not address some additional issues of concern to this Department and the public. We believe siting the ROTHR facilities in the existing hunting areas on Northwest Field and NAVCAMS will result in the closing down of virtually all gun hunting there. The recreational hunting programs there are the most popular on the island and their cessation will significantly reduce the amount of hunting now available on the 114

#114. See #106.

COMMENT

island. We do not think the quality and quantity of hunting now being provided at Northwest Field can be duplicated elsewhere. Loss of this recreational resource will be irreplaceable. The document makes no mention of mitigating this loss. Also, the DEIS does not adequately address impacts on adjacent private property and private development now planned.

COMMENTS RELATING TO SPECIFIC SECTIONS OF THE DEIS. The bold lettering indicates the section of the DEIS that the comments refer to.

8. §1.0 Purpose and Need for the Project. We believe that all three radar segments should be considered as one for the purposes of evaluating cumulative effects as required by NEPA and the ESA. Our position is substantiated by the DEIS itself in this section. The explanation of the purpose and need for the project clearly illustrates the connection between the 3 segments of the project. For example, Paragraph 1 indicates that "no other location in the western Pacific provides this extensive coverage position." Therefore no other locations will be acceptable to provide the coverage desired by the military. Figure 1.1 illustrates the "interrelated" and "interconnected" coverage anticipated by the radar. NEPA in Section 1508.7 defines "Cumulative impact" as "the impact on the environment which results from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other action. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time." Further, Section 1508.8 states that "Effects" includes: ...(b) Indirect effects, which are caused by the action and are later in time or farther removed in distance but are still reasonably foreseeable".

9. §2.1 Program Description. The general description of the project makes it clear that the overall objective is to provide 180 degree coverage of the Western Pacific from the Soviet Union to Vietnam which requires three radar units. This reinforces our position that all three segments should be considered together in order to evaluate the cumulative impacts as required by NEPA and ESA.

Receiver Description

10. §2.3.3 Receiver Construction. The Navy is now claiming that each project site will require 172 acres instead of 200 acres as stated in the DEA. Further they now state that they will not need to clear areas in front of the antennas that might interfere with reception. The DEIS states that "from computer evaluations that an acceptable level of performance can be achieved without the clearing of trees". We earlier estimated in our comments on the DEA that up to 600 acres will be destroyed by such clearing. What is to keep the Navy from deciding after the receivers are constructed that performance is not in fact up to "predicted" specification and thereby cause the cutting of this additional vegetation? We are concerned that the new estimates of the amount of vegetation that will be cleared may be a "paper exercise" designed to "get the foot in the door".

11. §2.3.4 Receiver Operational Data. According to the DEIS, 216 military personnel will be required to run the three RCVR's on Guam. Nowhere in the EIS is an analysis made of the effects of the mere presence and increased vehicular traffic of so many additional personnel in NWF on a daily basis on the endangered species. The USFWS final draft Recovery Plan for the native forest birds indicates that the Mariana Crow is not found in areas of human habitation. The presence of such a high level of human activity is likely to drive the crows away from the area into locations where crows are not now found that presumably have a higher level of predation by the brown tree snake. This we would construe as illegal take under the ESA.

RESPONSE

#115. The Navy also desires to minimize the clearing of vegetation. Computer evaluations were undertaken to determine the minimum amount of clearing that would be operationally acceptable. By allowing trees and vegetation to remain in front of the receiver array, outside of the cleared 172-acre area, performance of the ROTHR will be degraded. However, this degradation will be within acceptable limits. As stated in the DEIS, there will be adherence to the 172-acre cleared area. To initiate any changes to this plan, the Navy would again have to comply with NEPA and U.S. Fish and Wildlife Service requirements. The time and effort involved in such an uncertain endeavor would likely jeopardize the success of the entire project. The present commitment would not be made if the Navy did not have a high level of confidence in the completed studies.

#116. Clarification of the personnel number and their work station may reduce concern of human activity to crows in the area. The 216 personnel represents the military staff for three ROTHR detachments or ROTHR projects. Additionally there will be 73 civilians with the receiver and control center operations, a total of 289 persons. Each receiver site will be manned by about 4 civilian personnel during the day shift and about 2 civilian personnel for the evening and night shifts. During the day, maintenance personnel will occasionally visit the antenna site to perform equipment, grounds and building work.

The labor intensive tasks are performed at the Operations Control Center (OCC) which is proposed to be located on existing developed and cleared areas in the vicinity of NAVCAMS WESTPAC communications receiver building located about 3.0 miles from the sites in Northwest Field. The crew at the OCC will consist of the 216 military personnel and about 26 civilians. The manning requirement for one OCC is about 19 persons or 57 persons for three ROTHR OCC's per shift. The administrative staff would be about 20 persons. Therefore, the maximum number of personnel at the OCC site would be about 134 persons during the shift change. The work plan is expected to be based on 5 shift crews working 8 hour shifts, 7 days a week.

Site Requirements

12. §2.4.1 **Operational Siting Requirements.** This section demonstrates the necessity and interrelatedness of the three RCVR's when it indicates that the radar is designed to detect aircraft and ships in critical areas as shown in Figure 1.1. All three RCVR's must be interconnected to detect rapid movements of aircraft as they move rapidly across the area covered by all three segments of the system which according to the DEIS can only be placed in the Mariana Islands. Clearly the operational requirements call for the three systems to be closely coordinated. | 117

#117. See #40.

ROTHR Alternative Sites

13. §2.5.2.1 **Transmitter Locations.** According to the DEIS, the major reason that transmitters are not located on Guam is Radio Frequency Interference (RFI). This section claims the NAVCAMS and NWF communications receiver facilities require a 15 mile isolation distance. Section 4.2.11 identifies an RFI zone of only 2 miles! The 15 mile isolation distance appears to be a ruse to avoid placing transmitters on Guam. We might point out that the ROTHR transmitters, although high powered, are directional and will be focusing their radiated power away from Guam. The Navy should seriously consider placing transmitters on Guam in order to reduce the amount of habitat that must be destroyed. | 118

#118. See #34.

14. §2.5.2.2 **Receiver locations.** We were pleased to see that the Navy has greatly expanded this section. However, even if you accept the reasons the Navy has given for rejecting many of the possible ROTHR sites they did choose to evaluate, there are numerous other possibilities that they have not investigated (Attachment 1). We would like to see the process of finding a suitable site contracted out to a private consultant not burdened by having to justify previous decisions made prior to the writing of an EIS. After consideration of additional sites, many of which we have suggested in past correspondence and the Navy has yet to investigate, we believe that an alternative site could be located. One possibility not considered by the Navy would be to remove some of the smaller antennas from locations such as Anderson AFB Barrigada or NAVCAMS Barrigada and install the ROTHR RCVRs there. The smaller less environmentally damaging antennas could be relocated elsewhere if not obsolete. Attachment 1 lists alternative sites for P-223, P-225, and P-002 that have not been considered. There are probably others as well. | 119

#119. The Barrigada area is the transmitter site for the Navy and Air Force communications on Guam, while the receiver site is at northern Guam. Therefore, locating the ROTHR receiver in the transmitting environment of Barrigada, even with removal of some small transmitters, is not operationally feasible. See Appendix J Review/Evaluations.

15. §2.5.2.1. **Page 2-19, Paragraph 1.** The DEIS states that a radio frequency occupancy test is needed to verify the adequacy of the Harmon Annex as a possible alternative receiver site. These results should be included in the "pre-final" DEIS so as to be available for public scrutiny. | 120

#120. The test results show that Harmon Annex is considered to be an acceptable ROTHR receiver site location. However, future development in the vicinity of the Harmon Annex site may change the electromagnetic interference level which may cause unacceptable interference with the ROTHR receiver.

Alternatives Including the Proposed Action

16. §3.1 **Project description.** It is obvious that project segment P-223 is not a stand alone project. Clearly, an early warning radar system designed to detect low altitude aircraft requires the broad coverage and coordination of all 3 units. Therefore, as we have already stated, the DEIS is flawed because it only considers one RCVR segment, P-223, and does not include P-225 and P-002 in order to evaluate cumulative effects as required by NEPA and ESA. | 121

#121. See #40.

17. §3.4 **Proposed Alternate Transmitter Sites.** Guam sites should have been included in this discussion of alternatives for transmitters. Possibilities might include Orote Point, Harmon Annex, South Finegayan, Tanguisson Point, Hilaan Point, Ague Point, | 122

#122. See #34.

FAA Site, and Dandan (utilizing the existing NASA facilities). Nowhere are the dimensions of the transmitter sites clearly described.

18. §3.4.1 **Proposed transmitter sites (Tinian).** The second paragraph of this section seems to imply that the three alternative sites on Tinian are unsuitable as transmitter locations because they are located on leaseback lands that may be leased back to farmers on Tinian as part of an agreement between the CNMI government and the Navy. We do not think that a political arrangement such as this should be used as grounds for deciding which sites are chosen. The decision on where to locate the transmitters should be based on ecological reasons as well as or in addition to political ones.

123

#123. The section discussed information of concern to the people of Tinian. The fact that the three alternate sites are on proposed leaseback areas were set forth in the DEIS. There was no statement in the DEIS that the locations were unsuitable for transmitter locations.

Mitigation Measures

19. §3.5.2 **Receiver sites mitigation measures.** Two measures considered as mitigation by the Navy for their preferred sites for P-223 and P-225 on NWF are mentioned here. Both sites are in areas where the last individuals of two endangered species, the Micronesian Kingfisher and Guam Flycatcher are known from Guam. It is our position that expected impacts associated with sites where endangered species are presently found will be so severe that they will not be mitigable under any circumstances. However, impacts at alternative sites located in "essential habitat" or proposed Critical Habitat that are presently devoid of birds may be mitigable on a case by case basis. Examples of possible mitigation measures might include financial support of snake control research and endangered species captive breeding programs, rejuvenation of degraded habitat, and purchase of additional appropriate habitat to add to Critical Habitat, etc.

124

#124. See #32, #63, and #64.

We have earlier expressed our reservation about claims that no clearing of vegetation will be necessary in front of the radar sites. In addition, we reiterate that destruction of any habitat on NWF would destroy proposed Critical Habitat and/or displace birds to areas not now containing birds which may result in death or harm and constitute illegal take under ESA.

Comparison of Alternatives

20. §3.6.2 **Guam (Guam alternative sites comparison matrix).** The matrix is misleading in that it contains inaccuracies and makes inappropriate comparisons. For example in the Physiography/topography section, all locations are listed as "site altered". The impression given is that all areas in question are equally altered from "natural" and therefore of little value. In fact, while all sites mentioned here are man altered, the NWF sites in particular contain much valuable second growth forest, a high percentage of which is mature, that provides excellent habitat for endangered native forest birds. The degree of alteration varies between sites as well.

125

#125. The matrix provides a summary comparison of each area of environmental concern discussed in the DEIS. The habitat comparison is under Fauna on the Table in Sections 5.7 and 8.5 of the FEIS.

21. §3.6.2 **Guam Matrix. Fauna section.** This should be expanded to contain separate categories for endangered species, Critical Habitat, and other fauna. The only impact mentioned in this section is that proposed "essential habitat" will be reduced. In fact, "essential habitat" should be replaced by the words "Critical Habitat" or at least "proposed Critical Habitat". Critical habitat as proposed includes all NWF sites. Destruction of Critical Habitat is illegal under the ESA. No impact on endangered species themselves is even mentioned! No mention is made that the P-223 site is the last location on Guam where the endemic Micronesian Kingfisher is found. Surveys have shown that the two P-223 sites on NWF contain together more than 20% of the known population of the Mariana Crow on Guam. The Guam Flycatcher was recently observed on or near the P-225 site. In addition, the only recent siting of the Mariana Fruit Dove on Guam is from the original P-223 site. It

126

#126. See #32, #39, and #64.

is our belief that displacing these birds from the sites where they are found to locations devoid of birds will result in death or harm and amount to illegal take.

22. §3.6.2 Guam Matrix. Flora section. This section states that there is no adverse impact on flora. This is at best incorrect. Much high quality second growth forest presently occupied by the last federally listed Micronesian Kingfishers, Mariana Crows and Guam Flycatchers and listed as essential in the USFWS's Recovery plan for these species and proposed as Critical Habitat will be destroyed thereby jeopardizing the species and their recovery. | 127

#127. See #32, #59, #63, and #64.

23. §3.6.2 Guam Matrix. Conflicts with land use plans section. Siting P-223 and P-225 anywhere on NWF as proposed may affect land use plans. The Artero family may be unable to develop their property which is zoned for hotels by the Government of Guam. This section does not address impacts on recreational hunting. Hunting should have a separate category. | 128

#128. See # 22. A discussion of hunting is shown in Sections 6.2.10; 7.2.17; 8.2.10; and 8.4.17 of the FEIS.

Affected Environment-Receiver sites (Guam)-Fauna

24. §4.2.7.1 Northern sites-Fauna. Paragraph 2. This paragraph states that the April 1988 survey conducted by the Navy at the P-223 site had 100% coverage. What is meant by this is that 100% of the area was covered. Because birds and bats are highly mobile and because many of the endangered species known from the area are secretive as well, no survey is ever able to find all individual on a given site, particularly sites as densely vegetated as the P-223 sites. In fact, nowhere in the April, 1988 survey report contained in the DEIS does the author, Bruce Eilerts, claim 100% coverage (see Appendix E). The Division of Aquatic and Wildlife Resources of the Department of Agriculture estimates that there are a total of about 50 crows left on Guam, all in the vicinity of NWF. The 500 acre survey conducted at P-223 in April 1988 found 32 crows, or approximately 60% of the island population, on or immediately adjacent to the project. | 129

#129. Comments noted.

25. §4.2.7.1 Northern sites-Fauna. Paragraph 6. As described in Paragraph 5 of this section, fruit bats occur in the Northwest Field area on a rare to occasional basis. Thus, they would be expected to be found on all of the possible radar sites in the vicinity of NWF and mentioned in the DEIS. This explains why this area has been designated as essential habitat for fruit bats and why it has been proposed as Critical Habitat. It should be noted that the DAWR conducted brief surveys for fruit bats in Northwest Field in September 1987 and September 1988. The results were one bat seen in 12 man-hours of observation in 1987 and two bats seen in 16 hours man-hours of observation in 1988. One of the bats observed in 1988 was on the P-223 Runway Site. These surveys were conducted after nightfall between 8 p.m. and midnight. In contrast to the methods of study used by the Navy's consultants and biologists, who searched for bats at dawn and dusk, it is more likely that fruit bats will be seen on NWF after dark. This is because fruit bats do not depart from their colony, which is locate on the east side of AAFB, until after nightfall and then must fly several miles to reach NWF. Future searches for bats on NWF should be conducted after 8 p.m. when bats are most likely to be active in the area. | 130

#130. Comments noted.

26. §4.2.7.1 Northern sites-Fauna. Paragraph 9. This paragraph states that the Government Guam found the Micronesian Kingfisher as late as 1986. In fact, kingfishers have been observed by DAWR staff as late as 1988. | 131

#131. See Sections 6.2.7 and 8.2.9 of the FEIS.

27. §4.2.7.1 Northern sites-Fauna. Paragraph 13. It should be noted that at least five other species of lizards occur in the NWF area. These include the rare moth skink (*Lipinia noctua*), the mourning gecko (*Lepidodactylus lugubris*), the big tree gecko | 132

#132. See Sections 6.2.7 and 8.2.9 of the FEIS.

(*Gehyra oceanica*), the stump-toed gecko (*Gehyra mutilata*) and the American anole (*Anolis carolinensis*).

28. §4.2.7.1 Northern sites-Fauna. Paragraph 14. Although this section points out that the NWF area is designated as "essential" for the survival and recovery of Guam's endangered native forest birds, it does not indicated that this same "essential" habitat is now proposed Critical Habitat as defined in the ESA.

133

#133. See #39.

29. §4.2.7.1 Northern sites-Fauna. Paragraph 15. Paragraph 15 appears to make the point that the Governor of Guam and the Director of the USFWS recommended Critical Habitat, for northern Guam solely as a reaction to this project. Nothing could be further from the truth. Critical habitat was recommended for the area in early drafts of the recovery plan long before the Navy project was even announced to the public. In fact, Critical Habitat including NWF, was requested in the original endangered species listing package submitted by the Governor of Guam in 1978. The fact that the USFWS did not go along with the Governor of Guam's request for emergency designation of Critical Habitat is, in fact, evidence that the Navy ROTHR project is not the only consideration for designating Critical Habitat by the USFWS.

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#134. Comments noted. The statements contained in Section 4.2.7.1 of the DEIS reflect the chronological order of events covering the Government of Guam's (GOVGUAM) petition for emergency designation of critical habitat as well as the U.S. Fish and Wildlife Service's (USFWS) response to that request. The DEIS simply reiterates the salient points raised by the GOVGUAM petition. It cannot be implied that the F&WS recommended critical habitat for northern Guam in reaction to this project as no "formal" F&WS decision has yet been made to designate critical habitat on Guam.

To set the record straight, it should be noted that the Navy's original plans for the ROTHR project called for the clearing of 1,600 acres in NWF to construct the three receiver sites. It was after the DAWR objected to destruction of such large amounts of habitat that the Navy scaled back its project plans and proposed to clear smaller amounts of forest. The DEIS completely mistrepresents the position of the Government of Guam by implying that it vastly overstated the size of the Navy's project in order to have Critical Habitat designated.

30. §4.2.7.2 Former FAA Site. Paragraph 2. This paragraph is incorrect in stating that the proposed site as shown in Figure 3.8 is in essential habitat in the bird and bat recovery plans. In fact, "essential habitat" includes all forest areas below the cliffline and adjacent areas up to 1 km to the east. Most of the proposed FAA ROTHR site is outside this area.

135

#135. See Sections 3.2.7 and 6.2.7 of the FEIS .

31. §4.2.7.3 Harmon Annex Site. Same as 4.2.7.2 above. Most if not all of the Harmon annex site is not in "essential habitat". The lack of a faunal and floral survey of this site illustrates the inadequate consideration given to this site. The DEIS should have not been released until these surveys were completed.

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#136. As a result of the EMI study, Harmon Annex was considered to be an acceptable site location for the ROTHR receiver. Therefore, complete flora and fauna surveys were conducted and the results are included in the FEIS. See Appendix E-1 and Appendix F-1.

Affected Environment-Receiver Sites (Guam)-Flora

32. §4.2.8.1 Northern Sites Flora. Paragraphs 1 and 2. We strongly disagree with the conclusions that Project P-223 "does not contain a major vegetation type." This statement is based on one of the botanical survey reports in Appendix F, which was written by a botanist contracted by the Navy. She reports that several plant communities such as *Pisonia* "pockets", fia forest, and *Pipturus/Cordia* forest occur on the P-223 site. According to Stone (1971. The flora of Guam. Micronesica 6:1-659), each of these plant groupings are in fact characteristic of the limestone forest or "typhoon" forest found on elevated limestone substrates in northern Guam. In addition, the botanical report says that another plant community referred to as mixed vegetation occupies a large portion of the P-223 site. It contains *Pandanus* spp., *Hibiscus tiliaceus*, seedlings and small trees of native species, and some introduced species. We consider this community to be a secondary growth form of limestone forest, based on the described species composition. DAWR observations on the site do indeed confirm that most of the P-223 site should be considered as secondary limestone forest, and thus is suitable habitat for most of Guam's endangered wildlife. The fact that some sections of trees on the site reach 50-60 feet in height argues

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#137. Comments noted.

COMMENT

RESPONSE

that portions of the forest on the site represent mature or climax forest areas. Dr. Lynn Raulerson of the University of Guam Herbarium has looked at the proposed site and believes that at least some of the P-223 site may not have been previously cut down. | 137

33. §4.2.8.1 Northern Sites Flora. Paragraph 2. The Bureau of Planning document cited in this section is simply wrong in stating that there is no limestone forest in the area of the P-223 site. | 138

#138. The document is a Government of Guam publication.

34. §4.2.8.1 Northern Sites Flora. Paragraph 3. Paragraph 3 understates' the value of the vegetation on the P-223 Runway site. The presence of more crows on this site during the Navy's faunal survey in 1988 than on their survey of the original P-223 site indicates the value of this habitat to this species. During the Navy consultant's survey of P-225 sites a Micronesian Kingfisher was found in similar habitat underscoring the importance of this habitat. | 139

#139. This paragraph addresses vegetation surveyed during February 1989 and does not address forest bird habitat requirements. Findings regarding fauna that have been known to occur in the proposed project areas are discussed throughout the DEIS on pages v and vii, and in Section II, pages 3-7, 3-15, 3-16, 4-5 through 4-8, 4-22 through 4-31, 5-10 through 5-16, 5-46 through 5-51, 5-56 through 5-62, 5-80, and 5-81.

35. §4.2.8.1 Northern Sites Flora. Paragraph 4. We are at a loss to understand why high winds would affect the vegetation any differently on this site than elsewhere on Guam, and cause a secondary forest or "regrowth" forest to form. Other than typhoons, which may strike any part of the island, we know of no winds that are particular to this part of the island. In fact, the P-225 site occurs on the leeward side of the island away from the predominant winds that generally blow out of the northeast for most of the year. | 140

#140. The botanical survey described this forest, like much of Guam, as being periodically being exposed to typhoons or tropical storms which have a major influence on what is referred to as the "typhoon forests" of Guam. See Appendix F.

36. §4.2.8.1 Northern Sites Flora. Paragraph 6: The half-day walk through botanical survey of the P-002 site is completely inadequate for determining the presence of endangered plant species at this location. DAWR work in this area have found several *Heritiera longipetiolata* trees, which is a Guam endangered species, on or very close to the proposed site. Also, there remains a slight chance that other *Serianthes nelsonii* trees occur in the area, which is not far from the existing *Serianthes* known from Ritidian Point. Thus, a new floral survey with 100% coverage should be conducted to determine exactly what plants occur on the area. These results of the new survey should be included in the "pre-final" DEIS and be available for public examination. | 141

The DEIS refers to the forest on the P-002 as being "modified limestone forest with little recent disturbance, a type of forest not found on the other northern sites". We think the paragraph should go farther and state that this forest is one of the most pristine examples of limestone forest left on Guam, as is directly reported in the botanical report in Appendix F. By failing to include this as part of forest's description, the authors of the DEIS drastically understate, or perhaps try to hide, the true value of the forest on this site.

#141. It should not be wrongly interpreted that the Navy relied only on the half-day transect survey of the P-002 Area of Consideration in determining the presence of endangered plant species. The survey findings are consistent with other botanical evaluations and reports involving the flora of the northern plateau of Guam, inclusive of the P-002 area. Extensive literature review was also used as apparent in the DEIS list of references. If Guam's Division of Aquatic and Wildlife Resources has information regarding the definite presence of endangered plant species on the proposed P-002 site, the information should be provided to the Navy for incorporation into its environmental analysis and to the Fish and Wildlife Service for their consideration in evaluating the potential environmental effects of the proposed ROTHR action on Guam's endangered species. DEIS references to the unique status and significance of the vegetative composition comprising the proposed P-002 site can be found on pages viii, 5-62, and page 5 of Appendix F, Botanical Report of Three Walk-Through Survey Sites. No attempt whatsoever has been made to understate or hide the true value of the forest of the proposed P-002 site as claimed.

37. §4.2.8.2 Flora-FAA site: We know of no 90' tall trees in this area. None are listed in appendix F. | 142

#142. The reference should be to 60-FT tall trees. See Section 6.2.8 of the FEIS.

38. §4.2.8.3 Flora-Harmon Annex site: No floral or faunal survey was done here. Such surveys would have indicated a mostly mixed shrub and grassland habitat. This site would have the least impact on Guam's critically endangered species!

Land Use

39. §4.2.10.1 Land Use-Northern Sites. The DEIS does not provide an indication of the amount of hunting that the NWF and NAVCAMS sites provide. A summary of this data is provided in DAWR annual reports. The NWF and NAVCAMS sites are open to gun hunting and are the most popular hunting areas on the island. NWF is hunted by up to 51% of legal hunters and NAVCAMS is hunted by up to 43% of legal hunters (DAWR Annual Report 1987) and each provides in excess of 1,000 hunter days of recreation per year. | 143

#143. A discussion of recreational hunting is shown in Section 6.2.10 of the FEIS.

40. §4.2.10.2 Land Use-FAA Site. The FAA Site is closed to recreational hunting. | 144

#144. Comments noted. See Section 6.2.10 of the FEIS.

41. §4.2.10.3 Land Use-Harmon Site. The Harmon Site is closed to recreational hunting. | 145

#145. Comments noted. See Section 6.2.10 of the FEIS.

42. §4.2.10.4 Land Use-Dandan Site. The Dandan Site is private property and public hunting is restricted to persons that obtain permission from the land owner.

Environmental Consequences.

Transmitter Sites (Tinian)-Fauna.

43. §5.1.9.1 Transmitter Sites (Tinian)-Fauna. Northern Sites. Page 5-11. The DEIS discounts potential impacts to the moorhen from collision with the transmitters and claims the impacts are unknown. The DAWR has recorded five fatalities in this species from collisions with man-made objects since 1981; most occurring at night or just prior to dusk. One bird was killed when it flew into a building at the Dept. of Agriculture (DOA) compound in Mangilao. Two birds were found dead on the side of the road, one along route 10 and the other on Dairy Road near the DOA. These birds had collided with either a car or power poles or wires along the road. A fourth bird was found dead beneath power lines near the corner of route 10 and Dairy road. A fifth bird was killed by a car near the prison pond in Mangilao. These cases demonstrate that collisions can be a significant cause of mortality.

44. §5.1.9 Page 5-13. Para 3. Transmitter Sites (Tinian)-Fauna. There have been a total of five reported snake sightings in the CNMI, four on Saipan and one at Rota.

45. §5.1.11 Social and Economic Characteristics. Locating receivers and the accompanying military personnel on Tinian would result in a larger work force, permanent presence of military personnel and dependents, and would result in greater economic benefits to the island of Tinian than would the location of transmitters. | 146

#146. See #34.

46. §5.1.11 Page 5-18. Social and Economic Characteristics. Siting three 58 acre transmitters at the eastern and western proposed sites is unlikely to prevent the lease back of all of the 12,500 acres now being considered.

Receiver Sites (Guam)

47. §5.2.7 Noise. Receiver Sites (Guam). As mentioned earlier above, and in the USFWS final draft recovery plan for Guam's endangered native forest birds, several of these species are very secretive, shying away from areas with heavy human activity and disturbance. We are concerned that the noise associated with the construction of the NWF sites will displace birds in occupied adjacent areas into areas where birds are not now found and where predation levels are likely higher. The disturbance of construction would affect birds in a much larger area than the actual dimensions of the site. This harassment can be construed as illegal take. This impact would not be a factor at the other sites. In addition, normal operational activities after construction is completed may have the same effect of displacing birds out of areas now inhabited into unsuitable areas or prevent birds from recolonizing the site once recovery is underway. | 147

#147. The potential effects of the Navy's proposed P-223 facilities on listed species has been evaluated by the U.S. Fish and Wildlife Service (USFWS) through a formal interagency Section 7, Endangered Species Act consultation. Their final determination concluded that the construction and operation of the proposed P-223 receiver at the location in question (northern runway alternative site location at Northwest Field) would not likely jeopardize the continued existence of any listed species. Appendix K.

It should be noted that the proposed P-223 receiver is a "passive" system requiring stringent radio free interference zones. Development within radio free interference zones will be prohibited to prevent interference with the receiving capabilities of the receiver. Because of this constraint, construction and operation of the receiver will afford added protection to species and habitats existing within radio frequency interference zones. In addition, increased security of the antenna areas should help to decrease instances of illegal hunting of fruit bats in the areas of the antenna arrays. See #32.

48. §5.2.9 Fauna. Receiver Sites (Guam). This paragraph is clearly misleading at best. Rather than mention that Critical Habitat was not designated for Guam's endangered

native forest birds and fruit bats when they were listed in 1984, it should indicate that the USFWS has decided that designating Critical Habitat will benefit endangered species and has initiated the process of doing so. The proposal under consideration includes all the northern sites and possibly portions of the other sites. This decision to designate was made in a letter to the Governor of Guam from the Director of the USFWS on February 27, 1989, and known by the Navy long before the circulation of this draft.

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#148. The statement pertaining to critical habitat contained in DEIS Section 5.2.9 is sound. Discussions concerning the U.S. Fish and Wildlife Service's (USFWS) proposal to "consider" designating certain areas on Guam as critical habitat for endangered species are incorporated in the DEIS. It should be noted that no "formal" USFWS decision has yet been made to designate critical habitat on Guam. See #39.

49. §5.2.9.1 Fauna-Northern Sites. Paragraph 1. This section is at best incorrect. The NWF Navy ROTHR sites are on habitat designated as "essential" in the USFWS final draft Recovery Plans for the endangered species. These sites are under consideration for designation as Critical Habitat and once so designated will receive the full protection of the Endangered Species Act. We do agree with the statement that " ...extensive loss of habitat could adversely affect the ability of any of the endangered species to continue to exist in the wild or to be reintroduced at a later date..." and wonder why this concern was not better addressed in the discussion of impacts of the project.

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#149. See #32, #39, and #148.

50. §5.2.9.1 Fauna-Northern Sites. Paragraph 3. The Navy's estimate of acreage required for this project is suspect because they are based on a degraded use of the radar. We fear that the Navy will need to clear additional acreage of proposed "Critical Habitat" if the performance of the system once activated is not as satisfactory as the computer evaluations predict. Therefore the figures in the DEIS may be unrealistically small. Additional clearing of forest at sites in NWF will likely be prohibited once Critical Habitat is designated. An alternate site or configuration of the system, i.e. receivers on Tinian, may allow an extended clear zone in front of the RCVR arrays.

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#150. See #115.

51. §5.2.9.1. Paragraph 3. The statement in the triple asterisk (***) section is incorrect. Quality limestone forest is not restricted to this site. Much limestone forest habitat is found on all three ROTHR sites, some is pristine and other is second growth at various stages of recovery.

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#151. The same paragraph states "Based on the limited botanical survey, the exact area of this limestone forest has not been determined." The paragraph also states that some of the vegetation characteristics found on the half-day transect survey of the Area of Consideration for Project P-002 site is not replicated elsewhere on other northern sites. There is no reference to the phrase "quality limestone forest" as stated in the comment.

52. §5.2.9.1. Paragraph 4. We agree with the Navy that construction of the ROTHR sites will cause the Mariana Crow, Micronesian Kingfishers, and Guam Flycatcher to move off disturbed sites into other areas. Many of these may be areas where they are not now found. Birds no longer occur in these areas for a reason, presumably because predation by the introduced Brown Tree Snake is higher there. Such dislocation would be harassment, may result in death and could be construed as illegal take under the ESA. If displaced crows, kingfishers, and flycatchers were to suffer higher predation rates once displaced, this would further reduce the critically low numbers of these animals surviving on Guam and jeopardize the continued existence of the Guam populations of these animals.

In the next several paragraphs the Navy attempts to make the case that there is plenty of habitat available for Guam's endangered species elsewhere on Guam. However, this is a misleading and erroneous argument. The habitat acreage they quote is in reality, available but not inhabitable at this time because of snake predation. The northern sites are proposed for location in the heart of the last known range of the affected species on Guam which is relatively small. The size of the proposed clearing for the northern sites will be a very significant reduction of that range. The habitat destruction and human disturbance will be to great to be permitted in this environmentally sensitive area. It is inconceivable to us that the Navy would propose to destroy this last remaining small area where the birds are found, particularly when there are other alternative sites available on Guam. The USFWS has recognized this fact by proposing the area for Critical Habitat designation. At this critical state of survival of these endangered species, the argument that the percentage loss of a particular habitat type is small and therefore of no impact is totally irrelevant and

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#152. The Navy is unaware of any scientific data supporting the claim that habitat areas reported in the DEIS, other than NWF, are "not inhabitable" because snake predation is more prevalent in those areas. As pertains to the statement on critical habitat, it should be noted that the U.S. Fish and Wildlife Service has not "officially" proposed critical habitat for any area(s) on Guam. See #32, #64, and #71.

inappropriate. The loss of a large section of habitat presently supporting endangered species is significant.

53. §5.2.9.1. Page 5-58, Paragraphs 2-5. We are almost at a loss to respond to the erroneous logic of the arguments presented in these paragraphs. To state that the P-223 and P-225 ROTHR sites are located on second growth forest and that crows and kingfishers prefer mature forest implies that the P-223 and P-225 sites are of questionable importance. To imply that the preservation of the habitat in the only place where endangered birds now exists is not absolutely critical to their survival is preposterous. The fact remains that the NWF ROTHR sites and adjacent areas are the only place on Guam where crows are found and the last refuge for the Guam Micronesian Kingfisher and Guam Flycatcher. Without repeating the arguments that we have already made previously in this review, let us reiterate that we would consider moving endangered birds out of their present locations into areas not now occupied harassment and tantamount to illegal take under the ESA. To conclude that the impacts that will occur at these NWF sites is equal or lesser than that which will occur at alternate sites is clearly false.

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#153. See #63, #147, #185, #218, and #222.

54. §5.2.9.1. Page 5-58, Paragraph 6-7. While it is correct that northern Guam as a whole was the last place to be affected by the brown tree snake, within that area the last place to be snake free was apparently Ritidian Basin. Evidence for this is that DAWR data shows that Ritidian Basin was the last location on Guam to have the complete ensemble of all native forest birds. DAWR data clearly demonstrates that birds started to disappear from NWF before the Ritidian Basin Area. Fortunately, for some reason, predation was less such that birds survived on NWF in contrast to the Ritidian Basin area where populations of native birds have been gone since 1986 (1986, DAWR Annual Report). Therefore, this pattern of distribution clearly demonstrates that not all forest habitat on Guam is habitable at this time for native forest birds. We argue that the present range of the crow is the only suitable habitat for this species on Guam at present.

55. §5.2.9.1. Page 5-59, Paragraph 2. Until further information is available on the exact security arrangements that will be implemented, we disagree that the increased security around the antenna arrays will automatically result in decreased poaching of fruit bats. Under present conditions, neither Navy or Air Force security patrols actively pursue poachers. Instead, they typically contact Government of Guam conservation officers who attempt to make the apprehensions. If this arrangement is maintained at the ROTHR sites, and security guards are restricted to patrolling only around the perimeter of the antenna fields, poachers may not be deterred from hunting in the area. If, however, security is strengthened throughout NWF and all vehicles are closely screened at all entry points, then a reduction in illegal hunting could result.

56. §5.2.9.1. Page 5-59, Paragraph 4. This paragraph discusses the Navy's claim that cumulative effects of all three antenna sites do not have to be considered together in this document and refers to the USFWS's definition of cumulative effects under the ESA. This conclusion is relying on the wrong definition of cumulative effects, i.e. the ESA definition. The Navy should be using the NEPA definition of cumulative impacts. NEPA (Section 1508.7) defines "Cumulative impact" as "the impact on the environment which results from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other action. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time." Further, Section 1508.8 states that "Effects includes: (b) Indirect effects, which are caused by the action and are later in time or farther removed in distance but are still reasonably foreseeable". Clearly the Navy's ROTHR project falls into the NEPA definition requiring consideration of cumulative effects for all three sites in one document.

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#154. See #44.

Additionally, we believe the Navy has stated the USFWS position on ESA cumulative effects wrong. It is stated that the USFWS has determined that all three sites will require a separate Section 7 consultation and cumulative effects analysis. If the Navy so requested, all three sites could be considered together for cumulative effects analysis under the ESA. While we have problems with the USFWS's interpretation of the ESA on this point, we believe that NEPA unequivocally mandates that all three sites be considered together for cumulative effects analysis.

57. §5.2.9.1. **Page 5-59, Paragraph 5.** The remark that "under normal resident bird population conditions" one would expect to see occasional foraging by Micronesian starlings and Marianas crows in cleared areas such as the ROTHR receiver sites is clearly wrong. Neither of these bird species feed on the ground in large treeless openings such as those that are proposed to be constructed for the antenna sites unlike starling and crow species found in North America. | 155

#155. The statement appears to have been misconstrued. Micronesian starlings are utilizing open areas at Andersen Air Force Base and southern Guam as habitat. The statement was not meant to imply that the crow and starling feed only on the ground. Starlings have been observed by Navy biologists nesting in coconut palms located along buildings and surrounded by acres of open lawn at Andersen Air Force Base (reported verbally by B. Ellerts to DAWR biologists during 1988). The crows have been observed to utilize "edges" by Navy, Air Force, and DAWR biologists. The statement referred to the "edges" created by the receiver sites which are likely to be utilized by both species.

58. §5.2.9.1. **Page 5-60, Paragraph 1.** As already described, fruit bats occur throughout NWF as determined by surveys conducted by the DAWR. It is wrong for the DEIS to ignore this data and imply that bats do not occur on the exact proposed construction sites, based on the extremely brief surveys completed by the Navy's contractors and biologists. Additionally, the surveys described in the DEIS did not use the most appropriate methods for observing fruit bats. | 156

#156. The Navy's methodology used during fruit bat surveys involved conducting surveys at all hours (dusk, midnight, dawn), at several elevated locations in and around the project sites, using spotting scopes and binoculars, and utilizing light conditions to illuminate or silhouette flying fruit bats. These measures are considered prudent and appropriate for observing fruit bats.

It is recognized that fruit bats may feed on certain trees growing in the forest comprising the proposed project location at Northwest Field and that the area may be used occasionally by bats for roosting. However, the location is not the only area in northern Guam supporting conditions suitable for use by fruit bats. There is an abundance of similar feeding and roosting habitat within Northwest Field which will not be affected by the proposed project.

The DEIS statement for which the above comment pertains merely states the fact that no fruit bats were detected within the northern sites during biological related surveys in support of this document. See #111.

59. §5.2.9.1. **Page 5-60, Paragraph 2.** While the Navy is correct in saying that the DAWR has no knowledge of bird strikes to antennas on Guam, we wish to state that no long term systematic searches of antenna fields have been made by anyone on the island. Further, considering the warm tropical conditions of the island, it is not surprising that bird carcasses do not accumulate beneath antenna lines because of the high rate of decomposition that occurs. Monitor lizards, brown tree snake, feral cats, and feral dogs may also remove injured birds or scavenge carcasses on many sites.

The DAWR has records of five fatalities in endangered Mariana common moorhen from collisions with what we assessed as electrical wires, buildings, and cars. Fatalities from bird strikes with antennas can be expected.

60. §5.2.9.1. **Page 5-60, Paragraph 5.** At least five other species of lizards not listed here are known to occur in the NWF area. All species of reptiles are not ubiquitously abundant in NWF, as reported by the DEIS. In fact, two species, the moth skink (*Lipinia noctua*) and the big tree gecko (*Gehyra oceanica*), are quite rare and could be impacted by the construction of the ROTHR receiver sites. It must be stated that in none of the biological surveys for the proposed antenna sites were any searches for reptiles conducted. Thus, it is impossible for the authors of the DEIS to state categorically that all reptiles are abundant in the area. This group of animals was probably ignored in the surveys because none are currently listed as threatened or endangered on the island. | 157

#157. Comments noted. Predation by the Brown Tree Snake, not habitat destruction, has been the cause of the decline of these species.

61. §5.2.9.2 **Former FAA site-Fauna.** A close examination of the proposed essential habitat in the USFWS final draft Recovery Plans makes it clear that the plans do not include most of the proposed FAA site. However, portions of this site are under consideration as Critical Habitat. | 158

#158. See #135, #168, and #172 .

62. §5.2.9.3 **Harmon Annex Site-Fauna.** A close examination of the proposed essential habitat in the USFWS final draft Recovery Plans makes it clear that the plans do not include most of the proposed Harmon Annex site. However, small portions of this site may be under consideration as Critical Habitat. | 159

#159. Comments noted. See Sections 3.2.7 and 6.2.7 of the FEIS.

Flora.

63. §5.2.10.1. **Paragraph 1.** Many of the comments that we have made for section 4.2.8.1 apply directly to this section as well. The statement asserting that the P-223 site does not contain a major vegetation type is misleading in that it seems to imply that the site is not vegetatively important. In fact the area contains excellent second growth native limestone forest habitat for the endangered species found in the area as is indicated by their nesting in the area at present and in the past. | 160

#160. See #59.

64. §5.2.10.1. **Paragraph 2.** This paragraph draws an erroneous conclusion. Please review the argument concerning section 5.2.9.1. Page 5-58, Paragraphs 2-5. The adverse effect on flora would be to proposed "Critical Habitat" necessary for the survival and recovery of the affected endangered bird species. | 161

#161. See #32.

65. §5.2.10.1. **Paragraph 4.** While no endangered plant species would be affected, proposed "Critical Habitat" (under ESA) for the recovery and survival of endangered native birds would be affected.

66. §5.2.10.1. **Paragraph 5.** The runway P-223 site is proposed "Critical Habitat" and as such its loss would impact the survival and recovery of endangered native birds. The paragraph understates the value of this habitat to endangered bird species. Crows are probably nesting on this site at present.

67. §5.2.10.1. **Paragraph 6.** As we indicated earlier, most of the vegetation of the P-002 site is in fact pristine native limestone forest. The Navy's own botanical survey (Botanical Report of Three Walk- through Survey Sites, page 9.) states that the P-002 site contains one of the most pristine examples of limestone forest left on the island of Guam."

68. §5.2.10.1. **Paragraph 7.** As pointed out previously, the half day walk through survey of the P-002 site is inadequate to locate endangered plant species on the site. This is particularly true considering that individuals of two endangered tree species are found in the area.

69. §5.2.10.2. **Former FAA Site-Flora.** Some portions of this site are currently being considered for designation as Critical Habitat. Loss of this vegetation would have an impact on the recovery of endangered species.

70. §5.2.10.3. **Harmon Annex Site-Flora.** A survey needs to be conducted for this site and the consequences of its use determined. Small portions of this site may be under consideration as Critical Habitat. | 162

#162. As a result of the EMI study, Harmon Annex was considered to be an acceptable site location for the ROTHR receiver. Therefore, a complete flora survey was conducted and the results included in the FEIS Appendix F-1.

71. §5.2.16. **Indirect Effects.** The DEIS does not clearly indicated what the impact of building receivers at the Northern Sites will have on the recreational hunting program. We believe siting the ROTHR facilities at the three sites on Northwest Field and NAVCAMS will result in the closing down of gun hunting at these sites because the receivers will require a large expanse of land and a surrounding security zone in which hunting will not be allowed for safety and security reasons. If P-223, P-225, and P-002 were all built at the northern sites, they would effectively shut down the existing regular season gun hunting program on both of these bases. During FY 1987 (the most recent year for which a complete data set is available), NAVCAMS provided 3,379 hunter-sorties and a harvest of 159 deer and pigs and NWF provided 2,411 hunter-sorties and a harvest of 187 deer and pigs (DAWR Annual Report 1987). The recreational hunting programs on Northwest Field and NAVCAMS are the most important on the island and their cessation

will significantly reduce the amount of gun hunting now available to island residents. We do not think the quality and quantity of hunting now being provided can be duplicated elsewhere. Loss of this recreational resource will be irreplaceable.

72. §5.2.22 Mitigation. The mitigating measures do not contain any provisions that rectify the impact on natural resources by repairing, rehabilitating, or restoring the affected environment or that compensate for the impact by replacing or providing substitute resources or environments. | 163

Topographic and Soil Surveys-Proposed Surveys

73. §6.1 Introduction- Paragraph 3 is misleading in that it implies that what is proposed for the P-225 antenna in Section III is similar to that done on site P-223. In fact, no bulldozer swaths were cut on the preliminary survey work on P-223. All clearing that was done, was done by hand only. We are strongly opposed to any survey work being done on P-225 other than minimal vegetation cutting by hand that doesn't cut trees of any significance. | 164

We are also concerned about the Navy's lack of effective supervision of its contractors actually performing work as specified. For example, while clearing a path by bulldozer for the laying of a fiber optic cable on two different cable routes, a swath up to 100' was cleared when specifications called for a maximum 15' width. This was in clear violation of what was agreed upon in their Preliminary Environmental Assessment. Navy contractors were caught cutting vegetation as a part of the survey work for the P-223 site under what proved to be a woefully inadequate PEA. They were ordered to cease operations by the AAFB Commander. An agreement was then reached by which the contractor was permitted to finish surveying on transects already cut. Unfortunately, they were again caught in the act of cutting additional vegetation and ordered by the USFWS to cease work.

74. §6.2.2 Guam Surveys-Paragraph 1. No explanation is given explaining the "25-FT system" mentioned. If this is the same system that was proposed in the original PEA for P-223, we are strongly opposed to it for the same reasons. As we see it, the combination of the bulldozer and hand clearing for the proposed surveys will destroy 40% of the habitat in forested areas. Trees with trunks up to 12" in diameter were cut for a similar survey on the P-223 site before that survey was stopped. We are opposed to the use of bulldozers for survey work because of the heavy damage they cause. In addition we feel that a 25' grid, even though hand cut, will destroy too much valuable habitat proposed as critical by the USFWS and listed as "essential" in the Final draft recovery plan for the endangered species found on the site. All borings should be conducted on already existing roads and already cleared areas. | 165

Affected Environment-§6.3.2 Guam Sites

75. §6.3.2.1- Northern Site-Paragraph 2 points out that the final draft recovery plan mentioned this area as essential habitat and not Critical Habitat. It then goes on to say that the area has been proposed by the USFWS as Critical Habitat. What is the point the Navy is making here? Under service policy, Critical Habitat if not already designated cannot be mentioned in the recovery plan. The term "essential habitat" is used instead. Again, what point is the Navy making here? | 166

76. §6.3.2.1- Northern Site-Paragraph 3. Flora. The "regrowth forests" mentioned here are in fact high quality second growth native forests. As we already mentioned in Section II, we are at a loss to understand why high winds would affect the vegetation any differently on this site than elsewhere on Guam, and cause a secondary | 167

#163. Mitigation measures mentioned in the DEIS address the possible direct impact on specific species of concern identified by GOVGUAM and federal agencies as having the potential of being directly affected. Such mitigating measures involving bird collisions and utilization of the proposed project area as habitat have been thoroughly addressed. Other significant impacts to plants and the flora of the area as a whole have been considered and the comment suggesting restoration, replacement, substitution, etc. has been noted.

#164. Section 9.1 of the FEIS (Section 6.1 of the DEIS) has been revised to indicate that no work was performed on Guam for Project P-223 that required tree cutting in the forest areas.

#165. The proposed forest clearing to conduct the survey work will impact an estimated 36 acres within a survey area of 9,000 feet by 1,000 feet, or 206 acres. The percent impact would be 17.5 percent. The FEIS clarifies the area and percentages.

#166. The DEIS states that the area identified as essential habitat is being "considered" by the Fish and Wildlife Service as critical habitat vice "proposed" as stated in the above comment. Until the process of proposing critical habitat is made official by means of formal publication in the Federal Register, areas under consideration for such designation are not afforded the special classification or protection assigned critical habitat under the Endangered Species Act. Aside from noting that certain areas on Guam are under consideration by the Fish and Wildlife Service for possible designation, the DEIS did not emphasize critical habitat so as to avoid ambiguity over the matter as reflected by the above comment.

As for essential habitat, this is a designation used in the recovery plans to designate important habitat areas. Essential habitat is neither defined in the Endangered Species Act nor afforded the federal protection established for critical habitat. See page 4-23 of the DEIS and response to Comment #39.

#167. See #140.

COMMENT

forest or "regrowth" forest to form. Other than typhoons, which may strike any part of the island, we know of no winds that are particular to this part of the island. In fact, the P-225 site occurs on the leeward side of the island away from the predominant winds that generally blow out of the northeast for most of the year. | 167

77. §6.3.2.2 Former FAA Site. Contrary to what is stated here, less than 1/3 of this site is included as essential habitat mentioned in the recovery plans for Guam's endangered birds and bats. | 168

Environmental consequences-6.4.2 Guam Sites

78. §6.4.2.1 Northern Site. Paragraph 1, last sentence. This sentence does not make any sense. | 169

79. §6.4.2.1 Northern Site. Paragraph 2. Fauna. This section mentioned that surveys conducted by the Navy located three critically endangered bird species. It failed to mention, however, that the observations of the Micronesian Kingfisher and the Guam Flycatcher are in fact the last observations of these species recorded to date on Guam! The importance of this site to these species cannot therefore be overemphasized. | 170

80. §6.4.2.1 Northern Site. Paragraph 3 states that revegetation will quickly replace that destroyed by the topographic surveys. Unfortunately, this is incorrect, as it will take may years for mature native forest to be restored in the areas where it is cut down.

81. §6.4.2.1 Northern Site. Paragraph 4, Flora. This section glosses over the loss of high quality second growth native limestone forest by implying that it is highly disturbed by human and "the high winds that affect this area". As we have stated previously, the forest in question is of high value for endangered species. In addition, we know of know special high wind conditions peculiar to this part of the island. In fact, the P-225 site is in the lee of the predominant trade winds that blow for most of the year from the northeast! | 171

82. §6.4.2.2 Former FAA site: Contrary to statements made in this section, most of the site is outside of "essential habitat". | 172

83. Appendix E: Bird and Mammal Survey-General Comments. Our comments for the Bird and Mammal Surveys are much the same as we made for the original DEA in our letter dated September 8, 1987 and we ask the Navy to review those comments again. The present surveys cover only the immediate areas of the project. They do not extend out into the surrounding areas in order to properly indicate the value of the site in relation to the endangered species distribution in the greater area. This is extremely important since most of the species in question have a very limited range centered in the NWF area only. None of the surveys were adequate to determine the usage and value of the sites for breeding activity by endangered bird species. In addition, the survey methods used in the fruit bat surveys were inadequate to detect this nocturnal rare species. The presentation of the data from these surveys appears to have been written in the DEIS in such a way so as to conceal the importance of the endangered species found on the site. | 173

RESPONSE

#168. See #135.

#169. The sentence should read: These clearing requirements will not be a significant adverse affect to the topographic conditions of the site. See Section 9.4.2.1 of the FEIS.

#170. Contents noted. Though it is noted that the last sightings of these species were in northern Guam, it should also be emphasized that these species once ranged over most of the island and their decline has been attributed to the brown tree snake predation.

#171. See #140.

#172. See #135.

#173. The surveys were conducted outside of the immediate proposed project sites in some instances such as the P-223 bird and bat surveys. However, the main focus of the surveys was on the immediate areas proposed as project sites since they were to be directly affected. Endangered species distribution should be viewed as "island wide" and evaluation of acreage around the project sites and elsewhere should be conducted by the responsible resource agencies. Section 7 consultations with USFWS certainly took this concern into consideration. As for adequacy of fruit bat surveys: fruit bat surveys were conducted in and around Project P-223 and Project P-225 sites during 1988 at sunset, mid-night, sunrise, and during the day using binoculars and spotting scopes, and at varying times with Navy, Air Force, and a DAWR biologist (R. Beck during a dusk to 2300 watch). The statement that the methods were not adequate to "detect" fruit bats is not one the Navy chooses to agree with. The Navy has not attempted to conceal any information regarding the importance of endangered species. See #32, #113, and #156.

Attachment 1. Possible Alternatives for Navy ROTHR Project

Alternative Technology

1. The placement of the ROTHR transmitters on Guam and the receivers on Tinian should be considered, as it may be possible to find suitable locations on Guam for the less land intensive transmitter sites that would not have the severe environmental impacts of the extremely land intensive receivers. A combination of transmitters and receivers on both islands should also be considered. 174

2. Consideration should be given to crisscrossing the receivers and having just one site on Guam for at least two and perhaps all three receivers. Because these are passive receivers and they are not emitting RF radiation, it seems that some degree of overlap such as would be involved in a crisscross alignment should be possible without significant degradation of efficiency.

3. It may be possible to break the one single large receiver for each project into two or more smaller pieces that could be offset to a certain degree, allowing the installation to be fitted into areas that are not large enough to accommodate the nearly 9000 foot length currently specified for each receiver.

#174. Any significant overlapping of the receiver arrays, using the required bore sights would degrade directional selectivity of the antenna, by scattering the signals into the side lobes and thus severely degrading the radar performance. The incoming signals for one array would be absorbed and scattered by the antenna poles from the other array. It would also require that both arrays be the same or nearly the same elevation (within 6 inches) which would reduce the siting options, increase the required grading, and increase the required clearing of vegetation due to decreased performance. For these reasons, crossing of the receivers is not considered technologically feasible.

Alternative Receiver Sites

We believe that there are several locations on Guam that offer potential as viable alternative sites for the ROTHR project that should be seriously evaluated. Some of these are within existing military reservations, some of them include military lands that have been previously identified as excess to military needs and available for transfer to the Government of Guam, and some include Government of Guam and private lands. Should any alternative involving Government of Guam land or military land that has previously been identified as excess or surplus to military needs and available for transfer to the Government of Guam be selected, it will be necessary to compensate the Government of Guam for this loss by exchange of suitable military land elsewhere on the island as well as through other mitigation measures. 175

#175. See #66 and Appendix J Review/Evaluation.

Some Suggested Alternative Receiver Sites Include:

1. Harmon Annex. P-223, P-225 Sites. This site was apparently considered as an alternative for the P-223 receiver, but should also be considered for P-225. As stated in the DEIS, this area may be unacceptable due to the presence of an IT&E-owned antenna tower, and also because of the power transmission lines from the Tanguisson Power Plant. Perhaps these problems could easily be removed by the relocation of the IT&E tower by the Navy, and the realignment or burying of the power transmission lines from Tanguisson. 176

#176. See #49.

2. Barrigada Annex. P-223 Site. Existing Navy and Air Force antennas may need to be relocated but it should prove to be far easier to find environmentally suitable sites for these small antennas than for the ROTHR receivers themselves. 177

#177. The Barrigada site for the ROTHR receiver is not operationally feasible. See #119.

3. Orote Point. P-002. There is adequate room on Orote Point for a ROTHR receiver with the same alignment as P-002. Since the MPS program has been dropped and the ammunition storage and equipment maintenance facilities planned for that program will 178

#178. See #28.

COMMENT

now not be constructed at Orote it may well be a viable alternative site for the ROTHR project.

4. Finegayan. This area is under consideration as an alternative for the P-225 project. It should also be considered for the P-223 project, which apparently is of higher priority. 179

5. Andersen-South/Marbo. There are sites in this area that may be suitable for all of the proposed ROTHR receivers, P-223, P-225, and P-002. 180

6. Government of Guam land in the central plateau. P-223. Because this area lies over the freshwater lens that provides the bulk of Guam's drinking water, it has been necessary to limit the agricultural potential of this area due to the risk of high fertilizer and pesticide use contaminating our water supply. The construction of a passive radar such as a ROTHR receiver installation may be a compatible use that would essentially provide a permanent conservation area for the protection of our water resources. 181

7. Nimitz Hill/Lonfit. This area is a combination of Navy and private land that is located at high elevation and that may be suitable for at least one of the proposed ROTHR installations such as P-002. 182

8. Dandan. This privately-owned area is apparently being considered as an alternative site for the P-223 project and should be considered for the others as well.

9. Pulantat. This privately-owned area should be considered as an alternative site for at least some of the proposed ROTHR installations.

10. Bubulao. This privately-owned area should be considered as an alternative site for at least some of the proposed ROTHR installations.

RESPONSE

#179. See #66 and Appendix J Review/Evaluation.

#180. These sites are unsuitable due to the proximity of major highways bordering the parcel. See Appendix J Review/Evaluation.

#181. The central plateau lands are generally level, but the areas are transversed by secondary roads providing access to residential housing units throughout the area.

#182. See #66 and Appendix J Review/Evaluation.

COMMENT

RESPONSE

Attachment 1. Possible alternative ROTOR-ECVE sites on northern Guam for the indicated antenna segment.

P-223: 1 - FAA Site
2 - AAFB Marbo Annex
3 - Barrigada AAFB Annex
4 - Lamlam
P-225: 5 - Harmon Annex
6 - Marbo Annex
P-0021: 7 - Marbo Annex
8 - NAVCAMS
9 - Orote Point (Not Shown)



COMMENT

RESPONSE

3771 San Ysidro Way
Sacramento, CA 95864
Sept. 19, 1989

Mr. James Chun
Pacific Division
Naval Facilities Engineering Command
Pearl Harbor, Hawaii 96860-7300

Dear Mr. Chun:

Thanks for keeping me informed about the progress of the review process for the electronic installations proposed for the Northern Marianas. Further exposure to the draft EIS has prompted me to make a few comments.

I am concerned about the impact on bird life. Guam's endangered species should experience reduced chance of survival because of habitat loss and hassling. The northern F-002, F-223 and F-225 sites should be removed from the plan for this reason. The Guam flycatcher, Micronesian kingfisher and Mariana crows live here, as so Mariana fruit bats. The proposed towers on Tinian threaten Mariana common moorhens because they are in their flyway.

Since the U. S. Fish and Wildlife Service is preparing proposals regarding critical habitat, the EIS should consider the areas it is considering as critical. | 183

Because of concerns like these, more consideration should be directed to alternative sites. There appear, for example, to be environmental advantages to placing receivers on Tinian and transmitters on Guam. | 184

Very truly yours.

Charles L Sanders

Charles L Sanders
Sacramento Audubon Society

#183. See #39, #64, #110, #148, and #166.

#184. See #34.

COMMENT

RESPONSE

NHB Room 336
SMITHSONIAN INSTITUTION
Washington, D.C. 20560
U.S.A.

September 19, 1989

Mr. M. N. Kaku, Acting Head
Facilities Planning Department, Pacific Division
Naval Facilities Engineering Command
Pearl Harbor, Hawaii 96860-7300

Dear Mr. Kaku,

I am writing to you to draw your attention to the critical need for your department to reconsider the planned placement of the proposed Relocatable Over the Horizon Radar on Guam and Tinian islands.

As Secretary Emeritus of the Smithsonian Institution, and as an authority of birds of the Pacific, I want to make clear to you that, as presently planned, the Radar installation will serious damage habitats critical to the survival of a number of threatened or endangered birds and mammals. 185

In spite of the Navy's filing a draft environmental impact statement for the projected radar, there are a number of points that still need resolution.

Is it not true that the proposed northern sitings for the radar will destroy a large portion of the remaining habitat of federally-listed species such as the Guam Micronesian Kingfisher, Marianas Crow, Guam Broadbill, and Marianas Fruit Bat on Guam, and the Moorhen on Tinian? 186

Why are the northern habitats being destroyed, when the U. S. Fish & Wildlife Service is currently in the process of listing these sites as critical, under the Endangered Species Act? 187

I have been told there are reasonable alternatives to the sitings that are currently scheduled. Why has the Navy not considered these alternatives -- ones that might satisfy both the needs of the Radar and the needs of the wildlife? 188

I strongly urge your department to reconsider the

#185. It should be noted that the primary cause of avifaunal decline on Guam has been attributed to predation by the brown tree snake and not loss of habitat. Many of the presently endangered species once utilized habitat that is still abundantly available in other areas on Guam. See #32, #59, #63, and #147.

#186. See #32, #59, #63, #147, and #185.

#187. To state that the "northern habitats" are being destroyed is over-exemplifying the current project proposals. The proposed project sites do not constitute the entire "northern habitats" of Guam. Clearing for the proposed receiver sites would represent less than 1% of the available forest habitat on Guam. See #39, #64, #110, #148, #166 and Appendix K.

#188. See #66.

COMMENT

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present siting-plan for the radar, and to attempt to reach an accord with the Marianas Audubon Society and other environmental groups who have been offering rational alternatives to your current plan which seem so destructive of what little remains of this fragile island ecosystem.

With all good wishes, I am,

Sincerely yours,

S. Dillon Ripley

S. Dillon Ripley
Secretary Emeritus

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Caller Box PPP 255
Saipan, MP 96950
Sept. 11, 1989

Mr. M.H. Kaku
Facilities Planning Dept.
Pacific Division
Naval Facilities, Engineering Command
Pearl Harbor, Hawaii 96860-7300

Dear Mr. Kaku,

I would like to comment on the proposed "Over the horizon" radar project (ROTHR) scheduled to be built on Guam and Tinian.

Currently the ROTHR project is scheduled to be built in an area that is under consideration by the US Fish and Wildlife for the designation of "critical habitat" for some of Guam's endanged bird species. It would be irresponsible in the extreme for the ROTHR project to take any action at that site until the Fish & Wildlife review is complete. If the proposed site area is home to any of Guam's endangered species, then an alternative site should be pursued. I understand that there are several sites that are suitable for this radar, but I know there is only a limited area of Guam that remains suitable for the Marianas Crow, the Guam broadbill and other of Guam's endangered birds. 189

Perhaps I've read too many Tom Clancy novels, but I am sceptical that the ROTHR project will provide the Navy with significantly new defensive abilities. I think this project ought to be reviewed in light of your other traffic monitoring devices.

Sincerely,

Ellen K. Rice

Ellen K. Rice

#189. See #39, #64, #110, #148, #166, and #187.

COMMENT

RESPONSE



SIERRA CLUB
LEGAL DEFENSE FUND, INC.

Sierra, Mt. McKinley Ansel Adams

212 Merchant Street, Suite 202 Honolulu, Hawaii 96813 (808) 599-2436
FAX (808) 521-6841

HAWAII OFFICE
Arnold L. Lum
Michael R. Sherwood
Staff Attorneys
Marjorie F. Y. Ziegler
Resource Analyst

Other Offices

SAN FRANCISCO OFFICE
2044 Fillmore Street
San Francisco, CA 94115
(415) 567-6100

ROCKY MOUNTAIN OFFICE
1600 Broadway St.
Suite 1600
Denver, CO 80202
(303) 861-9898

WASHINGTON, DC OFFICE
1516 P Street, N.W.
Suite 200
Washington, DC 20005
(202) 667-4500

ALASKA OFFICE
325 Fourth Street
Juneau, AK 99801
(907) 586-2751

NORTHWEST OFFICE
216 First Avenue, South
Suite 330
Seattle, WA 98104
(206) 343-7340

10 - 82

September 28, 1989

Commander
Pacific Division
Naval Facilities Engineering Command
Pearl Harbor, Hawaii 96860-7300

Re: Comments on Draft Environmental Impact Statement For Electronic Installations (Relocatable Over-the-Horizon Radar (ROTHR)) In the Western Pacific

Dear Sir,

I submit the following comments on the above Draft Environmental Impact Statement (DEIS) on behalf of Marianas Audubon Society and National Audubon Society. Those organizations, as well as individual members thereof, either have already commented or will do so, as well. Their comments are hereby incorporated by reference.

As is meticulously documented in the comments of the Marianas Audubon Society, as well as those of the Guam Division of Aquatic and Wildlife Resources (DAWR), this DEIS is so fundamentally flawed that the Navy should withdraw it and prepare an entirely new DEIS for circulation and comment.

The DEIS is deficient in at least the following areas:

1. It grossly understates the impacts of construction of these radar facilities on the several federally listed endangered species (Guam rail, Guam Micronesian kingfisher, Guam broadbill, Guam bridled white-eye, Marianas crow, Marianas fruit bat, and little Marianas fruit bat) whose habitat on Guam will be sacrificed for construction. Guam DAWR biologists, 190

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who have the most extensive field experience of anyone studying these endangered species and their needs, have stated repeatedly that construction of the facilities in habitat that has been identified by the U.S. Fish and Wildlife Service (Service) as "essential" would severely jeopardize those species' continued existence and their chances for eventual recovery. The DEIS fails to disclose this information. The DEIS similarly understates the potential impacts on the Mariana Common Moorhen of construction of the transmitters in northern Tinian. 190

As of this writing, the Service has not issued its formal biological opinion on this issue pursuant to Section 7 of the Endangered Species Act (ESA), 16 U.S.C. § 1536. Regardless of the eventual conclusion of the Service in this regard, the Navy's legal duty to protect these endangered species will not end. Rather, under Section 7(a)(2) of the ESA, 16 U.S.C. § 1536(a)(2), the Navy will have a continuing, substantive duty to "insure" that its activities do not jeopardize the continued existence of these species. The Section 7 consultation process is merely a means to this ultimate end. If the Service disregards the data and opinions of those wildlife biologists who have the most intimate field knowledge of the species, or if its biological opinion is otherwise inadequate, then the Navy would not necessarily be free to proceed even if it has received a "no jeopardy" opinion from the Service. See, eg, Conner v. Burford, 848 F.2d 1441, 1451-1458 (9th Cir. 1988)(on-shore oil and gas leases on Flathead National Forest enjoined because, among other things, of impact on endangered species notwithstanding "no-jeopardy" opinion from Service; "incremental-step" consultation under Section 7 ruled invalid).

In addition, the DEIS fails to discuss the impacts of the proposed radar facilities on critical habitat of the species in question. In response to formal petitions submitted to the Service both by the Governor of Guam and by my clients, the Service has announced that it will propose designation of critical habitat for six Guam endangered species: the Guam Micronesian Kingfisher, Guam broadbill, Mariana crow, Guam bridled white-eye, Marianas fruit bat, and little Marianas fruit bat. The current schedule is that a proposed rule will be published in the Federal Register in April or May of next year and a final designation in the summer of 1990. Letter from Allan Harmelstein, Pacific Islands Administrator, U.S. Fish and Wildlife Service, to Michael R. Sherwood dated September 7, 1989. Once critical habitat is designated, Section 7(a)(2) the ESA, 16 U.S.C. § 1536(a)(2), will impose a substantive legal duty on the 191

#190. The DEIS thoroughly assesses the impacts of the proposed projects on listed endangered species. Effects of the proposed projects on habitat, flora, fauna, and specifically endangered species have been discussed throughout the DEIS on pages v, viii; Section II, pages 3-7, 3-15, 3-16, 4-5 through 4-8, 4-22 through 4-31, 5-10 through 5-16, 5-46 through 5-51, 5-56 through 5-62, 5-80, and 5-81; and Appendices B, C, E, and F.

The potential effects of the Navy's proposed Project P-223 facilities on listed species has been evaluated by the U.S. Fish and Wildlife Service (USFWS), the regulating agency for endangered species issues, through a formal interagency Endangered Species Act consultation. Their final determination concluded that the construction and operation of the proposed P-223 receiver at the location in question (Northwest Field runway site alternative on Guam), and corresponding transmitter site alternative on Tinian, would not likely jeopardize the continued existence of any listed species. See Appendix K.

See responses to comments #32, #33, #53, #59, #63, #68, #111, and #185 for added clarification regarding potential project impacts on endangered species.

#191. Discussions concerning the U.S. Fish and Wildlife Service's (USFWS) proposal to "consider" designating certain areas on Guam as critical habitat for endangered species are incorporated in the DEIS. It should be noted that no "formal" USFWS decision has yet been made to designate critical habitat on Guam. See #39, #60, #64, #110, #148, and #166.

Navy to "insure" that its actions will not "result in the destruction or adverse modification" of that habitat. 191

The DEIS mentions in passing the Service's decision to propose critical habitat designation, and in fact concedes that "most of the area currently proposed as essential habitat in the forest bird recovery plan may be included in the designated critical habitat." Pp. 4 - 25-26. It completely omits, however, any discussion of whether the proposed facilities will result in the destruction or adverse modification of the areas that will probably be included in critical habitat. My clients believe that it is self-evident that construction of the facilities anywhere within essential/critical habitat would without question destroy and/or adversely modify that habitat and would therefore be illegal under the ESA. The DEIS should candidly acknowledge this. 192

#192. See #32, #39, #64, #110, #148, #166 and #187.

2. The discussion of alternatives is inadequate. The alternatives section is supposed to be "the heart of the environmental impact statement." Council on Environmental Quality (CEQ) regulations on the preparation of environmental impact statements, 40 C.F.R. § 1502.14. The CEQ regulations (which are, of course, binding on all federal agencies, including the Navy, see, e.g., Trustees For Alaska v. Hodel, 806 F.2d 1378, 1382 (9th Cir. 1986)), explain that the alternatives section "should present the environmental impacts of the proposal and the alternatives in comparative form, thus sharply defining the issues and providing a clear basis for choice among options by the decisionmaker and the public." Ibid. The regulations require among other things, that this section of the EIS:

> Rigorously explore and objectively evaluate all reasonable alternatives, and for alternatives which were eliminated from detailed study, briefly discuss the reasons for their having been eliminated;
>
> Devote substantial treatment to each alternative considered in detail including the proposed action so that reviewers may evaluate their comparative merits;

and

> Include appropriate mitigation measures not already included in the proposed action or alternatives.

40 C.F.R. § 1502.14(a), -(b), and -(f).

Measured by these standards, as it must be, the DEIS's discussion of alternatives is legally unacceptable. In their comments both my clients and the Government of Guam have listed a number of reasonable alternatives to the proposed project which the DEIS fails altogether to mention, let alone "rigorously explore and objectively evaluate". As we have made clear for the last two years when we first started corresponding with the Navy on this matter, neither National Audubon Society nor Marianas Audubon Society is opposed to the Navy's construction of the proposed ROTHR per se, but only to its location within habitat that is essential to the continued existence and recovery of endangered species. We believe that a number of feasible alternative locations are available.

193

#193. See #66.

Moreover, with respect to those few alternatives that the DEIS does mention, the discussion is inadequate, because it does not include analysis of the environmental impacts of each alternative. The whole purpose of this section -- to disclose the relative environmental impacts of each alternative so that the decisionmaker can compare those with the proposed action and make an environmentally informed decision -- is therefore frustrated.

Finally, there is no meaningful discussion of mitigation measures either for the proposed action or any of the alternatives. This is required not only by the CEQ regulations, but by a recent U.S. Supreme Court decision. In Robertson v. Methow Valley Citizens Council, ___ U.S.___, 109 S. Ct. 1835, 1846-1847 (1989), the Court noted that:

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#194. Mitigation measures were presented in Sections 3.5, 5.1.22 and 5.2.22 of the DEIS and Sections 4.4 and 8.5 of the FEIS.

> [O]mission of a reasonably complete discussion of possible mitigation measures would undermine the "action-forcing" function of NEPA. Without such a discussion, neither the agency nor other interested groups and individuals can properly evaluate the severity of the adverse effects.

(The court also held, however, that an EIS need not commit the agency to any particular mitigation measure. Ibid.)

The inadequacy of the DEIS's treatment of alternatives alone requires withdrawal of this DEIS and preparation of a new DEIS. As the Ninth Circuit Court of Appeals has recently stated,

> Where the information in the initial EIS was so incomplete or misleading that the decisionmaker and the public could not make an informed comparison of the alternatives, revision of an EIS may be necessary to provide "a reasonable, good faith, and objective presentation of the subjects required by NEPA".

Animal Defense Council v. Hodel, 840 F.2d 1432, 1439 (9th Cir.1988).

3. My clients remain convinced that the three sets of transmitters and receivers are in reality phases of a single project -- that, in the words of the CEQ regulations, they are "interdependant parts of a larger action and depend on the larger action for their justification". 40 C.F.R. § 1508.25(a)(1)(iii). Thus, they are "connected" actions which "means that they ... should be discussed in the same impact statement." Ibid. Alternatively, the three projects are "cumulative actions" within the meaning of the CEQ regulations, "which when viewed with other proposed actions have cumulatively significant impacts and should therefore be discussed in the same impact statement." 40 C.F.R. § 1508.25(a)(2). In either case, the EIS must candidly discuss in detail the cumulative impacts of all three phases of the project on endangered species and their habitat. See, e.g., Kleppe v. Sierra Club, 427 U.S. 390, 410 (1976) ("where several proposals for ... actions will have cumulative or synergistic environmental impact, ... their environmental consequences must be considered together"); Thomas v. Peterson, 753 F.2d 754, 757-760 (9th Cir.1985) (cumulative impacts of road construction and timber sales that road was designed to facilitate); 40 C.F.R. § 1508.7 ("cumulative impact is the impact on the environment which results from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions ... .") This the DEIS fails to do.

195 #195. See #44.

In summary, this DEIS is so flawed that it fails to fulfill the very purpose of an EIS. That purpose, as recently articulated by the U.S. Supreme Court, is to

> ensure[] that the agency, in reaching its decision, will have available and will carefully consider detailed information concerning significant environmental impacts; it also guarantees that the relevant

information will be made available to the larger audience that may also play a role in both the decisionmaking process and the implementation of that decision.

Robertson, supra, 109 S.Ct. at 1845. See also CEQ regulations, 40 C.F.R. § 1502.1 (purpose of EIS).

Because an EIS is supposed to inform the decisionmaker, it must be an objective, pre-decisional document which the Navy will utilize in reaching an environmentally informed decision, and must not be a work of advocacy used "to rationalize or justify decisions already made." 40 C.F.R. § 1502.5. By failing to disclose the full scope of the impacts of the proposed project on endangered species and their essential/critical habitat, including the cumulative impacts of all three phases of the project, and by failing to discuss a number of reasonable alternative locations for the project which would not have those impacts, the DEIS is little more than a brief in support of the Navy's preferred alternative. It should be withdrawn and a new draft EIS prepared and circulated for comment.

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Thank you for this opportunity to comment.

Very truly yours,

Michael R. Sherwood

MICHAEL R. SHERWOOD

COMMENT

RESPONSE

Rt. 5, 760 Lynn Haven Drive
Seneca SC 29634
29 September 1989

Mr. James Chun (Code 2012)
Pacific Division
Naval Facilities Engineering Command
Pearl Harbor, Hawaii 96860-7300

Dear Mr. Chun:

I am writing in response to the Navy's Draft Environmental Impact Statement, issued 12 July 1989, concerning installation of the Relocatable over the Horizon Radar Project (ROTHR) on Guam and Tinian in the Northern Marianas. My interest and concern over this issue stems from my involvement over the past three years with conservation of the endangered and threatened avifauna in the Northern Marianas. In my capacity as a Research Associate of the Smithsonian Institution (Washington D.C.), I am conducting genetic and population studies to determine optimal strategies for reintroduction of Guam Rails (Rallus owstoni) and Micronesian Kingfishers (Halcyon cinnamomina cinnamomina) to the wild. I have been to the Marianas and visited sites where the birds formerly bred including sites under consideration for Critical Habitat designation.

Given limited suitable forest habitat on Guam for its' native forest birds, I find it hard to believe that the Navy would plan the ROTHR project in the heart of the most important habitat on the island when so much of the rest of the island would be suitable and placement of ROTHR at an alternative site would not involve destruction of native forests. The EIS does not indicate that the Navy has taken a serious look at alternative sites on Guam and yet when I inspected the habitat it was obvious that changing the ROTHR site to just a short distance from the Critical Habitat would make a significant difference in our ability to reintroduce native birds back to Guam and to have them maintain viable populations.

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#196. See #66 and Appendix J Review/Evaluation.

The Brown Tree Snake (Boiga irregularis) situation on Guam will be under better control in the near future and I am confident the native birds will soon return to Guam if proper habitat is available. I urge you to reconsider the ROTHR proposal and take another look at the site location. There is a great opportunity for the Navy to be a hero in the eyes of conservationists without compromising national security. No doubt you know that the Marianas Audubon Society, Government of Guam, and Smithsonian personnel will be more than happy to help you with selection of sites so that the birds will not be severely impacted.

Sincerely,

Susan M. Haig

Susan M. Haig, Ph.D.
Smithsonian Research Associate

COMMENT

RESPONSE

September 27, 1989

Carmen A. Kasperbauer
P.O. Box 20434
GMF, Guam 96921
(671) 632-0431

J.L. Busekrus
Commander Pacific Division
Naval Facilities Engineering Command
Pearl Harbor, Hawaii 96860-7300

Dear Mr. Busekrus,

I wish to inform you, the United States Navy, and the United States Air Force that I am opposed to the construction of the "Relocatable Over the Horizon Radar" on Guam.

The United States Military has caused much hardship, pain, and economic stress on our island of Guam since the second World War. Enough is enough.

We are pursuing the return of our seized land from the U.S. Military. By allowing you to install the ROTHR it will not only prohibit the return of our land to the civilian community but will also cause non-use of adjacent private lands for future development and economic gain due to the the Military sensitivity need of the "Radar". This will cause millions of dollars to be lost in development, now and in the future. In addition, thousands of future jobs will be lost as well because if there is no development then there certainly will be no jobs. Your intention of employing about sixty civilians will not increase our economy. Those sixty civilians may be off island or alien labor which could add a financial burden to our Government because of their housing, education, and welfare needs. This is not beneficial to Guam and its fragile economy. We are only a small island with a rapid growing population. We need all the space we have for now and our future.

Because the U.S. Military forcably took our land without due process of law we are trying to discover every effort to have it returned. The Organic Act gave us partial U.S. Citizenship without any public hearing on Guam before its enactment. We the people of Guam never voiced our total agreement in any referendum or compact agreement or treaty to the Organic Act. The United States entered into a signed Compact Agreement with other offshore territories. This situation is yet to come with our proposed Commonwealth Status.

Tinian's desire to allow you to erect the transmitter on their island is of some economic gain for the CNMI because a lease agreement on land will have to be entered into according to the Compact of Free Association relationship they have with that of the United States. They could be gaining millions of dollars in land rental fees plus gainfully employing some of their people.

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#197. Sites proposed on Guam for the ROTHR project include military lands that are not excess, military lands that are excess and lands that are in private ownership. This land ownership status has been identified in the DEIS. The Harmon Annex is an alternative site that has been reported excess and the DEIS acknowledges that status. Northwest Field is not excess military land and that status is not affected whether the ROTHR is sited there or not.

#197A. The compatibility of the ROTHR project with other development is discussed in Section 7.2.12 of the FEIS. Development of the of adjacent private lands will not be precluded by construction of the ROTHR receivers See #251.

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The endangered species of plants and animals may be eradicated by the ROTHR. We have lost so much of our natural enviroment, we have very little left.

Please go find another island where it will be both beneficial to you as well as the islanders like that of the CNMI.

Sincerely,

Carmen A. Kasperbauer

Carmen A. Kasperbauer
Senator 15th and 16th
Guam Legislature

cc: Congressman Ben Blaz
Governor Joseph Ada
Speaker Joe T. San Agustin
Senator Frank Santos

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COMMENT

RESPONSE

MARIANAS AUDUBON SOCIETY
P.O. BOX 4425, AGANA, GUAM 96910

September 25, 1989

Commander
Pacific Division
Naval Facilities Engineering Command
Pearl Harbor, Hawaii 96860-7300

Dear Sir:

The conservation committee of the Marianas Audubon Society has reviewed the Draft Environmental Impact Statement (DEIS) for Electronic Installations (Relocatable Over the Horizon Radar-[ROTHR]) in the Western Pacific issued in July 1989 and submits the following comments. Please note that these comments are in addition to general comments dated August 18, 1989 and submitted at a public hearing held here on Guam.

1. Sec 1, 2.1, and 2.4.1-Purpose and Need. Contrary to the claim made in the DEIS, the described need to provide "...early warning coverage of aircraft and ships coming from the Pacific coast of Russia, China, and Vietnam..." clearly involves an interconnected and coordinated system of three radar segments located in the west central Pacific. The stated need to provide early warning coverage against aircraft originating from as far north as Russia and as far south as Vietnam cannot be met with just one radar segment alone. The P-223 or just one of the other two segments alone can only provide 1/3 the coverage desired and can be easily circumvented by aircraft flying around its outer perimeter. It is apparent from the description in the Programmatic EIS and the planning undertaken to date that the Navy intends to deploy all 3 segments of the system. Therefore, the DEIS must speak to the combined impact of 3 sites in order for this to be a valid document.

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#198. See #40.

2. Sec. 2.3.3. Receiver Construction-clearing of trees. The DEIS claims that the Navy has determined, via computer evaluations, that an acceptable level of performance can be achieved without clearing of trees in front of the receivers. In the Draft Environmental Assessment for this project, the engineering specifications called for a clear zone well out in front of the receiver and with no obstructions into the front receiver zone that extends out and above the front edge of the receiver at a 1 degree slope. Any trees immediately in front of the receiver will protrude into this zone. How reliable were the computer evaluations of the performance of the system with obstructions in the forward receiver area? Were any experimental tests done? Wooden telephone poles or other wooden screens could be used to simulate tree trunks in front of a receiver. Results from such tests should be analyzed before any additional action is taken on the Guam ROTHR sites.

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#199. Computer evaluations were undertaken to determine the minimum amount of clearing that would be operationally acceptable. By allowing trees and vegetation to remain in front of the receiver array, outside of the cleared 172-acre area, performance of the ROTHR will be degraded. However, this degradation will be within acceptable limits. As stated in the DEIS, there will be adherence to the 172-acre cleared area. To initiate any changes to this plan, the Navy would again have to comply with NEPA and U.S. Fish and Wildlife Service requirements. The time and effort involved in such an uncertain endeavor would likely jeopardize the success of the entire project. The present commitment would not be made if the Navy did not have a high level of confidence in the completed studies.

3. Sec 2.5.2.1 Transmitter Locations. The elimination of all Guam sites but the Dandan site from consideration for location of the transmitters is based on superficial, generally unsubstantiated and consistently self serving justifications for eliminating many of the alternate sites. For example, Orote Point was eliminated for safety reasons because inhabited facilities cannot be built within the ESQD arc of the new ammunition wharf located there. Our review of the ESQD arc in the Final EIS for the Orote Point Ammo Wharf indicates that there is adequate room for inhabited facilities on the south and east side of Orote Point near the existing Navy housing. There may be adequate room to locate two transmitters, P-223 and P-225, on Orote Point. Likewise, eight sites in northern Guam were eliminated because of an unsubstantiated claim that Navy and Air Force communication receiver facilities located at NAVCAMS Finegayan and Northwest Field

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#200. See #34. All Federal lands were considered for siting of the ROTHR system. The Harmon Annex site is an excess parcel which was considered in the DEIS for the receiver antennas. See Appendix J Review/Evaluation.

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require a 15 mile isolation distance from high power, high frequency transmitters. Contrary to this claim, Figure 5.2.2 indicates a 2 mile RFI free zone, or isolation zone, is acceptable for NAVCAMS receiver facilities. The existing communications facilities at Barrigada are within this 15 mile isolation distance but do not seem to interfere with the NAVCAMS facilities. Is it not overly restrictive to claim a 15 mile isolation distance from these transmitters that are highly directional in design? It appears to us that transmitters could be located at the FAA, South Finegayan, and Harmon sites without interference with NAVCAMS. The Dandan site was listed as a potential transmitter site but was not further discussed elsewhere in the DEIS. A transmitter could be located on the current NASA site and utilize existing facilities such as the generators, housing, fences, etc. at a cost savings. Perhaps all three transmitter sites could be located in Dandan. The text implies that a factor in eliminating a number of transmitter sites on Guam was because the sites are on the federal excess lands list. We believe that other lots or portions of lots have been taken off the excess land list for other reasons, why not for use in this project. Other sites to consider for transmitters include Nimitz Hill Annex in the vicinity of the pipeline and Naval Magazine in the vicinity of the West Lookout Tower. 200

The location of transmitters on Guam and the receivers on Tinian is an approach that would resolve environmental problems on both islands. Because transmitters require less land, they would have fewer impacts on endangered species habitat on Guam. Additionally, the large receivers could be more easily located on Tinian and the smaller stature, passive receivers would not pose a radiation hazard or barrier to flying moorhens. 201

4. Sec 2.5.2.2 Receiver Locations. A number of receiver sites were excluded without adequate discussion of the rationale and justification for exclusion. For instance, the receiver for P-002 could be located on Orote Point if inhabited buildings were located outside the ESQD arc near the existing Navy housing and the receiver was equipped with a RFI barrier or shield as described on page 5-67. Likewise, the AAFB Marbo Annex was eliminated because of RF interference and vehicle traffic but the RFI free zone for a AAFB Marbo Annex site appears to be well out of the way of the communications equipment at Barrigada. If set back far enough, traffic along Route 1 should not be a problem or the system could be equipped with a RFI barrier or shield as described on page 5-67. The text implies that a factor in eliminating a number of receiver sites on Guam was because the sites are on the federal excess lands list. We believe that other lots or portions of lots have been taken off the excess land list for other reasons, why not for use in this project? Finally, a number of alternative receiver sites that seem practical to us were not considered. For instance, P-225 could be moved further south and accommodated in the South Finegayan and Harmon Annex area with a reduced loss of forest. These and other alternatives must be given serious consideration and thoroughly discussed in rewriting this document in order for it to meet accepted standards for an EIS. 202 203

5. Sec 2.5.2.1 and 2.5.2.2. Island-Combinations Meeting Siting Requirements. The DEIS claims that the island of Rota was eliminated from consideration for siting either receivers and transmitters there because use of Rota would be politically controversial. The DEIS cites a provision of the CNMI Covenant that requires the siting of all military facilities in the lease area on Tinian if at all possible before considering other areas. This provision does not appear to exclude Rota because Tinian would be used as well in a Tinian-Rota island combination. Furthermore, the provision requiring siting of all military facilities on Tinian can be waived upon agreement of the CNMI government as is evident from the recent siting and construction of the U.S. Air Force PACBAR III Satellite Tracking Station on Saipan rather than Tinian. During the public discussion of where to site the PACBAR III facilities, the Mayor of Rota expressed support for the idea of locating military facilities on that island. Locating ROTHR facilities on Rota would diversify the economy of that island. 204

#201. See #34. Radiation hazard to birds are not expected as discussed in Section 5.1.15.2 of the DEIS. The migration of moorhens between Tinian and Saipan has not been confirmed. However, the antenna towers are recognized as an obstacle since it projects above the skyline.
See #74.

#202. See #36 and #180.

#203. Land status is often an issue. All Federal lands were considered for the location of the ROTHR projects.

#204. See DEIS Section 2.5.2.1. The Covenant (Section 806) states that:

> The United States will continue to recognize and respect the scarcity and special importance of land in the Northern Mariana Islands. If the United States must acquire any interest in real property not transferred to it under this Covenant, it will follow the policy of seeking to acquire only the minimum area necessary to accomplish the public purpose for which the real property is required, of seeking only the minimum interest in real property necessary to support such public purpose, acquiring title only if the public purpose cannot be accomplished if a lesser interest is obtained, and of seeking first to satisfy its requirement by acquiring an interest in public rather than private real property.

Any action which is contrary to the spirit of this Covenant provision would be politically controversial. The siting of the Air Force PACBAR III tracking station on Saipan was controversial. However, the project requirements for this facility dictated a high elevation such as on Saipan as compared to low level sites on Tinian. To meet this Covenant condition, every effort should be made to site military projects on Tinian, including the ROTHR receiver or transmitter. Accordingly, since Federal lands are available on Tinian and Guam, Rota has not been considered suitable for consideration.

6. Sec 2.6 Reasonable Action Alternatives. The DEIS did not discuss a number of alternatives that were suggested by the MAS in writing or discussions with Navy Representatives. These included:

a. Overlapping Receivers so that they could be situated at just one site. The passive receiver function of the RCVRs suggests this is possible. Overlapping RCVRs would reduce the total amount of land needed by 2/3's for the project. 205

b. Divide the one large receiver into smaller pieces that will be easier to site. For example, locate one half in Harmon and one half in FAA, etc. 206

c. Relocate the smaller transmitters and receivers now located in the communications facilities at NAVCAMS Finegayan, NAVCAMS Barrigada and AAFB Barrigada area to other Navy land on the island (Naval Magazine, Nimitz Hill, Naval Station, etc.) thereby making room for all ROTHR Facilities at NAVCAMS Finegayan, NAVCAMS Barrigada, and AAFB Barrigada. 207

7. Section II Project P-223 EIS. Sec 3.1 Project Description. This overall section (secs 3.0-5.2.22) is titled the EIS for the P-223 segment. However, throughout the text all three segments, P-223, P-225, and P-002 are discussed as well as a discussion of the preliminary topographic and soil survey work for the P-225 site. From the organization of the document, it appears that discussion of all three segments was added at the last minute and consequently it is quite confusing throughout. Is this intended to cover all three sites? If so, there is inadequate consideration of alternate sites for P-225 (2-transmitter and 2-receiver sites) and P-002 (2-transmitter and 1-receiver). The alternative of locating transmitters on Guam (such as at Dandan or any of the other sites) and receivers on Tinian should be considered. 208

8. Sec 3.5.1 Transmitter Sites Mitigation Measures. 209
a. We are doubtful that the mitigation plan to retain the trees surrounding the transmitters will significantly reduce the hazard of bird collision with the antenna. Most trees on the site appear to be only 30 feet tall and we doubt they would deflect birds up over the 125-foot transmitter.
b. If a snake prevention plan is included, it must be described in adequate detail to allow evaluation of its effectiveness as a mitigation measure. If it is grossly inadequate to detect and intercept snakes, it is not a mitigation measure. 210

9. Sec 3.5.2 Receiver Sites Mitigation Measures. The few mitigation measures proposed by the Navy here and in section 5.2.22 are grossly inadequate to mitigate the impacts of the overall project. Those described apply only to the P-223 runway site. 211

10. Sec 3.6.1 Tinian Comparison Matrix. The matrix should have a separate section for endangered species. Further information on the impact of electromagnetic radiation hazards to birds must be presented before the conclusion that there will be no adverse impact can be accepted (Ref. CNMI Division of Fish & Wildlife letter of 22 August 1989 on DEIS). From our knowledge of the sites considered, the western and eastern sites will have far fewer impacts on endangered species and other wildlife due to collision with wires and electromagnetic radiation than the northern site. 212

11. Sec 3.6.2 Guam Comparison Matrix. The matrix should have a separate section for endangered species and proposed critical habitat. The matrix does not address impacts on recreation such as sport hunting at the various sites. The comparison of impacts between sites for fauna and flora as now written is absurd. The fauna section makes no mention of 213

#205. See #174.

#206. See #174.

#207. See #66 and Appendix J Review/Evaluation.

#208. The Description of the Proposed Action in the Summary for Section II (page iv) explained that the EIS would examine the probable impact from construction of Project P-223. In addition, the DEIS examined the probable environmental impacts from the construction of Projects P-225 and P-002 to the extent of available information. EIS's will be prepared to further explore additional sites and address in detail the environmental impacts of Projects P-225 and P-002.

#209. See #68 and #70.

#210. See #78.

#211. The mitigation measures have been reviewed for applicability to the preferred site in the FEIS. The DEIS did not have a preferred site.

#212. See #53.

#213. Effects of the proposed projects on habitat, flora, fauna, and specifically endangered species have been thoroughly discussed throughout the DEIS. Responses to Comments #32, #63, #64, #106, #111, #147, and #187 provide additional clarification regarding these concerns.

It has not been determined that hunting activities would be halted entirely at the proposed project areas, therefore, potential negative effects on recreational hunting cannot be substantiated.

The Navy is fully aware that certain portions of Guam are under "consideration" by the U.S. Fish and Wildlife Service for designation as critical habitat. If and when a proposal for designation of critical habitat is formally published, and if the Navy determines that its project may affect that proposed

COMMENT

impacts to endangered species that reside on P-223, P-225 and runway site. Endangered species do not reside on FAA and Harmon site but the matrix has the same impacts to fauna for all three sites. There are differences in the amount of proposed critical habitat that will be destroyed on all the sites yet this is not correctly evaluated. From our knowledge of the areas, there will be fewer impacts on fauna, flora, endangered species, proposed critical habitat, and recreational hunting on the Harmon site than any other site. There will be unacceptable impacts on endangered species, proposed critical habitat, and flora, and recreational hunting if any of the projects are built at the P-223, P-225, Runway, and P-002 sites. Other sites exist that will have far fewer impacts than the northern sites. | 213

12. Sec 4.1.7. Affected Environment-Tinian-Fauna. This section claims no Common moorhen observed on any of the sites because of the lack of wetlands. This does not consider impacts on birds and fruit bats flying through the general area that would collide with the antenna. The northern sites intersect the most direct path between Lake Hagoi and Lake Susupi. This is most likely the most heavily used flyway for Common moorhen moving between these two major wetlands. The Western and Eastern sites are not in this direct path flyway and would not have these problems. This should be noted and discussed in this section. | 214

13. Sec 4.1.12 Economic Characteristics. The alternative of locating receivers on Tinian would provide a greater economic benefit to the island of Tinian than the existing plan to locate the transmitter there. Locating receivers on Tinian would result in the permanent presence of more military personnel and dependents than transient contract workers. This would result in more infrastructure development such as housing, roads, etc. and contribute more to the local economy than contract workers. This should be considered. | 215

14. Sec 4.2.7.1 Affected Environment-Fauna Guam-Northern Sites.
a. The brief on site surveys of the P-225 (4-days), Runway (3-days) and P-002 (1/2-day) sites are not adequate to detect rare endangered species, particularly the nocturnal fruit bat. | 216
b.The DEIS does not mention the results of the 1986 fauna surveys for the P-223 site in which Micronesian kingfishers, an endangered species on Guam, were recorded. | 217
c. The text does not discuss the significance of the project sites for the remaining endangered species. The text states that northern Guam appears to be habitat for the remaining bird population of the island. This is imprecise and includes far to much land area now devoid of endangered species. It would be more correct to say the northern tip of the island including NAVCAMS, AAFB, Naval Facility and adjacent land locked private lands are the last remaining habitat for most endangered bird and bat species. Northwest Field, the Conventional Weapons Storage area on AAFB, and the northern forested area on NAVCAMS represent essentially all of the remaining habitat on the island that is suitable for the endangered Mariana crow, Micronesian kingfisher, and Guam flycatcher. | 218
d. The DEIS does not identify how much of each site is in habitat currently proposed for critical habitat designation. An estimate such as 100%, 50% etc., would be meaningful and assist in decision making. | 219

15. Sec 4.2.7.2 FAA Site. The DEIS does not identify how much of this site is in habitat being proposed for critical habitat designation. An estimate such as 100%, 50% etc., would be meaningful and assist in decision making. | 220

16. Sec 4.2.7.3 Harmon Annex Site. Why was this alternate site not surveyed or given serious consideration? This omission demonstrates that alternative sites were not given appropriate consideration throughout the entire EIS planning process. The 1/2 day surveys done for the other alternate sites also demonstrate this point. From our knowledge of the environmental resources on this site, it is the site with the least environmental concerns but it apparently has not been given serious consideration. The DEIS does not identify how | 221

RESPONSE

critical habitat, it will confer with the USFWS as directed by Section 7 of the Endangered Species Act. See Section 3.2.7 of the FEIS.

#214. This item was discussed in Section 5.1.9 of the DEIS.

#215. See #34.

#216. Extensive biological studies have been conducted on Guam to identify potential conflicts between the proposed receiver facilities and any GOVGUAM or federally listed species, and to satisfy biological assessment requirements under Section 7 of the Endangered Species Act. The results of these studies are discussed throughout the DEIS and are consistent with other flora and fauna evaluations and reports involving the plants and animals of the northern plateau of Guam. Extensive literature review was also used as apparent in the DEIS list of references. See #113, #156, and #173.

#217. Comments noted. See Section 6.2.7 of the FEIS.

#218. The U.S. Fish and Wildlife Service (USFWS) has estimated that approximately 30,500 acres of forest habitat suitable for the Mariana Crow currently exist on Guam (16,900 in northern Guam and 13,600 in southern Guam). Only 12,500 acres in northern Guam are required to obtain the USFWS Draft Guam and Rota Forest Bird Recovery Plan population size of 500 crows in northern Guam. This means that approximately 4,400 additional acres currently exist in northern Guam over what would be required to meet the recovery plan goals for this species. This is particularly significant considering the Mariana Crow requires more forest habitat than any of the other species considered. It is therefore clearly evident that project related habitat losses, calculated at less than 1% of the available forest habitat on Guam, would not negatively impact habitat requirements needed to sustain, or permit the recovery of, Guam's endangered species.

It is also noted that the primary cause of avifaunal decline on Guam has been attributed to predation by the brown tree snake and not loss of habitat. Many of the presently endangered species once utilized habitat that is still abundantly available in other areas on Guam. See #63 and #185.

#219. This comment is considered inappropriate as no action has yet been taken by the U.S. Fish and Wildlife Service to formally propose critical habitat designation on Guam. See #110, #148, and #163.

#220. See #219.

much of this site is in habitat being proposed for critical habitat designation. An estimate such as 100%, 50% etc., would allow comparisons with other sites on this critical variable. | 221

17. Sec 4.2.8.1 Northern Sites-Flora. We disagree with the conclusions of the flora surveys for the P-223, P-225, P-002 and Runway sites. The DEIS indicates that there is no limestone forest on any of these sites with the exception of a portion of the P-225 site which contains a regrowth limestone forest and modified limestone forest on P-002 site. Secondary and primary limestone forest does occur on these sites. The GOVGUAM Bureau of Planning maps showing no limestone forest on these sites are wrong. The native species described as minor vegetation types are for the most part characteristic of secondary and primary limestone forest. The author appears to be suffering from an inability to see the forest because of all the trees. Virtually all of P-002 is pristine limestone forest. Sizeable portions of the P-223, and P-225 are good quality secondary limestone forest. All four sites are utilized by endangered species and included in proposed critical habitat and essential habitat. The quality of these sites is indicated by the continued presence of endangered species on and only on these sites and contiguous areas. If the habitat was not good, they would not be there. | 222

18. Sec 4.2.8.3 Harmon-Flora. A flora survey needs to be done for this site. Our general knowledge of the Harmon area indicates that most of this site is highly disturbed, i.e. short grass and shrubs with few trees. Thus, use of this site would have the least impact on vegetation. The comparison of this site with other sites on the basis of consequences to flora cannot be made unless the survey of flora is included in the DEIS. | 223

19. Sec 4.2.10.1 Land Use-Northern Sites. The DEIS correctly indicates that all 4 sites are within hunting areas of AAFB and NAVCAMS. However, the document does not indicate how important these areas are to recreational hunting on the island. The NAVCAMS and AAFB are the most important and most popular hunting areas on the island. | 224

20. Sec 4.2.10.2 and 4.2.10.3 Land Use-FAA and Harmon. The Harmon site is not open to public hunting. Only a small portion, if any, of the FAA site is open to public hunting. | 225

21. Sec 4.2.11 RFI. This section indicates that the RFI-free zones for the NAVCAMS communication equipment is 2-miles, not the 15 miles used as justification for not putting the ROTHR transmitters in any central or northern Guam sites. This is an example of contradictory statements being used in this DEIS to support or justify decisions on sites at different places in the document. Here a site is promoted on the basis that because it is 2-miles away from NAVCAMS communication equipment it will not be a problem. Earlier in the document, all transmitter sites in central and northern Guam were regarded as unsuitable because they would be within 15-miles of communication equipment. | 226

Environmental Consequences Section

22. Sec 5.1.9.1 Tinian-Fauna-Northern Sites.
a. The DEIS claims that the antenna towers and guy wires would not present significant obstacles to birds in flight and discounts the threat that the 125 foot tower posses to endangered Common moorhen's from bird strikes and collisions during migration between Lake Hagoi on Tinian and Lake Susupi on Saipan. The northern transmitter sites lie directly in the path of birds that would be migrating between these two wetlands and collisions are expected. Collisions with cars, buildings, and wires are a sources of mortality for this species on Guam and is expected on Tinian. Location of the transmitters at the eastern and western sites would take the towers out of the moorhen direct flight path between Susupi and Hagoi and greatly reduce the probability for collisions and death. | 227

#221. Field studies of the Harmon Annex site for Project P-223 were conducted in March 1990. The results are presented in Appendices E-1, F-1, and G-1.

Surveys were not conducted at Harmon Annex because a major electrical power plant is located less than one mile in front of and adjacent of the site. A radio frequency occupancy test was undertaken by the Navy to verify whether the existing electromagnetic radiation interference at the site would still enable receipt and identification of the returning radio wave data from the over the horizon target area. The survey results indicated that the Harmon Annex is considered an acceptable site location for the ROTHR receiver. Complete flora, fauna and archaeological surveys were subsequently conducted and all sites that are operationally feasible alternatives for P-223 have been surveyed. See FEIS appendices.

#222. There is ample forest area of equal and higher habitat value in both northern and southern Guam to allow for the recovery of Guam's endangered avifauna. Only a very small percentage of the existing forest habitat in northern Guam which is known to support endangered species would be affected by the receivers. See #32, #64, #138, #185 and #218.

#223. Comments noted. See Sections 6.2.8 and 7.2.8 of the FEIS and Appendix F-1 for a discussion of the flora survey for the Harmon Annex site.

#224. Hunting statistics have been included in Section 6.2.10 of the FEIS.

#225. See Section 6.2.10 of the FEIS.

#226. See #34.

#227. Potential affects of the proposed transmitter sites in northern Tinian on the Mariana Common Moorhen are discussed in the DEIS on page v, and in Section II, pages 3-7, 5-10 through 5-13, and 5-49 through 5-51. The U.S. Fish and Wildlife Service in their Section 7 Endangered Species Act consultation process has identified mitigation measures are needed to reduce the chances for moorhen collisions. See Appendix K.

It should be noted that data demonstrating moorhen flight movements occur between Commonwealth islands are not available. See #33, #68, and #70.

b. The threat to Tinian from the accidental introduction of the brown tree snake is real. There have been two new snake reports from the CNMI in the past 6 months, one on Rota and a third sighting on Saipan. The snake has also been reported from Cocos Island which is snake free. Translocation is occurring. Additionally, this snake has the ability to store sperm for future use. 228

#228. Comments noted. The Navy is aware of the seriousness of translocation of the brown tree snake and is in support of all efforts to control and eradicate this species. See #78. See FEIS Section 4.4.

23. Sec 5.1.11 Social and Economic Characteristics.
a. Locating the Receivers rather than the Transmitters on Tinian would increase the number of permanent personnel needed to operate the system and result in greater economic benefits to the island of Tinian.
b. The DEIS does not provide any estimate of the size of the exclusion zone for hunting on Tinian. 229
c. The DEIS implies that the use of 174 acres at the Eastern and Western Sites would somehow preclude the lease back agreement for 12,500 acres of land. 230

#229. The hunting exclusion zone will have to be determined based on the type of weapon used. Safe distance from the firing area to the facilities and personnel working at the ROTHR sites is the primary concern.

#230. The use of 174 acres at the Eastern and Western sites would not preclude the total leaseback agreement proposed by the U.S. However, adjustments to the area would be expected and negotiations would be undertaken in accordance with the Covenant and Technical Agreement discussed in Section 3.1.10 of the DEIS.

24. Sec 5.1.15.2 Radio Frequency Hazards to Personnel. The DEIS claims that small animals and birds, because of their small size relative to the wavelength of the ROTHR signal, are in no danger from ROTHR radio frequency emissions. The preparers of the DEIS do not provide any data on which to base this conclusion but rely on an internal Navy report on the electromagnetic environmental effects associated with ROTHR [Ref. 3]. Because electromagnetic radiation can be hazardous to living animals, as is recognized by the delineation of a radiation hazard zone, and because the issue of harming an endangered species via electromagnetic radiation is involved, this section on HERPs should be supported by original or referenced data from studies conducted utilizing accepted scientific methodology and have all or at least the appropriate sections of the Navy report [Ref. 3] included as a referenced appendix. 231

#231. See #74.

25. Sec 5.1.22 Mitigation for Transmitters on Tinian.
a. We doubt that the mitigation plan to leave tall trees around the transmitters will significantly reduce the hazard from bird strikes. Most trees on the site are only 30 feet tall and we doubt that they would deflect birds over the 125-foot transmitters as stated.
b. The mitigation plan also states that access to waterbird or forestbird habitat adjacent to ROTHR antennas will be prevented. How will this be accomplished without additional fencing or personnel to patrol the areas. Neither fencing or personnel are included in the project description. Even if these measures were implemented, we doubt they would be very effective. Fences and security personnel have not stopped poaching on Guam. 232
c. The following mitigation measures should be included in the snake mitigation plan:
1). Direct shipment of high risk materials and equipment from Mainland US to Tinian by-passing Guam. 2). Mandatory implementation of the CNMI Division of Fish and Wildlife new snake detection protocol. 3). Establishment of a snake-response stock pile of traps, bait, head lamps, and other materials on Tinian to provide equipment on site for an emergency response team. 233

#232. The Northern sites on Tinian are located about 1 1/2 miles from the known waterbird habitat. Construction and operation of the transmitters will not affect this habitat.

To prevent easy access to bird habitats, the site layout plan will ensure that new accesses to the ROTHR site are kept to a minimum and a continuous forest barrier be maintained, if existing, around the transmitter site except for the necessary access connection to existing roads or taxiways. The proposed project will not prevent hunters or sightseers from entering bird habitats from other entry points. However, entry into the transmitter area would be controlled by warning signs and by visual observation due to the cleared open areas of the antenna field.

#233. Comments noted. See Section 4.4 of the FEIS.

26. Sec 5.2.9 Guam-Fauna-Northern Sites-Critical habitat. The discussion on the need for and merits of critical habitat is without merit. The USFWS has concluded that critical habitat will benefit the species involved and has initiated the designation process. Virtually all the areas included in the northern sites fall within the area proposed for critical habitat by USFWS. 234

#234. This comment is considered inappropriate as no action has yet been taken by the U.S. Fish and Wildlife Service to formally proposed critical habitat designation of Guam. See #39, #148, #166, #191, #213 and #219.

27. Sec 5.2.9.1 Fauna-Northern Sites. The statement that clearing forest areas for construction of the antenna arrays will merely cause the movement of endangered birds into other habitat without impact is unsubstantiated. Dislocation of endangered species off currently occupied habitat into unoccupied areas could results in the death of the bird due to higher predation rates or just stress from the dislocation. Dislocation would likely disrupt 235

#235. See #32, #64, #147, #190, and #218.

breeding behavior and reproduction. Dislocation of the endangered species on these sites will likely result in their death which in the case of the Micronesian Kingfisher and Guam Flycatcher will jeopardize the species continued existence in the wild. Dislocation and death of a considerable number of crows will impede the recovery of the Guam population of this species. 235

28. Sec 5.2.9.1 Fauna-Northern Sites. The Habitat loss analysis performed in the DEIS is not appropriate to the issue of the projects impact on endangered species. The analysis assesses the percentage loss of habitat from the project in relation to forest habitat on the entire island as if the entire island was still inhabited by the endangered species at risk. The northern sites under consideration for this project are in the heart of and a major portion of the last remaining occupied habitat of the endangered Mariana Crow, Micronesian Kingfisher, and Guam Flycatcher. The loss of this habitat will have a significant major negative impact on these species. The fact that major portions if not all of these sites are proposed "critical habitat" further establishes the importance of this habitat and the need to protect it. 236

#236. See #218 and #234 for added clarification regarding habitat loss and proposed critical habitat.

29. Sec 5.2.9.1 Fauna-Northern Sites. The argument that much of these sites is secondary vegetation and of lesser value to Crows and Kingfishers is in error. Clearly the habitat on these sites is good for these species because these are some of the few sites where these endangered species are still found. 237

#237. See #59, #218 and #222.

30. Sec 5.2.9.1 Fauna-Northern Sites. The statement that Northwest Field and the Conventional Weapons Storage Area were the last snake free areas of Guam is wrong. USFWS 1983 bird surveys found some species of birds gone from Northwest Field by this date but all remained in the Ritidian area. This is evidence that the snake reached Northwest Field prior to Ritidian. 238

#238. Comments noted.

31. Sec 5.2.9.1 Fauna-Northern Sites. The cumulative effects definition used in this section is wrong. It is the definition used in the Endangered Species Act. Cumulative effects in the NEPA process must include all actions, federal and non-federal, that are reasonably certain to occur. Contrary to the statement in the DEIS, all three sites will require analysis for cumulative effects according to NEPA regulations. 239

#239. See Sections 4.3 and 8.3 of the FEIS.

32. Sec 5.2.9.2 Fauna-Former FAA. Contrary to what is stated in the DEIS, construction on this site will not have impacts similar to those described on northern sites. Because this site does not contain endangered species, it clearly will not have the major significant effect on endangered species as will occur in the northern sites. Also, the amount of proposed critical habitat located on the FAA site is much less than that on any of the Northern Sites. However, there will be some loss of proposed critical habitat which is of concern. 240

#240. Comments noted.

33. Sec 5.2.9.3 Fauna-Harmon Annex. Because this site does not contain endangered species nor proposed critical habitat, construction on this site will have fewer impacts on endangered species or fauna in general than the northern sites.

34. Sec 5.2.10.1 Flora-Northern Sites. Loss of the good quality secondary and pristine limestone forest on these sites will be a significant negative impact. Good quality secondary and pristine limestone forest is a valuable, limited natural resource on the island and it provides good wildlife habitat. A number of recovery programs for reestablishment of viable populations of formerly native species are dependent on the continued availability of this habitat.

COMMENT

35. Sec 5.2.10.2 Flora-Former FAA. Loss of the good quality secondary limestone forest on this site will be a significant negative impact. Good quality secondary forest is a valuable, limited natural resource on the island and it provides good wildlife habitat.

36. Sec 5.2.10.3 Flora-Harmon. We believe this site is predominantly mixed grass and shrub and construction of the project here will have the least effect on flora.

37. Sec 5.2.16 Hunting. There is inadequate discussion of the size of the security area around the receivers and how hunting will be limited. Will gun hunting be allowed? The Northwest Field and NAVCAMS area represents a significant portion of the area currently available for public hunting. We suspect that the location of receivers in either of these areas will eliminate all gun hunting in these areas because of safety and security reasons. Hunting is currently not authorized on the Harmon site and use of this site would have little effect on the amount of hunting available to sportsman.

38. Sec 5.2.22 Mitigation of Adverse Impacts. The DEIS list siting the receiver on the North Runway as a mitigating measure. Using the criteria discussed in this section, siting the receiver at Harmon outside the occupied range of endangered species is a mitigative measure that would have fewer impacts on endangered species, destroy less proposed critical habitat, and remove less forest vegetation than any of the northern sites or the FAA site.

39. Sec 6. Topographic and Soil Surveys. A 25 foot topographic and soil survey grid system is not justified for the environmental planning needs of this project. The impact of a 25 foot grid on the vegetation alone is excessive, particularly in proposed critical habitat. Destructive vegetation surveys of this magnitude should not be done until there has been a final determination made as to the siting of the P-225 segment. We note that similar topographic and soil surveys are not proposed for alternate sites, again indicating that alternate sites are not being seriously considered.

Our review of the DEIS as discussed above found that the document was incomplete in that it did not address a number of viable alternatives that deserve serious consideration, it did not address the scope of the whole project, i.e. three sites within one functional system and the cumulative impacts of all three sites, it did not correctly assess the impacts on endangered species and their habitat, and it did not address other impacts such as the effect on recreational hunting on the island. Contrary to what is indicated in the DEIS, it is clear from the information presented (albeit somewhat limited on alternative sites) that siting receivers at the Harmon, FAA, or Dandan sites will have far fewer environmental impacts than siting receivers at the proposed Northern Sites. We therefore request that the deficiencies detailed above be corrected by rewriting and circulating a second draft of this document prior to proceeding to the Final Draft stage in this environmental review process.

Thank you for the opportunity to comment.

Sincerely,

Ralph Frew
Chairman, Conservation Committee

RESPONSE

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#241. For the Runway site, four hunting areas will be eliminated of the 55 designated. Six hunting areas which border the southern side of the antenna may be reduced in size for safety reasons. However this decision should await on-site evaluation of the actual field condition.

242

#242. See Section 4.4 and 7.3 of the FEIS.

243

#243. Topographic information is needed to make informed engineering decisions. The proposed action described in Section 9.2 is to conduct the surveys at those feasible location that lack the information. The impact to the areas to be surveyed are discussed in Section 9.4. See Appendix L for the USFWS biological opinion.

COMMENT

RESPONSE

Commonwealth of the Northern Mariana Islands
Office of the Governor
Capitol Hill, Saipan, MP 96950

Phone: (670)322-5091
(670)322-5092
(670)322-5093
Telex: 783-622 Gov. NMI
Telefax: (670)322-5096

4 OCT 1989

Commander E.C. Rushing, Jr., CEC,
Head, Facilities Planning Department
Department of the Navy, Pacific Division
Naval Facilities Engineering Command,
Pearl Harbor, Hawaii, 96860-7300

Dear Commander Rushing:

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The Commonwealth of the Northern Mariana Islands appreciates the opportunity to comment on the Draft Environmental Impact Statement for Electronic Installations in the Western Pacific, Department of the Navy, Naval Space Command, July, 1989. We also appreciate the additional time you gave us by moving the deadline for comments to 5 October 1989.

It is the very strong policy of this Administration to support the U.S. Milltary whenever possible. However, as you are aware, in my role as Governor, I must weigh all the various factors involved in a decision as important as this. This letter forwards my comments and comments from two CNMI agencies. Because public hearings were conducted in Saipan, and because you wrote directly to our Coastal Resources Management Office (CRMO), CRMO and the Division of Fish and Wild Life of our Department of Natural Resources provided their comments directly to you or Mr. James Chun of the Naval Facilities Engineering Command. I am enclosing additional copies of those comments for your convenience.

The first set of comments enclosed is from our Coastal Resources Management Office (CRMO). The administrator of that office has found that some aspects of the draft EIS are not consistent with CRMO policies. The first CRMO comments asks that you coordinate your planning with the CNMI Historic Preservation Office to protect the historic nature of the North Field site. It also references the comments made by the CNMI Division of Fish and Wildlife and asks that additional research be undertaken to determine various possible impacts on bird life and to determine what mitigation measures, if any, would be necessary. It asks that such planning for such mitigation measures be done in cooperation with the Division of Fish and Wildlife. Finally, the CRMO comments ask that additional research be done to assess the potential impact of electromagnetic radiation on mammal and human life.

COMMENT

RESPONSE

This letter also forwards copies of the comments already provided to Mr. James Chun by the Division of Fish and Wildlife of the CNMI's Department of Natural Resources on 28 September 1987, 29 June 1988, 22 August and 6 September 1989.

I am also forwarding a set of comments prepared by Dr. Michael Kenney of my staff on the potential impacts of the electromagnetic radiation of the ROTHR facility on human health. This is a revision of an earlier draft which was forwarded to you by our Coastal Resources Management Office and Division of Fish and Wildlife. Dr. Kenney and Dr. Stephen Weinstein, pathologist at the Commonwealth Health Center collaborated on the research for these comments. You will note that the research conducted by Dr. Kenney and Dr. Weinstein is grounded in respectable scientific journals. It does appear that these health concerns require additional study by the Navy before a decision is made to build the facility. I endorse their recommendations and respectfully request that you will seriously review them as I consider the health and safety of those who will work at the Tinian site as well as the residents of the CNMI to be of paramount importance.

Finally, I am also concerned about information provided to us by Lt. Governor Frank F. Blas, Chairman, Aviation Policy Task Force, of the Government of Guam. Lt. Governor Blas forwarded a consultant's analysis (copy enclosed) prepared by Mr. Willis Cannon, which states that the ROTHR transmitters "could possibly render all the Instrument Approaches to Runway 7 as unusable, effectively closing the Saipan Airport during "Instrument" weather conditions. If true, this would be a serious blow to Saipan's economy. I would very much appreciate it if you would address this issue as you revise the draft EIS.

10 - 100

At this time I have no objection to the proposed ROTHR facility for Tinian. Indeed, I would like to support the proposal, but it is incumbent upon me to take into consideration the safety and welfare of the community. I am sure you will give serious consideration to our concerns. As I stated above, my office would like to assist you in producing a final EIS which will be acceptable to all parties. I think we should have no serious problems in cooperating on this important issue.

Sincerely,

PEDRO P. TENORIO
Governor

COMMENT

RESPONSE TO THE DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR THE OVER-THE- HORIZON RADAR INSTALLATION PROPOSED FOR TINIAN:

POTENTIAL HUMAN HEALTH IMPACTS OF THE ROTHR INSTALLATION

Michael L. Kenney, Dr. P.H., M.C.P.
Special Assistant for Socioeconomic Planning
Office of the Governor

Introduction

The proposed ROTHR transmitter facility for Tinian will generate non-ionizing electromagnetic radiation operating in the range of 5 to 32 MHz according to the "Draft Evinronmental Impact Statement for Electronic Installations In the Western Pacific", Department of the Navy, Naval Space Command, July, 1989. Each system will produce up to 200 kW of electrical power. (Draft EIS, page 2-4). The draft EIS asserts that the primary biological effects of the "quantum energies from RF radiation" are thermal (Section 5.1.15.2, pp. 5-22 to 5-23). The draft EIS states that "such effects do not constitute a hazard." The section goes on to state that a radiation hazard exclusion fence will be constructed along the perimeter of the 58 acre transmitter site on Tinian's North Field to protect personnel near the transmitters. The name of this fence implies a radiation hazard, if only thermal. No distinction is made between potential hazards to employees of the facility inside the radiation hazard fence; to persons on the ground on Tinian excluded by the hazard exclusion fence, or to persons on Saipan living under or in the radar beam transmitted by the facility. 244

The assertion that non-ionizing electromagnetic radiation poses no human health hazards other than thermal effects rests on the citation of a Navy publication, "A Study of Electromagnetic Environmental Effects Associated with the Relocatable Over the Horizon Radar" given as reference [3]. Reference [3] is dated March 7, 1989. The Navy furnished a photocopy of a document with the same name dated 1 August 1989. It is subtitled: "Volume I: Hazadrous Electromagnetic Radiation". To distinguish between reference [3] dated 7 March 1989 and the 1 August document of the same name, the 1 August document will hereinafter be called "Volume I". For purposes of these comments, it is assumed that reference [3] (which has not been made available to the CNMI) and Volume I are two different reports of the same study, and that they are identical or nearly identical. 245

Section 5 of Volume I is labeled "RADIATION HAZARDS". Sub-section 5.0 is labeled "BIOLOGICAL EFFECTS". Sub-section 5.0 is virtually word-for-word the same as the first two paragraphs of Section 5.1.15.2 of the draft EIS. Sub-section 5.0 does not contain any evidence regarding the potential biological effects of electromagnetic radiation. This means that in essence the draft EIS: (1) is citing itself as authority; and (2) lacks any evidence to support the assertion that electromagnetic radiation poses no threats to human health! 246

(Enclosure to CNMI Governor Pedro P. Tenorio letter of 4 Oct 1989)

RESPONSE

#244, # 245, and #246. In response to the collection of comments made in the introduction of Dr. Kenney's letter, it is apparent that a clear understanding should be made concerning the purpose of the publication, "A Study Of Electromagnetic Environmental Effects Associated With The Relocatable Over The Horizon Radar" (short titled, ROTHR E^3 Study).

The basis of the ROTHR E^3 Study can be explained by the two objectives used to develop the document:

1. Present the national recognized standard and Department of Defense (DOD) adopted policies concerning non-ionizing Electromagnetic Radiation (EMR) exposure to personnel, volatile fuels, ordnance and electronically controlled aircraft.

2. Present technical papers, studies and calculations which identify and explain the analysis used to determine safe separation distances from the ROTHR transmitting elements for all of the aforementioned exposure subjects.

The ROTHR E^3 Study does not attempt to establish it's own safety standards for any of the known Electromagnetic Radiation (EMR) hazards. Each of the organizations which publish standards utilized in the ROTHR E^3 Study has, in developing recommendations, critically reviewed the available literature, studies and experiments pertaining to the subject matter. Specifically, for biological hazards, the DOD has adopted through DOD Instruction 6055.11 [Ref. 78], the recommendations of the American National Standards Institute (ANSI) document C95.1, 1982. A copy of the ANSI standard C95.1 can be obtained at most libraries or by contacting The East 47th Street, New York, N.Y. 10017 (the organization which holds the copyright). It is suggested that all persons concerned with biological effects of EMR obtain a copy of this document as it contains explanation and insight to the process of establishing the standard and describes the added degree of conservatism written into the limit exposure levels.

The ROTHR E^3 study has been compiled for inclusion by reference into the environment impact document for all planned ROTHR sites and, as previously expressed, it's contents are based on the recommendations of recognized and adopted national standards. Therefore, neither the DEIS nor the ROTHR E^3 Study has "cited itself as authority". The evidence which Dr. Kenney had hoped to find to support an assertion that "electromagnetic radiation poses no threats to human health" was not found in the ROTHR E^3 Study simply because such as assertion does not exist. To assert that "electromagnetic radiation poses no threats to human health" would preclude the need to adopt safety criteria. The Navy has recognized the potential threats of EMR to human health since the topic came into existence.

COMMENT

Although asserting that there will be no direct negative health effects of the electromagnetic radiation from the proposed ROTHR facility, page 4 of Volume I contains the admission that "There are few definitive sources of data for quantifying and evaluating the radiation hazards identified in this document." In the same passage the point is made that "As emitters become more and more powerful . . . the need for research and agreed-upon standads to minimize risk is escalating." At the very least the draft EIS should propose exposure standards for public review in the potentially affected population, and should provide estimates of expected exposures.

There is a growing body of credible scientific evidence which indicates that in addition to the stipulated thermal effects, there are or may be potential carcinogenic, teratogenic, and perhaps mutagenic effects from electromagnetic radiation. Some of this evidence is cited below. These risks were not identified in the draft EIS. Evidence of these potential biological effects of non-ionizing electromagnetic radiation or the uncertainty surrounding them has been presented in the literature for humans and animal models. There is even evidence that the thermal effects of non-ionizing electromagnetic radiation cause birth defects in laboratory animals.

Early concerns over the possible negative health consequences of non-ionizing electromagnetic radiation arose with respect to very high voltage (765 kV) electric transmission lines which came into increasing use in the 1970s. A number of studies were published which reported negative effects on the health of humans exposed to the electric and/or magnetic fields generated by these transmission lines. Other studies have been undertaken to assess the effects on human health of electromagnetic fields from housing wiring, appliances, and other potential sources of such fields. Many studies reported no effects while others reported some negative human health effects. In general, the evidence was mixed and inconclusive.

The Office of Technology Assessment (OTA), an agency of the United States Congress, commissioned a background paper on the biological effects of power frequency electric and magnetic fields from the Department of Engineering and Public Policy of Carnegie Mellon University.[1] This study is a substantial (but not exhaustive) review of the literature involving: sources and nature of field exposure; cellular level experiments; whole animal experiments; comparison of laboratory and human exposures; and epidemiological studies of cancer and electromagnetic fields. The study found the results of the literature review "complex and inconclusive". The authors stated that "epidemiological evidence, while controversial and subject to a variety of criticisms, is beginning to provide a basis for concern about risks from chronic exposure". They continue:

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[1] Nair, Indira; Morgan, M. Granger; and Florig, H. Keith, "Biological Effects of Power Frequency Electric and Magnetic Fields: Background Paper": Washington D.C: U.S Congress, Office of Tecnology Assessment. May, 1989.

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RESPONSE

#247. Although accepted standards for exposure of certain aircraft flight control systems have not clearly emerged, the hazards of RFEMR at HF frequencies have been researched over much of this century and are very well understood.

The recommended limits of EMR exposure to both facility workers and the general population are given by the ANSI standard and explained in Section 5.2.1 of the ROTHR E^3 Study. Specifically for ROTHR frequencies, these limits are for 3Mhz to 30Mhz and described as follows:

> The planewave free-space power density at the incidence of exposure shall not exceed a value given by 900/F^2 in the unit of milliwatts per square centimeter (mw/cm^2), where F denotes the value of frequency in megahertz.

For example, at a frequency of 28Mhz, the maximum allowable power density would be 900 divided by (28)^2 or 1.15 mw/cm^2.

For estimates of the expected EMR exposure levels to the general population by the proposed ROTHR transmitter see the response to question #248 following.

COMMENT

"In our view, the emerging evidence no longer allows one to categorically assert that there are no risks. But it does not provide a basis for asserting that there is significant risk". (emphasis added)

The Government of the Commonwealth of the Northern Mariana Islands (CNMI) cannot go beyond the known scientific evidence and assert a proven significant risk to its population from the proposed ROTHR facility. However, the CNMI Government does take note of the finding that there is sufficient evidence of the potential risk to human health of electromagnetic fields and radiation that one cannot make the categorical assertion, as the draft EIS does, that there are no human health risks from the proposed ROTHR facility.

The CNMI government also wishes to emphasize that the studies cited in the OTA background paper centered on exposures to 60 Hz electromagnetic fields. The proposed ROTHR would operate between 5 and 28 MHz. This frequency operating range is five orders of magnitude higher than the 60 Hz exposures studied.

Volume I states that "The greatest hazard to humans is in front of the high band array in the main beam of the antenna at 28 MHz." (page 13). The facility will be using transmitters capable of producing 200 kW of input power to the antennas. However, the antennas are high gain and will propagate a much more powerful beam. On page 14 of Volume I the antenna array gain at 28 MHz (worst case) is given as 25 dbw, a power magnification of 316 times. This means the 200 kW must be multiplied by 316 to calculate the actual, effective 63.2 million watts of electromagnetic radiation being emitted from the center of the antenna.

Chronic exposure to both the very high power and the considerably higher frequencies of the proposed ROTHR facility may have significant human health impacts not assessed in the literature which focuses on lower frequencies. In addition, there are wave length factors which may have an effect on human beings. These three parameters -- power, frequency, and wavelength -- should be discussed separately in the EIS as they may significantly affect human health.

Although the beams will be directed "at an upward angle" (volume I, page 13), because the beams will be cone-shaped and the spread of the beams will increase as they move away from the transmitters, it may be possible that the high level of power passing over the length of the most populated region of Saipan from project P-002 expose the residents of the island to significant levels of electromagnetic radiation. The draft EIS does not estimate a range of doses of electromagnetic radiation to the people of Saipan living continuously under the beam at different effective radiated power levels. Similarly, no estimates are given potential exposures to people living along the northwest coast Tinian from the project P-225. Also, such estimates must be among the first taken taken to determine if a potential hazard exists or does not exist. An estimate exposure level to workers should also be calculated.

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RESPONSE

#248. The comments contained in this section of Dr. Kenney's response do not ask any specific questions but seed several implications which deserve discussion.

Dr. Kenney cites epidemiologic statistical studies which suggest a link between cancer and Extremely Low Frequency (ELF) electromagnetic fields (60Hz power lines) and questions if such radiation might have at least the same, or if not greater an effect at much higher frequencies. To begin with, there are currently nearly as many epidemiological studies that suggest there is no parallel between ELF and cancer as there are studies which suggest a trend. [Ref. 79]

Just as there is a distinction made between ionizing and non-ionizing EMR, there is also a distinction to be made between non-ionizing EMR and ELF electromagnetic fields. In a response prepared for Dr. Kenney's comment by the Navy Bureau of Medicine and Surgery (see Appendix 1) there is explanation concerning the magnitude of difference between these two kinds of fields and their effects on biological entities. It is the position of the Bureau that the epidemiological studies cited in Dr. Kenney's letter have "...no relevance to the known biological effects of HF transmission of 5 to 32MHz".

Dr. Kenney also stated that 63.2 million watts of electromagnetic radiation will be emitted from the center of the antenna. This deserves clarification particularly for individuals submitting concerns for bird and small animal species which may penetrate the boundaries of the personnel exclusion zone. At no one point will 63.2 million watts of energy exist either around or in among the elements of the antenna array. The transmitter array is made up of 16 elements each of which radiate at power levels from 5kw to 20kw. The total power radiated is 200kw maximum. This is comparable to the highly directed 100kw signals transmitted from shortwave stations KHBI and KFBS which have been safely operating on Saipan for several years. The directional "beam forming" of these antenna is similar to that of ROTHR. Antennas of this type focus their radiated energy in the preferred direction at the expense of energy radiated in all other directions. The result for ROTHR is that, beginning at a distance of 1.5 to 2 kilometers (the far field boundary), along the main beam, the signal appears to be coming from a much larger transmitter. At the far field boundary where the beam has formed the ROTHR appears to be coming from a point source isotropic transmitter of 63.2MW (200kw x 25dB gain) -Dr. Kenney's figure. It must be understood, however, that signal dissipation with increasing range dominates the equation by the time the signal reaches the far field boundary. The effect is that the highest (and therefore most potentially harmful) field strengths are those found in close to the antenna elements. The value of these field strengths are well documented in the ROTHR E^3 Study and the levels which exceed the recommended exposure criteria will only exist within the boundaries of the personnel exclusion fence.

Dr. Kenney raised concern for the safety of the general population of Saipan which is approximately 3.5 miles from the proposed northern ROTHR transmit site. Some estimates of expected EMR exposure to the general population are presented in Figures 1 and 2. It should be noted that these levels are several hundred times smaller than the exposure limits recommended by ANSI and each estimate represents the very highest exposure level attainable (main beam steered to provide the maximum ground wave to the area). In fact, the ground wave levels

COMMENT

Potential to Damage Human Health

Summaries of some of the studies which have found that non-ionizing electromagnetic radiation has the potential to damage human health follow:

Brown and Chattopadhyay conducted a substantial literature review of the potential relationship between electromagnetic field exposure and cancer.[2] The authors cite numerous studies which indicate that exposure to non-ionizing elecromagnetic radiation is associated with development of various cancers. Although they acknowledge the difficulites involved in epidemiological studies of human populations which attempt to attribute disease causation to environmental agents, they define the studies they reviewed as "attention-deserving".

Following other studies which raised concerns over the possible cancer causing effects of low frequency magnetic fields (50-60 Hz) for both children and adults, Savitz and colleagues [3] investigated the possible relationship between residential exposure to magnetic fields and the development of childhood cancers. This study was designed to overcome many of the identified weaknesses in six earlier studies cited by the authors. Savitz and colleagues found some statistically significant association between childhood cancer incidence and magnetic field exposure.

The findings of Savitz' investigation are not conclusive evidence of a causal relationship since it was a retrospective, case-control study rather than a prospective longitudinal study. However, the results of this study were consistent with, and lent credibility to, the earlier studies cited reporting similar associations between exposure to electromagnetic radiation and human cancers. This is precisely the pattern of initial evidence which ultimately led to conclusive evidence of the carcinogenic effects of tobacco smoking and exposure to benzine and arsenic. The study indicates that the potential carcinogenic effects of human exposure to non-ionizing electromagnetic radiation must be taken seriously.

Samuel Milham, Jr., studied the mortality experience of workers exposed to electromagnetic radiation from 1950 to 1982.[4] In assessing mortality data for 486,000 deaths during the study period, Milham found increased proportionate mortality ratios for leukemia and non-Hodgkin's lymphomas in men employed in occupations with intuitive exposures to electromagnetic radiation. In addition, Milham cited studies in a summary of findings from

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[2] Brown, H.D., Chattopadhyay, S.K., "Electromagnetic-field Exposure and cancer", Cancer, Biochemistry, Biophysics, Volume 9, No. 4. May, 1988, ppg 295-342.

[3] Savitz, D.A.; Wachtel, H; Barnes, FA. John, E.M.; and Tvrkik, J.G., "Case-Control Study of Childhood Cancer and Exposure to 60-HZ Magnetic Fields", American Journal of Epidemiology, Volume 128, No. 1, July, 1988, pp. 21-38.

[4] Milham, Jr. S., "Mortality in Workers Exposed to

RESPONSE

from the currently proposed Project P-223 are expected to be smaller than signals from the aforementioned shortwave stations currently operating on Saipan. These commercial "fixed frequency" stations have been operating and serving the public on Saipan and the surrounding region for many years.

A more detailed analysis of the expected exposure levels from the three proposed ROTHR transmit facilities, if all located on the northern tip of Tinian island, is provided by the Electromagnetic Field Environment analysis [Ref. 77]. This analysis was performed by the Naval Research Laboratory (NRL) and provides the highest expected ground level field strength values for the ROTHR transmitted signal at several locations on both Tinian and Saipan. The expected levels of exposure are above those of Project P-223 because parts of Saipan would be within the proposed coverage area of the Project P-002 radar. But, even in this direct configuration the field strength values at worst case (Pt. Agingan, Saipan) would be 26 times smaller than the ANSI recommended limits for continuous exposure at 28MHz. For 5MHz, the expected field strength would be nearly 150 times smaller than the continuous exposure limit. These worst case estimates are for locations on the shore line of Saipan. As the signal propagates farther inland, the field strength values become significantly reduced. Also, during normal ROTHR operations the system scans the radar coverage area. Due to this scanning process the predicted field strength values presented in the NRL analysis will not continuously exist. Rather, the average exposure over any 20 second time period would be only 2.5 seconds.

occupational literature which indicates "that non-ionizing radiation is a human carcinogen." He went on to summarize findings indicating that non-ionizing radiation has biological effects on non-human species including teratogenic effects on developing chickens.

In a separate study investigating the potential cancer effects of electromagnetic radiation on amateur radio operators, Milham found elevated standardized mortality ratios involving lymphatic tissues including multiple-myeloma and non-Hodgkin's lymphomas as well as acute myeloid leukemia.[5] He concluded by stating: "Avocational and/or occupational exposures to electric and magnetic fields should be among the possible etiologies considered in explaining this excess mortality."

Spitz and Johnson conducted a population based case-control study in Texas covering the years 1964-1978 which investigated the possibility that children with fathers employed in occupations exposing them to electromagnetic radiation were at increased risk of dying from neuroblastoma.[6] They found that, "Children of fathers employed in occupations with electromagnetic field exposure were at significantly increased risk [for neuroblastoma]."

Young and Young, surveying reports of electromagnetic radiation effects on humans in the Bulletin of Atomic Scientists state that there is a strong suggestion that long-term damage to humans occurs from exposure to "high electric fields", call for prudence in the face of the evidence, and note that the USSR has established rules of exposure of personnel to such electric fields. [7]

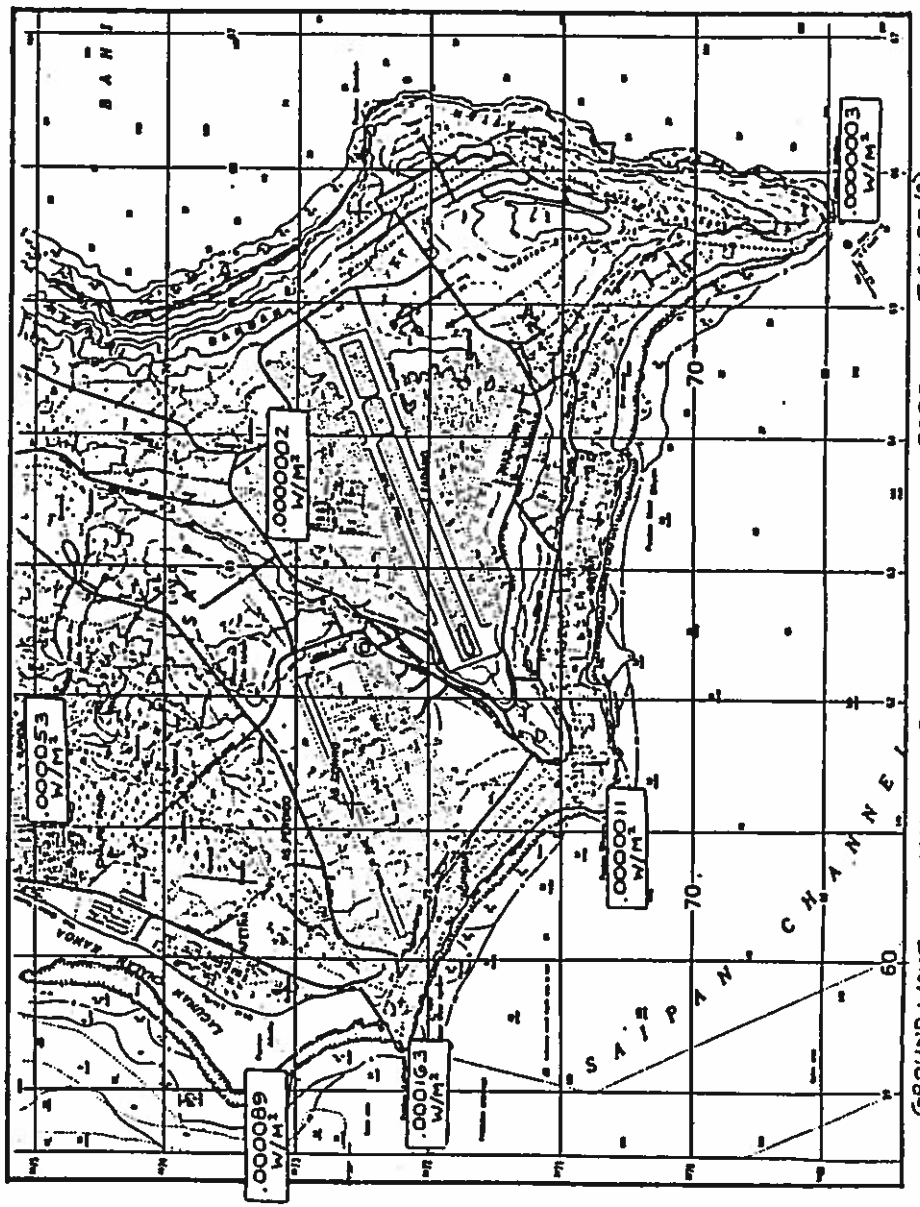
Shulman, a general surgeon and amateur radio operator, reviewed the literature on effects of electromagnetic radiation on human health for the audience of readers of the amateur radio operator's magazine, QST. In distinguishing between ionizing and non-ionizing radiation, he noted that:

> "Although the energy level of nonionizing radiation is lower and thus may not affect large molecules or generate measurable amounts of heat in the same manner as ionizing radiation, there is substantial evidence that nonionizing radiation has subtle effects at a more basic cellular level, including effects on hormones, enzymes and the cooperative mechanisms involved in maintaining the integrity of intracellular systems."[8]

Electromagnetic Fields", Environmental Health Perspectives, Vol 62, pp. 297-300, 1985.

[5] Milham, Jr. Samuel, "Increased Mortality in Amateur Radio Operators Due to Lymphatic and Hematopoietic Malignancies", American Journal of Epidemiology, Vol 172, No. 1, 1988.

[6] Spitz, M.R., Johnson, C.C., "Neuroblastoma and paternal occupation. A case-control analysis", American Journal of Epidemiology, June 1985, Volume 121, No. 6, pp. 924-929.



FIGURE(1)

COMMENT

Shulman's research found evidence that electromagnetic radiation is or may be related to spontaneous abortion, cataract formation and retina damage, and cancer. With respect to cancer, he states that electromagnetic radiation may first affect immune system which would not be able to suppress cancers from other causes:

> "Evidence at this time seems to suggest that an appropriate interpretation of this (sic) data is not that nonionizing energy necessarily causes cancer, but that it may act instead to promote the efficiacy of other agences in doing so."

Shulman also points out that "there is clear evidence that adverse tissue effects can occur without a detectable rise in temperature."

Animal Models

Animals (particularly mammals) are often used as models for human biology.

Szudzinski and colleagues investigated the co-effects of exposure to a chemical carcinogen and microwave irradiation in mice.[9] They found that exposure of mice painted with 3,4-benzopyrene (a known carcinogen) to microwaves with a power density of 2,450 MHz cancer significantly accelerated the development of skin cancer and reduced the life of the animals with tumors. The radiation levels did not produce detectable increases in body temperature, leading to the hypothesis that microwave radiation may modulate the immune response in mammals.

Sikov and colleagues investigated the effects of exposure to 60-Hz electric fields on Hanford miniature swine.[10] They report that while a direct cause and effect relationship cannot be unequivocally stated, there does appear to be a significant association between chronic exposure of a strong electric field and teratogenic effects in the litters of the exposed animals.

Lary and colleagues studied the potential for radiofrequency fields to cause birth defects in rats through increases in thermal effects of the radiation. [11]

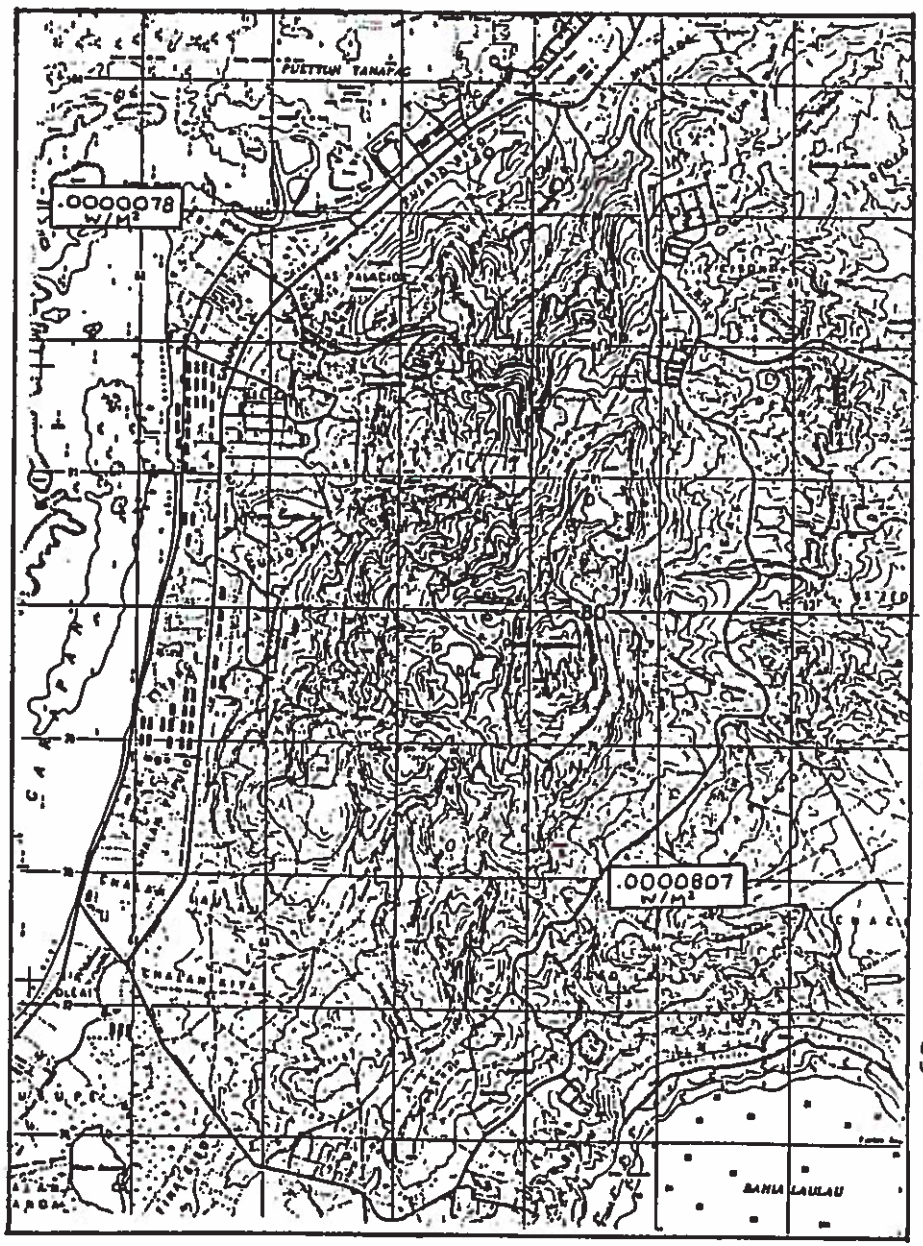
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[7] Young, L.B., Young, H.P.; "Pollution by Electrical Transmission", Bulletin of Atomic Scientists, December, 1974, Volume 30, Number 10, page 34.

[8] Shulman, Ivan A., "Is Amateur Radio Hazardous to Our Health?" QST, October, 1989.

[9] Szudzinski, A; pietraszek, A; Janiak, M; Wrembel, J; KaLcsak, M; Szmigielski, S;, "Acceleration of the

RESPONSE



GROUNDWAVE - MAXIMUM POWER DENSITIES FROM P223 FIGURE 2

Conclusion.

The draft EIS states that there will be no human health hazards from the transmitter facility in Tinian. It does not discuss the evidence cited above which was gathered during a brief literature search in Saipan. A brief search was necessitated by the short amount of time available for comments on the Draft EIS. A more extensive literature search could be expected to produce additional evidence of the potential of the electromagnetic radiation of the proposed Tinian transmitter facility to cause cancer among all workers, and birth defects in the fetuses of pregnant workers exposed in sufficient doses. Based upon the literature search done for these comments, it is not possible to assess the possibility of mutagenic effects of the electromagnetic radiation from the Tinian transmitter.

Given the evidence presented above, one must assume some human health risk from exposure to electromagnetic radiation at this facility, and one may assume that workers inside the fenced ROTHR facility will be at risk. If female workers are recruited to operate the station, fetuses of pregnant workers will be at the highest risks among those exposed on the job-site (e.g., inside the fenced hazard perimeter.) No worker should be involuntarily exposed to potentially harmful non-ionizing electromagnetic radiation. Full disclosure and informed consent must be the rule.

In addition, there may be risk to persons outside the fenced perimeter to an as yet undetermined distance from the transmitter. Such risk, if identified, may vary according to the direction and strength of signals. Such risk, if any, should also be estimated and disclosed.

Recommendations

1. Further Research

It is recommended that before proceeding with this project the Navy undertake a more extensive study of the potential human health hazards of the electromagnetic radiation from the proposed Tinian transmitter site on workers inside the 58 acre perimeter, and to the general populations of Tinian and Saipan. Such a study would involve an assessment of national and international research on the effects of electromagnetic radiation on human health, and on worker exposure standards used internationally.

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development of benzopyrene-induced skin cancer in mice by microwave radiation, Archives of Dermatological Research, 1982, 274 (3-4), pp. 303-312.

[10] Sikov, M.R.; Rommereim, D.N.; Beamer, J.L.; Buschbom, R.L.; Kaune, W.T.; Phillips, R.D.; "Developmental studies of Hanford miniature swine exposure to 60-Hz electric fields", Bioelectromagnetics, 1987, Volume 8, No. 3, pp. 229-42.

[11] Lary, J.M.; Conover, D.L.; Johnson, P.H., burg, J.R.,

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#249. Neither the Space and Naval Warfare Command nor the Navy Bureau of Medicine and Surgery can agree with the conclusions presented in Dr. Kenney's written comments. (See Appendix I) First, with regard to cancer, there is no critically reviewed scientific literature or experimental research that have concluded that non-ionizing electromagnetic radiation (EMR) is the cause of cancer. Further, non-ionizing EMR has not been found to cause cancer or any other adverse affects to human health when exposure levels are within the recommended guidance of the ANSI standard C95.1. Second, it should be well understood that no humans will be permitted within the boundaries of the personnel exclusion fence whether they are workers at the facility or members of the general population. The fence has been specifically located with added margins of safety and will be conspicuously marked to preclude personnel from entering the area. Third, there is no credible basis to suggest that "the fetuses of pregnant workers will be at the highest risks among those exposed at the job-site" (ROTHR transmitter facility). A review of scientific research centering on teratogenesis and mammalian exposure to RFEM show that adverse effects are proportional to the elevation of colonic temperature. [Ref. 80] And, the effects of RFEMR-induced teratogenesis and developmental abnormalities are the result of heat produced by the RFEMR rather than from any special teratogenic properties of RFEMR. The operational precautions outlined in the DEIS and in these responses will ensure that no such elevation of temperature will occur due to ROTHR EMR. Pregnant females working at the ROTHR facilities will not be subjected to risk greater than any other individual.

However, in a more targeted fashion, it would involve an assessment of the site-specific parameters of the potential exposures and risks to people on Tinian and Saipan. 249

2. Minimize Exposure

Until unambiguous evidence of the potential of ROTHR-generated electromagnetic radiation is available, the Navy should adopt a policy of "prudent exposure".[12] Such a policy would avoid or minimize exposure to general populations or to workers as an interim policy until more conclusive evidence is available to assess the ROTHR risks to humans.

3. Set Conservative Exposure Standards

If the Navy chooses to build the facility without following recommendation 2 above, stringent exposure standards based upon the research outlined in recommendation 1 should be employed. In addition, all exposures should be done under a policy of informed consent.

4. Conduct Prospective Epidemological Study

If the Navy chooses to build the transmitter facility on Tinian, it should build into the management system an prospective epidemiological research protocol which would track the health impacts of the electromagnetic radiation from the facility on the workers and general populations of Saipan and Tinian for the projected twenty-year life of the project.

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to duration of hyperthermic exposure", Bioelectromagnetics. 1983, Volume 4, No. 3, pp. 249-55.

[12] This label is a modification of the strategy recommended in the Office of Technology Assessment background paper of "prudent avoidance" of exposure to electromagnetic fields (pp. 78-80).

COMMENT

RESPONSE

Territory of Guam
Teritorion Guam
OFFICE OF THE GOVERNOR
LIFESAVAN I NANGA'LAN
AGANA, GUAM 96910 U.S.A.

SEP 0 3 1989

The Honorable Pedro P. Tenorio
Governor
Commonwealth of the Northern
Mariana Islands
Saipan, CNMI 96950

Hafa Adai Governor Tenorio:

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I am writing to you as Chairman of the Governor of Guam's Aviation Policy Task Force to alert you to the enclosed findings of our consultant on the impacts of the Navy's Relocatable Over the Horizon Radar Project. As you may know, the U.S. Navy plans on building three (3) radar transmitters on Tinian and three (3) receivers on Guam to provide surveillance over portions of the Asian and Russian coasts.

Our consultant, Mr. Willis Cannon, is a retired Federal Aviation Administration employee who was asked to review the radar project specifically in terms of its impacts on aircraft flight patterns. Other GovGuam agencies are reviewing the project in terms of its environmental effects.

I hope that the enclosed information will prove helpful.

Si Yu'os Ma'ase',

FRANK F. BLAS
Chairman,
Aviation Policy Task Force

(Enclosure to CNMI Governor Pedro P. Tenorio letter of 4 Oct 1989)

COMMONWEALTH NOW!

COMMENT		RESPONSE
TRANSMITTER - TINIAN Although the transmitter(s) are to be located on Tinian, CNMI and would have no effect on the Territory of Guam, it would appear that the use of the "NORTHERN SITES" may have a significant effect on the existing ATC communications facilities and air navigational aids serving the Obyan, Saipan International Airport - SN NDB I-GSN LOCALIZER, GLIDESLOPE, DME, future VOR/TAC (frequency and location undetermined) proposed 75mHz Middle Marker that would have to be located on North Tinian, directly under the localizer final approach course, and current Air/Ground frequencies 123.6mHz, 118.4mHz, 272.7mHz, 290.5mHz and 5205kHz. Radiating 200kw in a FM, frequency shifting, CW mode may also have some effect on aircraft Avionics making an instrument approach to PGSN, runway 7. Particularly those executing the NDB/DME RWY 7, the NDB RWY 7 or the S-LOC-7. The aircraft could be as low as 480' AMSL directly over the Northern ROTHR Transmitter site. In figure 5.1.6 there is an indication that aircraft executing the ILS/DME RWY 7 approach would safely clear the ROTHR Restricted Zone for CAD equipped aircraft. Aircraft executing the above listed approaches could easily descend and penetrate this "Restricted Zone". Also based on figures 5.1.7, 5.1.8 and 5.1.9 aircraft carrying susceptible Ordnance could not use the Obyan, Saipan International Airport. Use of the Northern Sites for the ROTHR Transmitters could possibly render all the Instrument Approaches to Runway 7 as unusable, effectively closing the Saipan Airport during "Instrument" weather conditions.	250	#250. See #76

COMMENT

RESPONSE

Commonwealth of the Northern Mariana Islands
Office of the Governor
Saipan, Mariana Islands 96950

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REPLY TO
DEPT. or ACTIVITY

8 August 1989

Commander E.C. Rushing
Civil Engineering Corps
U.S. Navy, Pacific Division
Naval Facilities Engineering Command
Pearl Harbor, HI 96860-7300

Dear Commander Rushing:

We received the Draft EIS for ROTHR program last week. We began reviewing it this week and found that it states that electromagnetic radiation should not be a problem for birds flying in the area. This is not explained other than to cite the following report: Department of the Navy, Space and Naval Warfare Systems Command, A study of Electromagnetic Environmental Effects Associated with the Relocatable Over-the Horizon Radar, March 7, 1989.

Many of our concerns stem for these possible effects. To see how these have been examined we will need to have a copy of the cited report. Please send us a copy of the study so we can complete our evaluation of the EIS. The sooner we receive the report the sooner our EIS comments can be sent to your office. I suspect they will not reach you by the 4 September 1989 date mentioned in your letter due to our not having access at this time to the previously mentioned study. Additionally, expecting us to review a detailed EIS of nearly 1000 pages in a month (we would have to mail our comments by 24 August to reach you) seems unreasonable.

Thank you in advance for you prompt sending of the needed report.

Sincerely,

James D. Reichel

Dr. James D. Reichel
Wildlife Biologist 3
Division of Fish and Wildlife
Saipan, MP 96950

(Enclosure to CNMI Governor Pedro P. Tenorio letter of 4 Oct 1989)

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COMMENT

RESPONSE

Commonwealth of the Northern Mariana Islands
Office of the Governor
Saipan, Mariana Islands 96950

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GOV. MAIL SAIPAN
REPLY TO
DEPT. or ACTIVITY

22 August 1989

Mr. James Chun (Code 2012)
U.S. Navy, Pacific Division
Naval Facilities Engineering Command
Pearl Harbor, HI 96860-7300

Dear Mr. Chun:

Enclosed are comments on the Navy Draft EIS for the ROTHR project from the Division of Fish and Wildlife primarily prepared by our Senior Wildlife Biologist, Dr. James D. Reichel. We feel that the Draft EIS has not fairly and adequately dealt with wildlife concerns in three major areas. First, mortality due to antenna collisions is understated using non-information from 5 sources who have never carried out research, instead of the vast body of scientific literature which deals with the subject. Second, habitat loss and subsequent population declines have not be fairly addressed, and cumulative impacts with prior Naval actions have not been considered. Third, electromagnetic effects have not been dealt with in any detail, some effects have not been discussed, and none give supporting data or allow independant evaluation. Please note that we will have additional comments on electromagnetic radiation effects at such time as the publication we have requested from your office is received. Thank you for the opportunity to comment on the Draft EIS.

Sincerely,

Arnold I. Palacios
Chief
Division of Fish and Wildlife

cc: CNMI Coastal Resources Management Office
Mr. Alan Marmelstein, USFWS Honolulu
Mr. Ernie Kosaka, USFWS Honolulu
Guam Division Aquatic and Wildlife Resources
Marianas Audubon Society, Saipan and Guam

(Enclosure to CNMI Governor Pedro P. Tenorio letter of 4 Oct 1989)

10 - 112

Commonwealth of the Northern Mariana Islands
Office of the Governor
Saipan, Mariana Islands 96950

FOR OFFICIAL USE
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REPLY TO:
DEPT. or ACTIVITY

22 August 1989

Mr. James Chun (Code 2012)
U.S. Navy, Pacific Division
Naval Facilities Engineering Command
Pearl Harbor, HI 96860-7300

Dear Mr. Chun:

We received the Draft EIS for ROTHR program on 26 July 1989. We began reviewing it and found that it states that electromagnetic radiation should not be a problem for birds flying in the area. This is not explained other than to cite the following report: Department of the Navy, Space and Naval Warfare Systems Command, A study of Electromagnetic Environmental Effects Associated with the Relocatable Over-the Horizon Radar, March 7, 1989. We have expressed concern over this factor in previous comments and asked for additional information. We have never received any. We asked for a copy of the report from Commander Rushing on 8 August 1989 and have not yet received one.

See #67.

Many of our concerns stem from these possible effects. To see how these have been examined we will need to have a copy of the cited report. Until such time as we see the report and are satisfied that it has answered our questions about effects of the radiation on Endangered and other bird species in the area, our concerns remain. Please send us a copy of the study so we can complete our evaluation of the EIS. The sooner we receive the report the sooner our final EIS comments can be sent to your office. I suspect they will not reach you by the 4 September 1989 date mentioned in your letter due to our not having access at this time to the previously mentioned study. Additionally, expecting us to review a detailed EIS of nearly 1000 pages in one month (we would have to mail our comments by 24 August to reach you) seems unreasonable. Comments concerning problems other than electromagnetic radiation are covered below.

Sincerely,

James D. Reichel

Dr. James D. Reichel
Wildlife Biologist J

COMMENT

1. Antenna mortality. The comments on possible mortality from antenna strikes (5.1.9.1) are misleading. You state that 5 people were contacted and "None of these personnel reported incidents with bird strikes and collisions with antennas and towers." However, we also interviewed one of your listed experts, Bob Beck, and he indicated that he has never conducted systematic searches in antenna or tower sites at any location. None of the experts apparently has, as your statement "Although, detailed on-site investigations have not been conducted..." indicates; I believe that statement says it all. You have no evidence that the towers will not be significant threats to fauna in the area. On the other hand, we provided you with a long list of scientific publications documenting significant mortalities caused by tower collisions in our 29 June 1988 letter. Locations which tend to funnel migratory birds, such as small tropical islands, are especially vulnerable to high mortality. While collisions for most resident species may not be a problem, the Endangered Mariana Common Moorhen, as a rallid, is particularly susceptible (Avery et al. 1976; Cornwell and Hochbaum 1971). This is particularly true since it flies at night, probably between Tinian and Saipan, as indicated in previous comments. On Guam at least two Moorhens are known to have been killed by collisions (wires and buildings) (Paul Conry pers. comm.). Given the low numbers and endangered status of this bird, even low mortality would be unacceptable. If this project is approved, we certainly believe that a systematic study by independent observers should be done on the first site, which you say is "a stand-alone system," not connected to later tower sitings, prior to approval of any additional tower sitings.

1.1. What lighting will be used at night? It has been shown in Hawaii that artificial lighting attracts burrow-nesting seabirds which are leaving from, or returning to, their burrows, often many miles distant. Possibly one-half the fledglings of Newell's Shearwater suffer collisions (Harrison et al. 1984). There is a colony of Wedge-tailed Shearwaters on Naftan Rock, about 7 miles SSW of Tinian, which could be impacted. If lights are present they will also increase the chance of mortality to night-flying Endangered Common Moorhens between Tinian and Saipan (Avery et al. 1976); the proposed western and eastern sites would be preferred for this species.

1.2. Mitigation Measures are discussed in section 3.5.1 and elsewhere. If lights are to be used as we questioned in our section 1.1 above, "highly visible strips, tape, or flagging" could increase the probability of night-time collisions. This would be especially true if such markers were reflective, as mentioned in other sections of the DEIS.

1.3. Mitigation Measures are discussed in section 3.5.1 regarding "...retaining trees would divert birds from flying in the direction of the antenna array." The majority of trees in the area are relatively short, introduced tangantangan (4.1.8). The Navy should

RESPONSE

See #68, #69, and #70.

plant and maintain a strip of taller-growing native forest trees for this "diverting" function. This would be actual mitigation, not just leaving alone some area not needed for the installation. Not destroying additional habitat is NOT mitigation for other destruction.

2. Habitat destruction and decrease in population numbers (5.1.9.1). Again the DEIS wording was misleading. It stated "Clearing the project site would displace all resident birds." What was not stated was that, almost invariably, displaced birds will die; certainly the population will decline by the proportion of habitat that is removed (58 acres for phase 1). Loss of 58 acres will result in a decrease in the Federally Threatened Tinian Monarch population by about 130 (north site) to 177 (west site). The east site has less monarchs, due to previous habitat alteration, so the loss would equal about 68 birds. Population density figures used in our calculations are from Engbring et al. (1986). These numbers are not large, but should be considered in the light of previous Navy actions described below.

2.1. Cumulative impact with leaseback of 12,500 acres (4.1.10) was not considered. Leaseback is for grazing and agricultural uses. These leasebacked lands will result in severe habitat changes. Engbring et al. 1986 found lowest Federally Threatened Tinian Monarch densities in the Masalog area; low densities here were also found in fieldwork for this DEIS (4.1.7.2). Engbring et al. (1984) attributed this to "large amounts of pasturage in this area." The leaseback will decrease Tinian Monarch populations by the difference between the densities in the leaseback (Diablo) and current pasturage area (Masalog) or about 1.9 birds/acre (due to habitat changes). This will reduce the actual population of monarchs in the world by about 23,600 birds or 60% of the world population. Certainly this cumulative impact should be considered. This population reduction may be an underestimate as more intensive agriculture and grazing come into practice, as is already happening.

2.2. Bird populations. You stated in the DEIS (5.1.9.1) that "... the resident avifauna has survived the extreme changes in land use that has occurred on the island over the years." This statement was misleading in that populations of native birds were very severely depressed under the vast agricultural use during the Japanese and following WWII period (Coultas 1931, Downs 1946). It also seems likely that birds went extinct which we have no record of, such as has been shown on Hawaii. Certainly the Marianas Mallard and Island Swiftlet have become extinct historically on Tinian (DEIS 4.1.7). Other possible bird extinctions (based on current range and historic documents) might include the Golden White-eye, Nightingale Reed-Warbler, Micronesian Megapode, and Short-eared Owl.

3. Electromagnetic radiation. The DEIS does not adequately

See #71, #72, #73, and #74.

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address this important effect to bird/bat mortality. We raised this point in previous comments but have not yet been provided with the Navy report on the effects of ROTHR electromagnetic radiation. The simple statement that birds and small mammals will be in "no danger" due to their small size relative to the wave length signal does not reduce our concern, nor provide substantive answers to our original questions regarding this in our 29 June 1988 letter. Birds may be more sensitive that mammals due to their typically higher normal body temperatures and less developed heat dissipating mechanisms. We wish to have a mathematical matrix (or equation) describing body temperature rise as a function of 1) time exposed; 2) weight of organism; and 3) distance to transmitter. With that information an informed decision on effects can be made for the organisms concerned while considering their typical behavior in the area. Lary et al. (1983) found birth defects in rats caused by radio-frequency fields via thermal effects; no mention is made of this, nor is this type of effect addressed. Yet the frequency used by Lary et al. was 27.12 M-Hz, well within the range of the ROTHR transmitter at 5-32 M-Hz (2.2.1).

In section 5.1.15.2 the DEIS states that the "primary effect" of the radiation is heat. We believe that other effects not discussed may be significant and should be addressed. These are listed for humans (and pertinent literature cited) in the comments of Dr. Michael Kenney, but include such things as increased cancer hazards for people living near radio transmitting towers or high tension wires (which would have similar electromagnetic wave effects). What are the effects of these processes on wildlife living in the area? Research has shown acceleration of carcinogenic effects due to exposure to electromagnetic waves such as ROTHR (Szudzinski et al. 1982). Additionally, Sikov et al. (1987) found a significant association between chronic exposure to a strong electric field and birth defects in pigs. These types of possible effects have not been explored in the DEIS, nor have their additive effects on mortality.

Additionally, you fail to discuss what effects the transmitter would have on possible future Tinian Airport improvements and increased usage. While the transmitter will, the DEIS states, "have no adverse impact to aircraft operations" that conclusion is based on the current circumstances of the field being "not equipped with navigational aids and primarily accommodates single engine air taxi operations to and from Saipan International Airport." Will the transmitter preclude future uses including (but not limited to) installation of navigational aids, use by other types of aircraft, or other destinations (such as Guam or Rota)?

4. Brown Tree Snake introduction prevention. In various locations in the DEIS it is stated that measures such as those used in the PACBAR radar site on Saipan will be used. A minor addition to these is construction and maintenance of a snake detection device as outlined below. We are currently requiring all major projects (public and private) to follow a prevention and detection plan such as outlined in the following. The permit conditions should include

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See #74, #75, and #76.

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brown tree snake prevention and control measures to prevent accidental introduction of the pest into the CNMI. Specific plans by developers must be approved in advance by the Division of Fish and Wildlife. These should include 1) The construction company discussing the problem with all workers and detailing to them the problem and what to do in case of a snake sighting; 2) placing brown tree snake alert posters in an office where workers check in or gather each day; 3) construction personnel being detailed to the dock to check all non-containerized material brought in by ship for snakes during unloading; and 4) establishment and maintenance of a snake detection device (detailed below and in Figures 1 & 2) within 50 m of stored material most likely to contain snakes, ie. lumber, pipes, and other non-container, irregularly shaped material and equipment, particularly that coming from Guam. If possible, it should also be placed adjoining the outside fence, and be as tall as, or taller than, the fence. This detection device should be a cage with live birds (chickens) at least 6X6X6 feet in size with several snake funnel traps built into the walls and ceiling. The design should be approved by CNMI-DFW and the device should be in operation and available to DFW personnel for inspection prior to construction beginning and continuing through completion of the project, including final installation of machinery and equipment. 6) Immediate notification of any snake trapping or sighting be given to DFW and the snake immediately killed, if possible, and turned over to DFW. 7) DFW personnel must be allowed to talk to construction workers and examine the poster and detection device locations at any time, to assure compliance with items listed above.

See #77, #78, and #79.

4.1. We believe that brown tree snake protocols should be established in the EIS, not later between the contractor and CNMI-DFW (5.1.22). We have no way to estimate the effectiveness of such procedures until they are established, hence no Environmental Impact Assessment can be made. Such procedures can then be made a part of the contract specifications, costs of which can be estimated by the contractor.

5. <u>Aesthetics</u>. In section 5.1.14.1 you state the towers etc. will be clearly visible to visitors to the Historic site on North Field. This seems totally at odds with the site comparison matrix (p. 3-15) which says under Aesthetics "No adverse impact to Tinian." I think most visitors to a Historic site would consider the installation to be aesthetically unpleasant.

6. In the public hearing on Saipan in August 1989 the ROTHR was described as protecting the national interest by giving longer response times for enemy missile attack and will be the primary device for early warning. The DEIS states "The proposed Navy ROTHR system is not designed to detect Intercontinental Ballistic Missiles (ICBM)." These statements seem diametrically opposed. Which is true?

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7. We also wonder why no cooperative agreement has ever been initiated by the Navy as required by various federal laws (e.g. Sikes Act) and Naval Regulations (e.g. OPNAVINST 5090.1). Our office encourages such cooperation in the future on all military installations in the CNMI.

CITATIONS

Avery; M., P.F. Springer and J.F. Cassel. 1974. The effect of a tall tower on nocturnal bird migration - a portable ceilometer study. Auk 93:281-291.

Coultas; H.F. 1931. Field notes of the Whitney South Seas expedition. Unpubl. field notes on file at the American Museum, New York, NY. pp. 104-140.

Cornwell, G., and H.A. Hochbaum. 1971. Collisions with wires - a source of anatid mortality. Wilson Bull. 83:305-306.

Downs, T. 1946. Birds on Tinian in the Marianas. Trans. Kan. Acad. Sci. 49:87-106.

Engbring, J., F.L. Ramsey, and V.J. Wildman. 1986. Micronesian forest bird survey, 1982: Saipan, Tinian, Aguigan, and Rota. U.S. Fish and Wildlife Serv. Publ. 143 pp.

Harrison, C.S., M.B. Naughton and S.I. Fefer. 1984. The status and conservation of seabirds in the Hawaiian archipelago and Johnson Atoll. ICBP Tech. Publ. 2:513-526.

Lary, J.M., D.L. Conover, P.H. Johnson and J.R. Burg. 1983. Teratogenicity of 27.12-MHz radiation in rats is related to duration of hyperthermic exposure. Bioelectromagnetics 4:249-255.

Sikov, M.R., D.N. Rommereim, J.L. Beamer, R.L. Bouschbom, W.T. Kaune, and R.D. Phillips. 1987. Developmental studies of Hanford miniature swine exposure to 60-Hz electric fields. Bioelectromagnetics 8:229-242.

Szudzinski, A., A. Pietraszek, M. Janiak, J. Wrembel, M. Kalczak, and S. Szmigielski. 1982. Acceleration of the development of benzopyrene-induced skin cancer in mice by microwave radiation. Arch. Dermatol. Res. 1982:274.

RESPONSE

See #80.

Commonwealth of the Northern Mariana Islands
Office of the Governor
Saipan, Mariana Islands 96950

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REPLY TO:
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6 September 1989

Mr. James Chun (Code 2012)
U.S. Navy, Pacific Division
Naval Facilities Engineering Command
Pearl Harbor, HI 96860-7300

Dear Mr Chun:

On 26 August 1989 we received pp.9-19 of Department of the Navy, Space and Naval Warfare Systems Command, A study of Electromagnetic Environmental Effects Associated with the Relocatable Over-the Horizon Radar, March 7, 1989. Enclosed are our comments on the Draft EIS for the ROTHR project regarding electromagnetic effects regarding wildlife; other comments (including some of these) were sent in our letter of 22 August 1989.

Sincerely,

Jim Reichel

Dr. James D. Reichel
Wildlife Biologist 3

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(Enclosure to CNMI Governor Pedro P. Tenorio letter of 4 Oct 1989)

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<u>Electromagnetic radiation</u>. The DEIS does not adequately address this potentially important effect to bird mortality. The referenced study (Department of the Navy, Space and Naval Warfare Systems Command, A study of Electromagnetic Environmental Effects Associated with the Relocatable Over-the Horizon Radar, March 7, 1989) stating no significant effects due to wildlife species small body size relative to the wave length signal does not reduce our concern, nor provide substantive answers to our original questions regarding this in our 29 June 1988 letter. Some seabirds in the area covered by the radar (2000+ feet out from the array) have wingspans of over 2 meters, which would be 1/4 wavelength and thus in the critical size. This may be aggravated by lighting in the site causing birds to circle for extended times in the area at night. Birds may be more sensitive that mammals due to their typically higher normal body temperatures and less developed heat dissipating mechanisms. We wish to have a mathematical matrix (or equation) describing both bird and mammal body temperature rise as a function of 1) time exposed; 2) length of organism; 3) length of the organism; 4) orientation relative to the array; and 5) distance to transmitter. With that information an informed decision on direct thermal effects can be made for the organisms concerned while considering their typical behavior in the area.

Lary et al. (1983) found birth defects in rats caused by radio-frequency fields via thermal effects; no mention is made of this, nor is this type of effect addressed. Yet the frequency used by Lary et al. was 27.12 M-Hz, well within the range of the ROTHR transmitter at 5-32 M-Hz (2.2.1).

In section 5.1.15.2 the DEIS states that the "primary effect" of the radiation is heat. We believe that other effects not discussed may be significant and should be addressed. These are listed for humans (and pertinent literature cited) in the comments of Dr. Michael Kenney, but include such things as increased cancer hazards for people living near radio transmitting towers or high tension wires (which would have similar electromagnetic wave effects). What are the effects of these processes on wildlife living in the area? Research has shown acceleration of carcinogenic effects due to exposure to electromagnetic waves such as ROTHR (Szudzinski et al. (1982). Additionally, Sikov et al. (1987) found a significant association between chronic exposure to a strong electric field and birth defects in pigs. These types of possible effects have not been explored in the DEIS, nor have their additive effects on mortality.

See #102 and #103.

CITATIONS

Lary, J.M., D.L. Conover, P.H. Johnson and J.R. Burg. 1983. Teretogenicity of 27.12-MHz radiation in rats is related to duration of hyperthermic exposure. Bioelectromagnetics 4:249-255.

Sikov, M.R., D.N. Rommereim, J.L. Baamer, R.L. Bouschbom, W.T. Kaune, and R.D. Phillips. 1987. Developmental studies of Hanford miniature swine exposure to 60-Hz electric fields. Bioelectromagnetics 8:229-242.

Szudzinski, A., A. Pietraszek, M. Janiak, J. Wrembel, M. Kalczak, and S. Szmigielski. 1982. Acceleration of the development of benzopyrene-induced skin cancer in mice by microwave radiation. Arch. Dermatol. Res. 1982:274.

COMMENT

RESPONSE

Commonwealth of the Northern Mariana Islands
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June 29, 1988

E.C. Rushing, Jr., Commander
Civil Engineer Corps
Naval Facilities Engineering Command
Pearl Harbor, HI 96860-7300

Dear Commander Rushing:

We are in receipt of your letter of 1 June 1988 to Mr. Allan Marmelstein, Pacific Islands Administrator for the U.S. Fish and Wildlife Service. In this letter, furnished us upon request by Mr. Peter Toves, Assistant Force Civil Engineer Guam, you summarize the results of the recent Brown Tree Snake census done by Dr. Thomas Fritts at the proposed MCON P-223 project site at Northwest Field, Anderson Air Force Base, Guam and request that the formal Endangered Species Act consultation be terminated and the Biological Opinion be delivered.

Since no mention is made in this letter regarding further studies at the Tinian P-223 project site, are we to assume that no more studies or analysis on the Navy's part is planned with regards to Endangered Species Act consultation for this project? I would appreciate being informed if this is or is not the case.

I call your attention to (and furnish copies of) our previous letter to you dated 28 September 1987 and to Mr. Alan Marmelstein dated 30 November 1987. In these letters, other copies of which I gave to you and the Navy's environmental contractor for this project, Mr. John Sakaguchi of VTN Pacific, at the public meeting on Saipan on 3 February 1988, we stressed several points which we felt needed to be addressed with a great deal more forthrightness and detail. Most of these points dealt specifically with potential (in our view probable) impacts to Federally-listed Endangered Species which were ignored or given the most cursory treatment in the Navy's Environmental Assessment and the U.S. Fish and Wildlife Service's original Biological Opinion. A brief summary of our list of unanswered questions is as follows:

1) Will individuals of the Endangered Marianas Common Moorhen (Gallinula chloropus) dispersing between the 2 largest known populations at nearby Lake Hagoi and Saipan's Lake Susupe fly through the danger zone of 1,000 ft (3,000 ft if all 3 antennas are built) and be killed in great numbers?

2) Will individuals of the Endangered Island Swiftlet (Aerodramus vanikorensis) be killed in great numbers?

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3) What is the potential for impact from the relatively huge quantities of electromagnetic radiation to be released on small birds and mammals which frequently fly in front of the antennas. Again, simple statements such as "potential impacts are not known" do not contain sufficient information to allow us to predict what will be the ultimate effect on populations of only a few hundred individuals.

4) What is the potential for impact from aerial collisions between the 1,000 linear-ft (or 2,000 or 3,000?) X 120 ft antenna(s?) and Endangered flying birds and mammals which use the area(s) on a daily basis?

5) What are the specific mechanisms and commitments from the Navy to insure that the Brown Tree Snake is not introduced to Tinian by this project?

The Division feels that answers to these questions are required, according to the requirements set forth in Section 7 of the Endangered Species Act, before a Biological Opinion can be rendered, and we hope that, as you told us at the Public Meeting in Saipan on 3 February 1988, the Navy intends to address these questions in a "good faith effort" to disclose any potential impacts to our unique and valuable wildlife resource before the environmental planning stage is considered complete.

Your clarification of the Navy's intentions regarding plans to address impacts of P-223 on Tinian's Federally-listed Endangered Species prior to the issuance of an Endangered Species Act clearance in the form of a Biological Opinion, in accordance with the Regulations for Interagency Consultation set forth in Section 7 of the Endangered Species Act, would be appreciated.

Sincerely,

Arnold I. Palacios
Chief of Fish and Wildlife

cc: CNMI Coastal Resources Management Office
Mr. Peter Toves, Asst. Force Civil Engineer, Guam
Mr. Alan Marmelstein, USFWS Honolulu
Mr. Ernie Kosaka, USFWS Honolulu
Guam Division of Aquatic and Wildlife Resources
Marianas Audubon Society, Guam

(Enclosure to CNMI Governor Pedro P. Tenorio letter of 4 Oct 1989)

COMMENT

RESPONSE

Commonwealth of the Northern Mariana Islands
Office of the Governor
Saipan, Mariana Islands 96950

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REPLY TO:
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September 28, 1987

E.C. Rushing, Jr., Commander
Civil Engineer Corp
Facilities Planning Department
Naval Facilities Engineering Command (Makalapa, HI)
Pearl Harbor, Hawaii 96860-7300

Dear Commander Rushing:

Enclosed please find the Commonwealth of Northern Mariana Island, Division of Fish and Wildlife's comments on the "Environmental Assessment (EA) for Electronic Installations on Tinian and Guam." Thank you for this opportunity to review the EA for this project.

As you will note, we have some considerable concerns with this project and with the project document. Not the least of these concerns is the failure of the document to quantify and assess the potential impacts of two (2) of the three (3) XMTR antenna fields on Tinian which are evidently planned. Another concern the Division has is that potential effects of the (seemingly massive) quantities of electromagnetic radiation to be aimed directly at Saipan's southern beach areas on our rare bird and mammal populations seem to be dismissed with a few simple phrases such as "the impact of electromagnetic radiation...is not known."

We hope that our concerns are given some attention. In light of recent controversies surrounding and opposition to proposed military development of a much less extensive nature on nearby Saipan, we think that every effort should be made to be open and honest regarding the actual impacts of this project.

Sincerely,

Arnold I. Palacios
Chief of Fish and Wildlife

cc: Director of Natural Resources
Acting Administrator, CEQ
Guam DAWR
U.S. Fish and Wildlife Service, Honolulu

(Enclosure to CNMI Governor Pedro P. Tenorio letter of 4 Oct 1988)

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Commonwealth of Northern Mariana Islands, Division of Fish and Wildlife — Comments on "Environmental Assessment (EA) for Electronic Installations on Tinian and Guam"

General Comments

1. In several places in the document, the needs and purpose of the proposed project are summarized by the phrases "for the strategic defense of the U.S." and "in the interest of national security." Surely it would be possible to more fully explain the project purpose without sacrificing national security. In light of the acknowledged impacts to the natural resources of the CNMI and the recent problems and controversy surrounding the proposed military developments on nearby Saipan, it would seem that at least a cursory explanation of the project purpose is in order. To simply say "in the interest of national security" is no longer enough to satisfy a public interested in the future cultural and environmental health of their very small and fragile island community. At least some explanation of the project purpose and benefits must be given in order to justify the statement that "the no action alternative is considered an infeasible and unreasonable choice." (PII-1).

2. Only 1 proposed site and facility is discussed in the document. However, in meetings held at the Saipan Coastal Resources Management (CRM) Office on 23 March 1987 representatives of the Navy stated the project would consist of 3 sites and structures, each of approximately equal size, and each to some degree dependant on the other(s). If this remains the case, the environmental impacts of the total (3 structures) project must be considered as a whole in order to assess the total impacts. If, as was clearly told to us at the 23 March meeting, the other 2 structures will follow the first, the Division insists that impacts from the total project be discussed in the final EA to allow us to assess the actual impacts.

3. The Division finds no specific fault with the methods and conclusions which Dr. Leonard Freed expresses in Appendix B "Bird and Mammal Survey." However, the results of this one, brief (29.5 hr) survey by a visiting scientist not intimately familiar with the area should not by itself be used to justify the conclusion that the (fairly common) Tinian Monarch would be the only Federally-listed Endangered species potentially affected by the project, as the text of the report implies (p III-3 and elsewhere). Pertinent factors not discussed in Dr. Freed's report or elsewhere in the document are:

a). whether individuals of the Endangered Marianas Common Moorhen (Gallinula chloropus guami) dispersing between the 2 largest known populations at Lake Hagoi and Saipan's Lake Susupe would fly through the (relatively huge) danger zone of 1,000 ft in front of the antenna and be killed. A map is included showing probable lines of flight between these 2 most important populations. Our limited data indicates

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that individuals of this species frequently disperse, most likely during nighttime flights, to small temporary wetlands throughout Tinian and Saipan.

b). whether individuals of the Endangered (and our data indicates definitely declining) Vanikoro Swiftlet (Aerodramus vanikorensis) frequently seen foraging over habitat identical to the project site on southern Saipan, only 4 miles to the North would be killed in great numbers. In light of the acknowledged fact that "Injury or death may result if a bird were to fly directly into the path of a beam..." (p IV-9), this seems likely. This is another reason why the cumulative effects of the 3 antenna systems should be considered in order to predict the impacts to our endangered bird fauna.

c). whether individual Marianas Fruit Bats (Pteropus mariannus) foraging over northern Tinian would be killed by the radar beams. This species is very rare on Tinian and Saipan (less than 100 individuals on each island according to our data), is proposed as Endangered, has been sighted recently on both Tinian and Saipan, is known to fly between islands on occasion, and is an extremely popular and important wildlife species to the Chamorro people. The very real possibility that a few individuals of this rare and declining species might fly through these (3?) relatively huge zone(s) of impact during their extensive nighttime foraging flights and be killed cannot be discounted and must be discussed.

4. Certain information pertinent to an understanding of the area of impacts appears to be missing from the EA. First, what is the actual length of the antenna? Second, does the 104 acres mentioned include all support facilities, including the quarters, etc. shown in figure II-2? Third, will the antenna be lighted at night? And fourth, what will be the size of the 2 additional antennas evidently planned for construction as part of this same project?

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Specific Comments

Page	Comment
IV-5	The statement that birds and other wildlife displaced by the project-related habitat removal would "seek other nearby habitat" is misleading. Birds displaced almost invariably die, since the areas to which they are displaced will already be occupied by other birds' territories. A more descriptive and scientifically accurate way of explaining the impacts would be to quantify the estimated percentages of habitat (and thus percentages of currently estimated populations of a given species) which would be permanently lost by this habitat removal. Again, it is imperative that the cumulative habitat loss of the total project be estimated in order to give us an idea of the complete picture. Quantifying only 1/3 of the eventual losses at this time would be deceptive and not in keeping with NEPA intent and specific requirements.
IV-5	Regarding the impacts of birds striking antenna arrays, the statement is made that "previous research on Guam and Yap has shown that birds striking towers, antennas and anchoring systems, have not been a significant problem." We question the accuracy and honesty of this statement. Obvious questions raised by this statement are first what type and how extensive a "research" effort is referred to? And second, this is "not a significant problem" for whom? Perhaps not for the Navy personnel who will man the facility in that it will not physically harm them. However, for the many local residents who enjoy and benefit from their native birds, including using seabirds to guide them to the schools of fish which comprise part of their livelihood, for the economically important tourists who come to the Marianas to enjoy tropical wildlife not available in their homelands, and for those dependant on the economically important tropical forest which is in turn dependant on the native fruit bats and birds to maintain its ecological health, this may be a very "significant problem." In fact, our brief literature survey supports just the opposite conclusion - that under certain conditions even much smaller antenna arrays, indeed single antennas, have caused "significant problems" to bird populations. These conditions include locating antennas in areas near important bird concentration points (such as Lake Hagoi, approximately 2 km SW of the proposed project), during inclement weather (such as the typhoons which frequently occur in the project area), along a bird migration path (such as a chain of small oceanic islands), where very large slow-moving flying animals are involved (such as the locally common Eastern Reef-heron and the rare Marianas Fruit Bat), and where very rare flying species are involved (such as the Marianas Common Moorhen, the Marianas Fruit Bat, and possibly the Marianas Mallard).

COMMENT

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Enclosed is a partial list of literature citations on the documented impacts of antennas and transmission lines on birds, for your information. It should be noted that none of the structures involved in these studies approaches the proposed structure in size, much less the size of 3 of these structures, yet each was involved in "significant problems" to bird populations.

We specifically request that, in light of this new information, you rewrite this section to honestly evaluate the risks that "significant problems" might occur to local rare and common bird populations as a result of their striking towers, antennas, and anchoring systems.

IV-5 As discussed, we consider the potential for impact from the relatively huge quantities of electromagnetic radiation to be released to be very great. Considering the millions of square feet of area in which a transient bird will admittedly be subjected to "injury or death" (p IV-9), this seems obvious. Therefore, this certainly should be discussed in any section entitled "Biological Considerations." Further, the simple statement that the emissions could cause "injury or death" does not contain sufficient information to allow us to evaluate the risk. Please supply specific information on distance of impacts, size of animals which would be most at risk, frequency of exposure required to cause injury, and findings at similar projects so that we can formulate an opinion on the dangers involved.

IV-8 Section 7. "Aesthetics." The facility will certainly be seen by the many thousands of foreign tourists and local residents which annually visit the popular beaches, reefs, and fishing spots of Saipan's southern shoreline, only 3 mi to the North. The presence of 120-ft high antennas dedicated to military purposes and emitting relatively huge amounts of electromagnetic radiation aimed directly at Saipan's southern beaches will almost certainly be considered offensive to a certain percentage of these tourists and residents and should be discussed here.

IV-9 In light of the above information, the simple statement that "the impact of electromagnetic radiation on birds is not known" is not sufficient to address our concerns. We request that efforts be made to ascertain what is known about impacts at similar facilities in order to help us understand the risks. While we acknowledge that the exact impacts may not be know, the preponderance of evidence seems to indicate that they may be severe. Therefore, statements such as this do not seem to show the "good faith effort" required by NEPA to disclose all potentially serious project impacts.

IV-15 Section I. acknowledges and discusses the increased risk of Brown Tree Snake introduction and lists steps which could be taken to minimize the risk. However, no specific mechanisms or

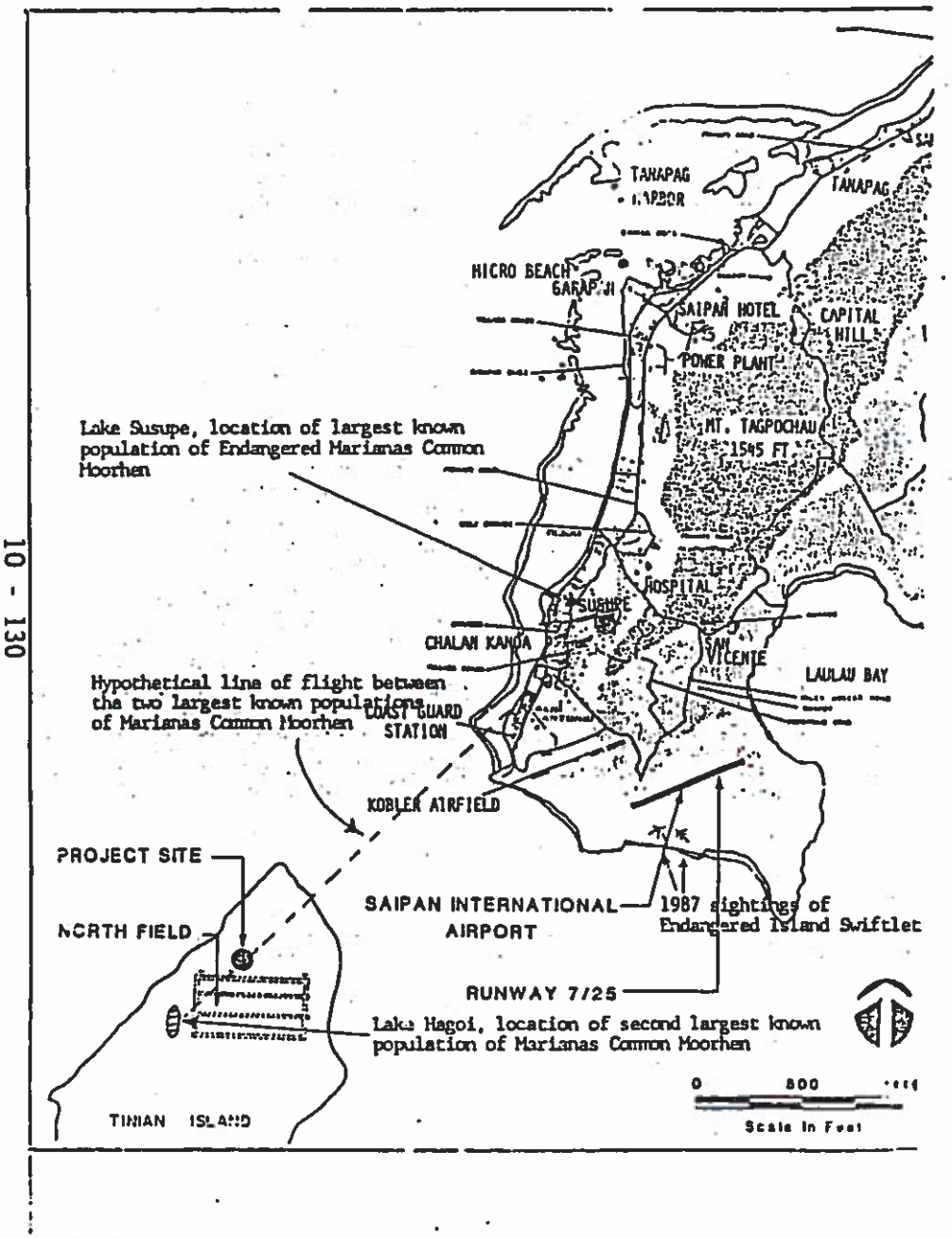
COMMENT

RESPONSE

commitments from the Navy are discussed. The Division will insist that inspection and control personnel and procedures be installed prior to any construction. As stated correctly the Division considers the "Brown Tree Snake to be the single greatest threat to CNMI's wildlife resources." In light of this, we request that a proposed protocol for the Navy's snake protection effort for this project be included in the final EA. If the EA is not considered to be the proper vehicle for this, please explain why, and when this will be forthcoming. At the 23 March 1987 meeting Navy personnel were unable to provide us with any contact point with which to begin discussions regarding this problem.

COMMENT

RESPONSE



COMMENT

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Literature on Bird Mortality from Towers and Transmission Lines

Anderson W.L. 1978. Waterfowl collisions with power lines at a coal-fired power plant. Wildl. Soc. Bull. 6 (2): 77-83.

Avery, L.M. ed. 1978. Impacts of transmission lines on birds in flight. Proc. of a workshop. U.S. Dept. Int. FWS/OBS-78/48. 151 p.

Avery. M. and T. Clement. Bird mortality at four towers in eastern North Dakota - Fall 1972. Prairie Nat. 4 (3-4): 87-95.

Avery, M.P.F. Springer and J.F. Cassel. 1976. The effects of a tall tower on nocturnal bird migration - a portable ceilometer study. Auk 93 (2): 281-291.

Avery, M.P.F. Springer and J.F. Cassel. 1977. Weather influences on nocturnal bird mortality at a North Dakota tower. Wilson Bull. 89 (2): 291-9.

Cornwell, G. and H.A. Hochbaum. 1971. Collisions with wires - a source of anatid mortality. Wilson Bull. 83 (3): 305-6.

Crawford, R.L. 1974. Bird casualties at a Leon Country, Florida TV tower: October 2966 - September 1973. Bull. Tall Timbers Res. Sta. Talla - hassee, FLA. No. 18:27 p.

Crawford, R.L. 1976. Some old records of TV tower kills from southwest Georgia. Oriole 41 (4): 45-51.

Faanes, C.A. 1983. Assessment of powerline siting in relation to bird strikes in the Northern Great Plains. USFWS Northern Prairic Wildlife Res. Center. Jamestown, N.D. 58401. Submit. to Avian Mortality Study Group: 54 p.

Faanes, C.A. 2984. Avian mortality from collisions with powerlines in the Northern great plains. Research Information Bulletin. No. 84-85. Aug. 1984. 2 p.

Halvorson, G. 1984. Whooping crane powerline mortality/injuries. U.S. Fish and Wildlife Service Region 2, Albuquerque N.M: 2 p. (This is an informal compilation of known strikes).

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COMMENT

RESPONSE

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COMMENT

RESPONSE

CHAIRMAN
Committee on General
Government Operations

TED S. NELSON
Vice-Speaker
Twentieth Guam Legislature

163 Dolor Santo Papa, Agana,
Guam 96910
Telephone: 671 (7) [illegible]

September 28, 1989

CDR. E. C. Rushing, Jr.
Pacific Division
Naval Facilities Engineering Command
Pearl Harbor, Hawaii 96869-7300

ATTENTION CODE 09P2

Re: Navy/Air Force Draft Environmental Impact Statement

Dear Cdr. Rushing:

10 - 133

The Navy's proposed project to construct three (3) Relocatable Over the Horizon Radar (ROTHR) receiver systems in northern Guam, raises many concerns. It is rather unfortunate that the public hearing conducted on Friday, August 18, 1989, at the Piti Middle School did not provide the public in attendance with an understanding of the project. As a matter of fact, it raised questions and concerns that were never answered. These concerns dealt with the development of adjacent private properties.

I need not dwell on the fact that the "Draft Environmental Impact Statement" (DEIS) comprises three sections. Section 1 addresses the overall program of installing three (3) ROTHR receiver systems on Guam. Sections II and III address the environmental impacts of the first three (3) ROTHR projects, and the work necessary for the Navy to start their preliminary work on the second ROTHR system.

In addition to inhibiting the development of the adjacent private properties, I must emphatically state my concern for the protection of the northern ground water lens. It is a known fact that the Department of Defense have at one time, with their abandoned disposal sites, contaminated Guam's water supply. In 1978, Andersen Air Force Base officials discovered that the drinking water on base was contaminated with cleaning solvent trichlorethylene (TCE), a suspected carcinogen. The contamination was coming from old abandoned military landfills where the solvents had been disposed.

Concerns were also raised regarding the Department of Defense's ability to monitor ground water pollutants. Guam has already experienced this and we know that the Department of Defense has not adequately involved all regulatory agencies in its own programs to clean up DOD-owned waste sites.

COMMENT

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This project, which comprises a series of ROTHR receiver systems, as proposed by the Navy, would completely clear and level over 600 acres of prime endangered species habitat in northern Guam. More importantly, rather than continuing to annihilate Guam's wildlife, the military should be supporting Guam's efforts to protect these endangered species such as the "Guam Rail" and the "Marianas Fruit Bat". These species are native to the very area in which the Navy desires to erect their monstrous receiving antennae. If completed, as proposed by the Navy, these endangered species will be forever lost to Guam and to the world. The Air Force claims that their primary mission is peace. Continuation of the ROTHR project on Guam does not seem to hold up to the Air Force's claim.

As a policy maker for the Territory, I will not allow the military to further contaminate Guam's northern ground water lens, destroy our critical habitat area, and, at the same time, deny our people permanent access to their inheritance and heritage.

Another issue of concern to me are the restrictions placed on the development of the adjacent private properties. For many years, the Artero and Castro families, owners of Urunao and Jinapsan Beach, have been trying to obtain permanent unfettered access to their properties. Since 1962, when the Navy condemned Ritidian Point from the Castro family, their prime real estate property has been landlocked. Presently, the Artero family are trying to develop Urunao Beach. While on the other side of Ritidian Point, the Castro family have plans to develop Jinapsan Beach. For many years, these two families have been trying to develop their properties. However, with the proposed ROTHR projects, not only would they not be able to develop their properties, but the military, known for owning prime real estate, will continue to build its real estate empire in Guam. 251

#251. See #21 and #22.

Can the Navy, or its authorized agents, guarantee the Artero and the Castro families unfettered access to their property? This question must be answered and the families assured that they will not be subject to more stringent rules and regulations.

Continuous denial of access to private properties under the guise of national defense or security with military projects or sites of doubtful defense or security purposes border and infringe on the owners constitutional rights. Its about time that the military started designing their projects so that they can perform their mission and still allow the landowners access to their private properties, instead of the old adage of lets design our projects so we can block them out of their property forever, and that way we don't have to give them access or fair and adequate compensation.

Based on the foregoing, and the lack of answers to the many questions that we have, we are respectfully requesting that another indepth study be conducted to determine the feasibility of locating such installations on another uninhabited or less inhabited islands, with

the specific purpose of changing any plans for locating ROTHR installations on Guam.

Thank you for allowing me to register my opposition on the Draft Environmental Impact Statement, and the construction of three (3) ROTHR Receiver sysetms in northern Guam, and I look forward to receiving your response concerning the development of adjacent private properties.

Sincerely,

TED S. NELSON

cc: Congressman Ben G. Blaz
Congressman Ron De Lugo
Congresswoman Patricia Schroeder
Congressman Robert Laqomarsino
Congressman Les Aspin
Congressman William Dickinson
Congressman Morris Udall

COMMENT

RESPONSE

SAVE THE WORLD

PO Box 84366 Los Angeles CA 90073

10/2/99

Dear Commander:

Thank you for the draft EIS for your proposed electronic installations on Guam and Tinian in the Mariana Islands, and for the opportunity to comment on it.
We find some deficiencies in the following areas:

1) Lack of protection of endangered species.
If you construct receivers at the northern sites on Northwest Field and NAVCAMS, you will quite likely hasten the federally endangered Guam Micronesian Kingfisher, the Mariana Crow, the Guam Broadbill and the Mariana Fruit Bat on their way to extinction. As you are undoubtedly aware, Fish & Wildlife Service is proposing critical habitat for these species. The revised EIS should honor the language and spirit of the Endangered Speices Act and withdraw sites P-223, P-225 and P-002 from consideration as receiver locales. | 252

#252. See #32, #218, #222 and #234.

On Tinian, leaving the tallest trees won't prevent Mariana Common Moorhens from flying into your towers and cables, if they're 125 feet high and the trees are only 30 feet. Alternate sites to the east or west do not pose this problem and will require, we understand, only 178 acres--no substantial impediment to the Navy's leaseback agreement with the government for over 12,000 acres. | 253

#253. Comments noted.

2) In general, alternative sites are ignored or glossed over. For instance, why not locate transmitters in the FAA, South Finegayan and Harmon areas on Guam and receivers on Tinian? Transmitters would displace very little critical habitat on Guam, and receivers wouldn't threaten moorhens on Tinian. (According to Fig. 5.2.2, NAVCAMS receivers need only 2 miles clearance from transmitters, not 15 miles as claimed in the text.) Other alternate receiver sites also exist but are left undiscussed. | 254

#254. See #34.

#254A. Comments noted. Each ROTHR system operates independently or in isolation of the other. The collocation of the ROTHR to adjacent sites is to utilize efficiency of scale in manpower and facilities.

3. The document needs to discuss the cumulative effects of all three pairs of transmitters and receivers. This is a single defensive system and doesn't operate in isolation; why treat it as such in the EIS? | 254A

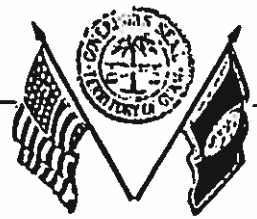
We urge you to write a second draft before undertaking a final EIS, in which you give endangered species their proper due, abandon the idea of using habitat FWS wishes to preserve, study more alternative sites and consider the system's effects cumulatively, rather than on a piecemeal basis.

Thank you very much.

Don Strachan
Director

COMMENT

RESPONSE



Territory of Guam
Teritorion Guam

OFFICE OF THE GOVERNOR
LIEUTENANT GOVERNOR
AGANA, GUAM 96910 U.S.A.

OCT 05 1989

Commander E.C. Rushing, Jr.
Division, Naval Engineering Command
Pearl Harbor, Hawaii 96860 (Code 09P2)

Hafa Adai Commander Rushing:

The purpose of this letter is to register the concerns of the Aviation Policy Task Force regarding the Navy's Draft Environmental Impact Statement on the Relocatable Over the Horizon Radar (ROTHR) Project. The Task Force was created by Governor Ada to review issues and opportunities relating to aviation matters as aviation is vital to Guam's economic growth.

The members of the Task Force feel that the DEIS does not sufficiently address the impacts of ROTHR on surrounding land areas and uses and does not adequately analyze all available alternate sites. While many inadequacies are evident in the DEIS, the Task Force focuses its comments on aviation-related deficiencies of the DEIS.

1. The task force is specifically concerned that aircraft would have to be re-routed around any of the proposed ROTHR sites, which would create problems for aircraft and generate noise over civilian areas not currently affected by aircraft overflights.

2. Training areas have been established over Guam for general aviation aircraft. This is a growing industry which must be nurtured. The DEIS must address impacts on these areas.

255

#255. Since aircraft are not normally emitters of noise in the HF spectrum, it is not anticipated that local aircraft operations will have a sufficient adverse impact on the ROTHR system to warrant placing any restrictions on these activities. However, in the event that frequent flights by certain aircraft are found to produce abnormal amounts of electromagnetic radiation, the Navy will request restriction of flights by such aircraft to stop the interference. This would be done by using the FAA's notice to airman (NOTAM) system.

10 - 137

COMMONWEALTH NOW!

3. Use of most sites would restrict airborne tours of the island's coastline by aircraft or helicopters, and could adversely affect to use of helicopters to provide surveillance of the island searching out marijuana farms, etc. 255

In that the DEIS does not address aviation concerns in detail, the Task Force opposes the location and operation of ROTHR on Guam.

Si Yu'os Ma'ase',

FRANK F. BLAS
Lieutenant Governor
and Chairman, Aviation
Policy Task Force Committee

COMMENT

RESPONSE

DEPARTMENT OF PARKS AND RECREATION

GOVERNMENT OF GUAM
490 Naval Hospital Road
Agana Heights, Guam 96910
Telephone: (671) 477-6620/1

JOSEPH F. ADA
Governor

FRANK F. BLAS
Lt. Governor

ANTHONY C. MARIANO
Director

DENNIS M. ZERMENO
Deputy Director

OCT 10 1989

Mr. J.L. Busekrus
Head, Facilities Planning Department
Department of the Navy
Pacific Division
Naval Facilities Engineering Command
(Makalapa, HI)
Pearl Harbor, HI 96860-7300

Dear Mr. Busekrus:

10 - 136

This comment is in response to your letter 11010 Ser 09P2/9648 of 31 August 1989.

I must point out that the Navy has not to this date determined whether Northwest Field, located on Andersen Air Force Base, is eligible for inclusion in the National Register of Historic Places, or even for designation as a National Historic Landmark (NHL). Several of the proposed alternatives will require use of lands either directly adjacent to the runways of Northwest Field or within larger areas at one time considered for nomination to the Guam Register of Historic Places.

While noting that the National Park Service had proposed NHL status for Northwest Field, the DEIS does not include any determination whether the area is a significant cultural resource nor whether the various alternatives in the area would constitute adverse effects to it if it is found to be significant. This lack of a determination is even more puzzling since one of the cultural resource survey reports included with the DEIS specifically notes that Northwest Field is probably significant under Register Criteria A and C.

Final alternatives for the ROTHR project should not be selected until compliance with the procedures of 36 CFR 800 are also met. After all, possible adverse effects to cultural resources are one of the factors that should be considered and weighed in the decision process, not afterward. In this case, the Navy should complete the identification process by finishing the documentation of Northwest Field adequately for making an evaluation of significance by National Register criteria. That documentation would probably also allow the National Park Service to resolve whether to designate Northwest Field as a National Historic Landmark, as well. Should the site in question be eligible for the more significant Historic Landmark designation, your obligation with respect to protection of its significance are increased--a concern that certainly should be resolved prior to committing a decision to place an antenna array adjacent to the runways and

256

#256. The U.S. Navy and the Guam Historic Preservation Office have conducted discussions regarding the historic values of Northwest Field. They do not concur with the proposed National Historic Landmark status as has been indicated by the National Park Service. Nevertheless, the U.S. Navy and the GOVGUAM do suggest that Northwest Field may be eligible for inclusion in the National Register of Historic Places. Therefore, the proposed northern sites for Project P-223 would have an adverse effect on Northwest Field.

However, since there are presently no standing structures associated with the original airfield operations, and because no significant localized events (such as the events associated with the atomic bomb at North Field in Tinian) seemingly occurred at Northwest Field, it is felt that the historic values of Northwest Field lie to a greater degree in the information contained in archival documents than in remains still extant within the confines of the proposed boundaries of Northwest Field National Historic Landmark.

Thus, the impact of the ROTHR project construction will be mitigated by: (1) a program of additional archival documentation; (2) field photography of the existing runways, taxiways, hardstands, and other surviving airfield remnants; and (3) disposition of the collected archival documents and photographs into appropriate repositories (the War in the Pacific National Historic Park and the main library facility for GOVGUAM) for curation and possible future interpretation.

COMMENT

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associated features of the site.

Since the Navy has been well aware of the probable National Register eligibility and possible National Historic Landmark eligibility of this site for several years but has not yet made any determination of the site's significance as required under 36 CFR 800, I have brought the matter to the attention of the National Register with the suggestion that they request a formal determination of eligibility regarding the property. Copies of our comments have also been forwarded to the Advisory Council.

The Navy should not make commitments to any specific alternatives prior to providing the Advisory Council on Historic Preservation an opportunity to comment through the steps detailed in 36 CFR 800. The Council will not have that opportunity until the Navy has completed its tasks of identifying and evaluating the significant properties that may be affected, and assessing those effects.

The lack of effort to follow this procedure in the case of Northwest Field is somewhat curious since appropriate identification and evaluation measures appear to have been completed with respect to possible pre-historic sites in the alternative project areas. In all cases, specific measures for mitigation of possible adverse effects to the identified sites remain to be decided and documented in an MOA as provided in 36 CFR 800.

10 - 140

Sincerely,

A. C. Mariano

ANTHONY C. MARIANO
State Historic Preservation Officer

cc: Director, Bureau of Planning
Director, Department of Agriculture
Director, Guam EPA
Governor's Office
Claudia Nissley, ACHP, Golden, CO
Carol Shull, National Register
Ed Bearss, NPS History Division
John Martin, AAFB

COMMENT

RESPONSE

September 28, 1989

Facilities Planning Department
Department of the Navy, Pacific Division
Naval Facilities Engineering Command
Pearl Harbor, Hawaii 96960-7300

Gentlemen:

We wish to offer comments and recommendations on the Relocatable Over the Horizon Radar (ROTHR) transmitter installation proposed for the island of Tinian.

We have reviewed two documents supplied by your office on this subject: (1) the "Draft Environmental Impact Statement for Electromagnetic Installations in the Western Pacific" dated July, 1989, and (2) "A Study of Electromagnetic Environmental Effects Associated with the Relocatable Over the Horizon Radar (ROTHR E^3 Study), Volume I, Hazardous Electromagnetic Radiation" dated 1 August, 1989. In this letter we will refer to the first document as "DEIS", and to the second as "ROTHR E^3".

10 - 141

According to the description of the preferred site found in both documents, the ROTHR transmitter and antennas will be located on North Field, Tinian Island, approximately three (3) miles from the southern end of Saipan Island[1]. This installation will eventually consist of three sets of transmitters, each capable of producing 200,000 watts of electromagnetic energy. Each set of transmitters will feed into a set of high gain antennas capable of effectively increasing the output power of the installation over 300 times[2]. The result will be three installations emitting between 12.6 million and 63.2 million watts of electromagnetic energy[3] twenty-four hours a day, seven days a week.[4]

257 #257. See #248.

One set of these transmitters and high gain antennas has a "boresight" (beam direction of highest concentration) bearing 38° east of north from Tinian[5]. This means that between 12.6 million and 63.2 million watts of high frequency electromagnetic energy will be beaming from Tinian, three miles away to the south, straight along the length of Saipan all day and all night, every day of the month, every month of the year for as long as the U.S. Navy, or the Department of Defense, considers it advisable.

[1] For footnote references, please see attached page at end of this letter.

"Not to worry!", your report says: according to the safety standards adopted by the U.S. Navy, "no adverse effects have been demonstrated to occur" to people, so long as they stay outside the fence we'll put up a thousand feet in front of the antennas on Tinian[6].

257

But we do worry. We worry because no one has demonstrated that the kind of radiation which will be bombarding us on Saipan twenty-four hours a day, week in and week out, is NOT harmful to people. No one knows yet what the cumulative, long term effects of this kind of exposure to close by, high powered radio beams may be. Just as no one realized the long term effects of dumping toxic wastes until children began to sicken and die at Love Canal.

We worry even more when we find your own report admitting that there are no universally accepted safety standards to guard against the kind of radiation the people on Saipan will be constantly experiencing if you proceed with your proposed project on Tinian. We quote from pages 4 and 5 of your August 1, 1989 report which you claim shows that your proposed radar installation on Tinian poses no radiation hazard to us who live and work on Saipan.

> There are few definitive sources of data for quantifying and evaluating the radiation hazards identified in this document. The most widely documented subject is that of RFEMR [radio frequency electromagnetic radiation] hazards to personnel about which much research has been done and for which an accepted U.S. national standard exists. But even this field varies widely when international conventions and standards are considered. . . . As emitters become more and more powerful . . . the need for research and agreed-upon standards to minimize risks is escalating. Currently much work is being done to deal with these developing issues but little in the way of international consensus has so far emerged. This report, therefore, draws upon what information is available in the literature, local standards such as MIL-STDs [military standards???] and Navy policy directives, and the extrapolation of nominal system design data in the light of experience gained in testing programs over the years . . . and [are] verified whenever possible by field tests of the ROTHR prototype located in Virginia.[7] [Emphasis added.]

But in the hearings on ROTHR held on Saipan it was stated that the prototype in Virginia has only been operating a short time. And even if no harmful effects had become evident after several years of operation, does the Virginia ROTHR have people living right in the path of a main beam of radiation like people on Saipan will be exposed to?

Since there is no international consensus on how harmful this radiation can be, the "assurance of safety" in your ROTHR[3] comes down to little more than an acceptance of "military standards" and "Navy policy directives". That,

gentlemen, is not reassuring to people who remember what the U.S. Navy and Department of Defense did to our Pacific island neighbors who lived on Rongelap, and Eniwetok, and Bikini.

To us the passage cited above amounts to this: you really cannot prove your over-the horizon-radar installation on Tinian will NOT be harmful to the people living on Saipan. Until you can prove that, we believe you should NOT BUILD THE ROTHR ON TINIAN.

If you feel an over-the-horizon-radar is necessary in this part of the Pacific for reasons of national defense, put it where it will not irradiate people. There are several uninhabited northern islands in the CNMI, well out of harms way. More expensive to build there? So be it! People are more important than money, even though some governments may not think so.

In closing, let us make it clear that we consider the proposed ROTHR proposed for Tinian to be a potentially lethal hazard to our health and safety, and to the health and safety of all the people living on the island of Saipan because we will be living in the boresight -- "right down the barrel" -- of your proposed radar installation only three miles away.

We urge that this relocatable installation be proven relocatable. We want it relocated to some remote area before it is built, so it will not endanger us and our families and neighbors -- or any other innocent people.

257

Sincerely,

Carmen Castro-Guskind
for The Coalition of Concerned CNMI Residents

cc. Governor, CNMI
President of the Senate
Chair, HEW Senate Committee
Washington Representative
Mr. Lorenzo I. Guerrero
Bishop of Chalan Kanoa
Editor, Marianas Variety
Editor, PDN
Station Director, KSAI
Lt. Governor, CNMI
Speaker of the House
Chair, HEW House Committee
Assistant to Washington Representative
Mr. Victor B. Hocog
Pastors, Saipan Churches
Editor, Marianas Review
Saipan Cable TV
Station Director, KCNM

COMMENT

RESPONSE

Footnotes for Letter from the Coalition of Concerned CNMI Residents

[1] DEIS: Section 4.1.1, and map on page 5 - 39

[2] ROTHR E[3]: formulas for 28 mHz, page 14

[3] Same as footnote 2

[4] DEIS: page ii

[5] DEIS: Figure 5.1.5, page 5 - 29

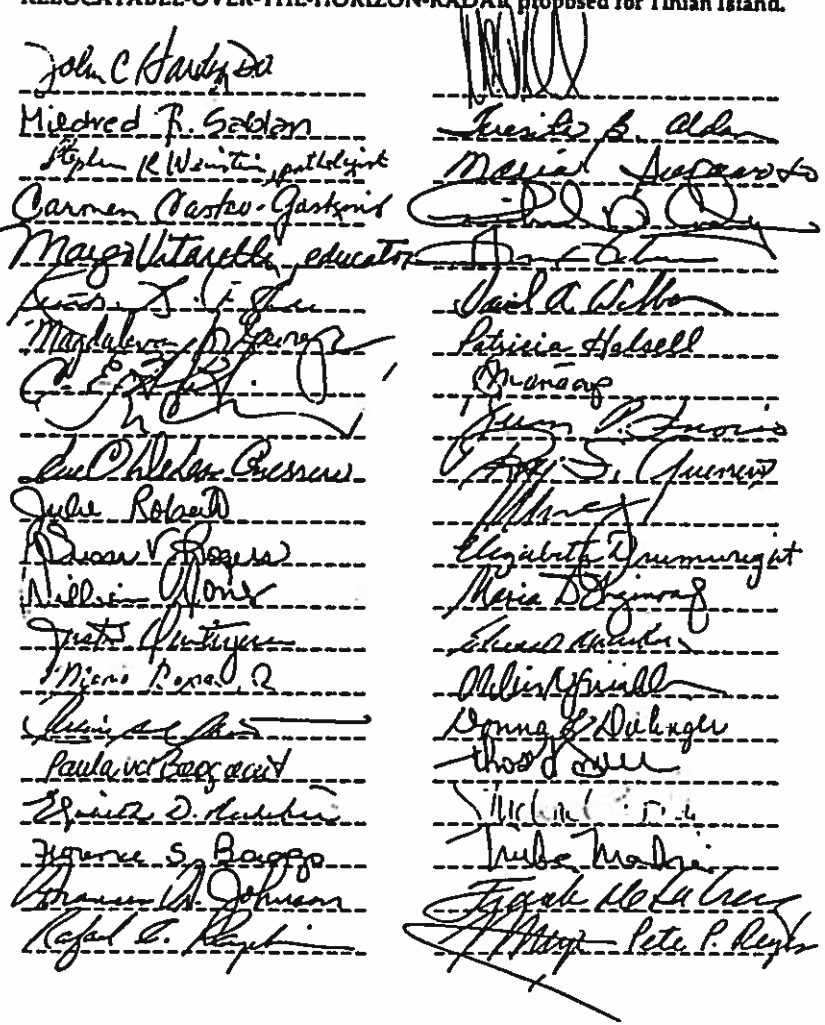
[6] ROTHR[3]: pages 11-15

[7] ROTHR[3]: pages 4 and 5

COMMENT

RESPONSE

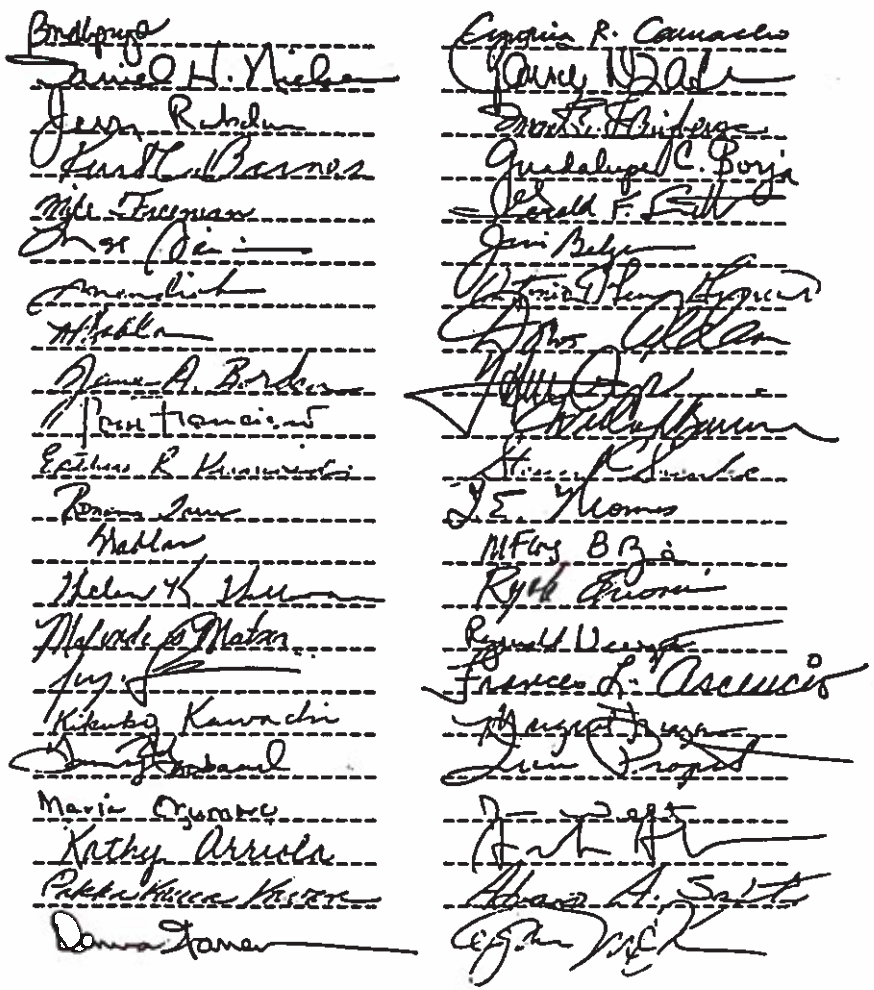
We, whose signatures appear below, are signing the letter, dated September 28, 1989, from the Coalition of Concerned CNMI Residents to the Naval Facilities Engineering Command in Pearl Harbor, Hawaii, concerning the RELOCATABLE-OVER-THE-HORIZON-RADAR proposed for Tinian Island.



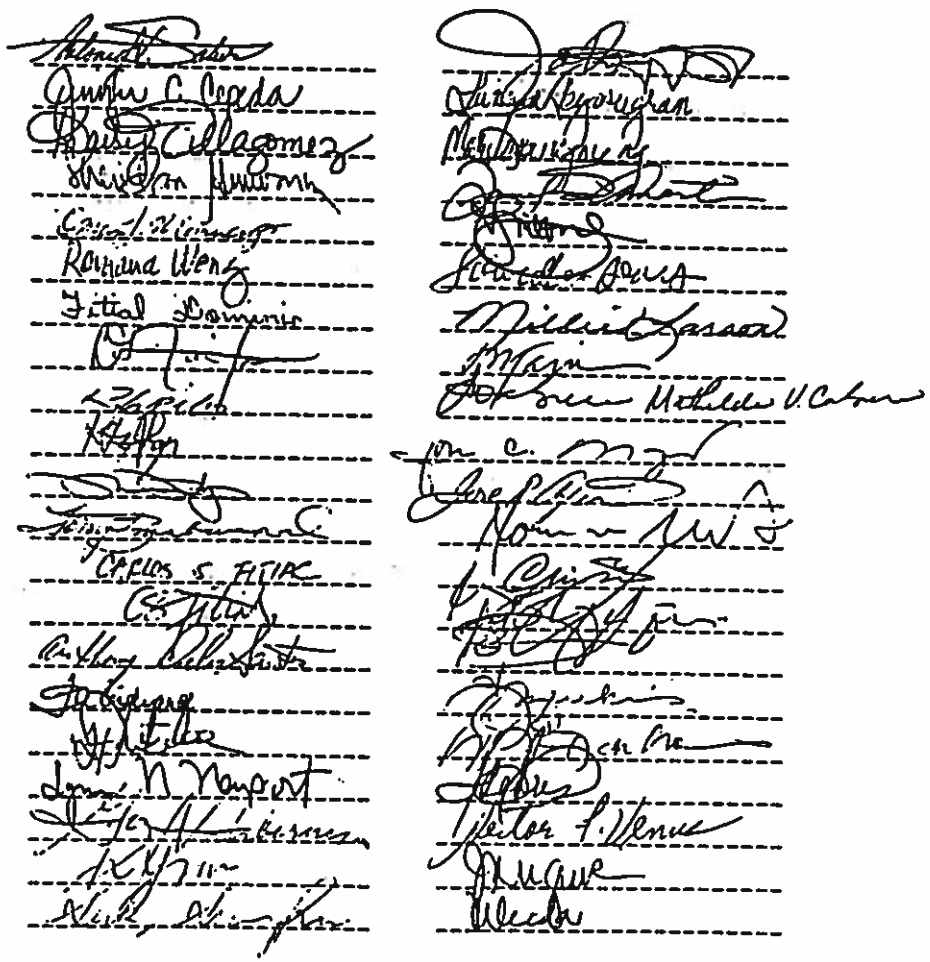
COMMENT

RESPONSE

We, whose signatures appear below, are signing the letter, dated September 28, 1989, from the Coalition of Concerned CNMI Residents to the Naval Facilities Engineering Command in Pearl Harbor, Hawaii, concerning the RELOCATABLE-OVER-THE-HORIZON-RADAR proposed for Tinian Island.



We, whose signatures appear below, are signing the letter, dated September 28, 1989, from the Coalition of Concerned CNMI Residents to the Naval Facilities Engineering Command in Pearl Harbor, Hawaii, concerning the RELOCATABLE-OVER-THE-HORIZON-RADAR proposed for Tinian Island.



COMMENT

RESPONSE

GOVERNMENT OF GUAM
AGANA, GUAM 96910

OCT 05 1989

Commander E.C. Rushing Jr.
Division, Naval Engineering Command
Pearl Harbor, Hawaii 96860 (Code 09P2)

Hafa Adai Mr. Rushing:

The Bureau of Planning is offering its comments on the Draft Environmental Impact Statement (DEIS) for Electronic Installations in the Western Pacific (ROTHR).

We believe the DEIS is deficient in the identification and evaluation of other viable alternate sites on Guam including those sites briefly mentioned and rejected. Section 2.5.2.2 rejects Andersen South and Andersen Barrigada Annex on the basis of (inadequate) size; possible interference with communication operations; possible electromagnetic interference from vehicular traffic; and other community activities. However, the DEIS does not discuss in detail the extent of these factors nor any feasible mitigating measures. Without this information, it would be difficult to make informed decisions on these sites. The Navy has determined that 172 acres is adequate for each receiver antenna site. The Andersen South property contains over 2,530 acres of which approximately 1,580 acres is idle land. Other potential sites the DEIS did not consider is the Navy property on Nimitz Hill (750 acres) and the existing NASA site at Dandan in Yona. 258

#258. See #47B.

#258A. See #66 and Appendix J Review/Evaluation.

We further believe that the three antenna receiver sites must be treated in one single environmental impact statement, as a single project, in order to evaluate both individual and cumulative impacts in accordance with the National Environmental Policy Act (NEPA) and the Endangered Species Act (ESA). Although the DEIS explains that each project is not dependent on the other two to be operational, the Navy's objective is to construct all three projects on Guam in order to provide the desired surveillance coverage in the Western Pacific. An interpretation of the NEPA indicates that these sites cannot be considered as separate and independant projects for the purposes of environmental impact assessment because all three projects are "reasonably foreseeable" developments. 259

#259. See #44.

The following are additional major concerns that the Government of Guam urge the Navy to address in developing a final EIS:

#260. See #66. See Appendix J Review/Evaluation.

1. <u>OTHER ALTERNATIVE SITES.</u> The Navy should consider additional viable alternate sites including those mentioned above. This 260

evaluation should include, but not be limited to, the actual size of the site; detailed discussion of possible interference with other activities; land use conflicts; and feasible mitigating measures. 260

2. P-223 SITE, NORTHWEST FIELD. Section 5.2.12.1 states that development at Urunao Beach property owned by the Artero Family could pose potential conflicts with the proposed ROTHR receiver at Northwest Field as well as the Navy communication operations at NAVCAMS WESPAC.

This property has recently been rezoned Hotel Zone. The Navy is keenly aware of the plight the Artero family has endured for years in the use and development of their property due to restrictions and denial of access to the property by the Federal authorities. Another private beachfront property owned by the Castro family is located in the area known as Jinapsan directly below the proposed site for project P-002. The Castro family has also been denied the right to fully develop and benefit from their property. There is no doubt the P-002 project will directly affect this property. The Navy should fully address this issue. 261

#261. See #22.

Another concern is the recent discussion between GovGuam and the Navy of possible relocation of the Naval activities at the Naval Air Station to Andersen Air Force Base. The DEIS should address the impacts the ROTHR would have on this program. 262

#262. The siting of the ROTHR receiver at Harmon Annex, NAVCAMS WESTPAC South Finegayan, or in the Northwest Field area would have no significant siting impacts on the possible relocation of Naval Air Station to Andersen Air Force Base. Andersen Air Force Base is about five miles from the proposed ROTHR sites at NAVCAMS WESTPAC Finegayan and Northwest Field.

3. P-225 NAVCAMS/WESPAC AND FORMER FAA SITES. Our evaluation of these sites indicates that the former FAA site appears to be more acceptable in terms of endangered species management, historical and cultural resource preservation and Radio Frequency Interference and land use considerations. The DEIS should elaborate on these sites. 263

#263. The comment will be considered in the site selection for Project P-225. See Appendix J Review/Evaluation.

4. P-223 ANDERSEN HARMON ANNEX SITE. The Navy recently indicated that 1,500 acres of property at Andersen Harmon Annex (vicinity of Puntan Dos Amantes) might not be released as they will be used for ROTHR. GovGuam opposes this proposal due to the impact of the project on existing infrastructure in the area that includes the Tanguisson Power Plant, Northern District Sewage Treatment Plant, numerous easements and a sewer pump station. The DEIS states that a radio frequency occupancy test will be required to verify adequacy of the site due to its proximity to the power plant. The project will also affect numerous utility easements including sewer lines, power and telephone lines, overseas communication cables, and public access to Two Lovers (Puntan Dos Amantes) Point Park and NCS Beach Park. This proposal will also affect GovGuam's effort to acquire this property under the surplus lands program.

5. MAJOR FACILITY SITING. (Section 5.2.17) The DEIS states that the proposed project at any of the alternative sites can be considered a major facility. The DEIS should elaborate in 264

#264. The project meets the criteria of a major project.

COMMENT

RESPONSE

detail why this project can be considered a major facility.

6. The GovGuam is also concerned on the impact of the ROTHR sites on commercial and private aircraft approach and departure paths associated with the Guam International Airport. The DEIS establishes a RFI FREE ZONE of 1 statute mile in front of the receiver, 1,200 feet behind, and approximately 10,000 feet wide; with additional area for vehicular traffic and power line control would require a massive area measuring 3.6 miles by 2 miles by 2 miles in a trapezoid shape. No vertical RFI requirements are stated in the document, however, we must assume that if transmission of radio frequencies or emission of electromagnetic pulse signals would affect the receiving capability of the receiver antennas then aircraft would be restricted from flying over the sites. The DEIS should address this concern. | 265 | #265. See #255.

7. The DEIS should also specifically discuss the impact of ROTHR on the development of approximately 100 acres of public beachfront property known as Falcona Beach just south of the Artero property. | 266 | #266. See #22.

We feel the DEIS is deficient in evaluating additional alternative sites in sufficient detail for thoses alternate sites mentioned above as well as those sites rejected. The Navy should be sensitive to the local community needs, particularly to those citizens whose properties are affected by the ROTHR projects. We firmly believe that final sites selections could be achieve through a cooperation between GovGuam and the Navy.

Si Yu'os Ma'ase,

PETER P. LEON GUERRERO
Director

COMMENT

RESPONSE

JPC james p. castro

P.O. Box 20731
GMF Guam 96921
(671) 472-3429

October 2, 1989

CDR. E. C. Rushing, Jr.
Pacific Division
Naval Facilities Engineering Command
Pearl Harbor, Hawaii 96869-7300

ATTENTION: CODE 09P2

Re: Comments on DEIS and ROTHR Project

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Dear Mr. Rushing:

My name is James P. Castro, a U.S. Citizen and resident of the Territory of Guam. My family owns real property in northern Guam, specifically, the area called Jinapsan which is situated between Tarague Beach and Ritidian Point.

By means of this letter, I would like to officially register my strong objections to the Draft Environmental Impact Statement [DEIS] on the proposed Relocatable Over the Horizon Radar [ROTHR] receiver project for Guam.

By virtue of their inheritance, my father, his brothers and sisters, are all owners of property that will be affected by the ROTHR P-002 project. As the construction of these ROTHR receiver sites directly affects the surrounding property, I am appalled that the Navy, knowing full well this project affects two parcels of privately-owned property, never notified the respective land owners. 267

#267. Adjacent private landowners were notified of the ROTHR projects along with the general public as part of the NEPA process. Discussions are ongoing with these landowners concerning possible expaned access to their property. See #21 and #22.

After condemning Ritidian Point in 1962 (which belonged to my family), the Navy has seen fit to landlock our inheritance. This, along with the fact that our family has been continually denied the right to fully develop and benefit from our property, has been the trade mark of the military in Guam. With regards to the planned ROTHR receiver project [P-002], let this letter serve as an official protest and objection to the plans for the placement of that facility at the location directly above Jinapsan Beach.

We only ask that the United States Government be more compassionate to its citizenry, and that its Defense leaders be guided by conscience and not be simply convinced that military expansion is the only solution.

COMMENT

RESPONSE

Thank you for allowing me the opportunity to comment and submit my objections to the DEIS and ROTHR projects for Guam. I would greatly appreciate it if a copy of the DEIS can be made available to me for my own review.

Sincerely,

JAMES P. CASTRO

cc: Congressman Ben G. Blaz
Governor of Guam
Speaker & Members, Guam Legislature
The Castro Family

COMMENT

RESPONSE

October 2, 1989

J. L. Busekrus
Head, Facilities Planning Department
Naval Facilities Engineering Command
Pearl Harbor, Hawaii 96960-7300

Dear Mr. Busekrus:

I wish to have this letter entered as comments on the proposed ROTHR transmitter and antennae sites on Tinian Island, Commonwealth of the Northern Mariana Islands.

Thank you for sending me a copy of your "Study of Electromagnetic Environmental Effects Associated with the Relocatable over the Horizon Radar" (ROTHR E^3 Study). I have studied it, and have shared it with colleagues. It is my understanding that some of them will be submitting letters to you commenting on the potential hazards to health of people in the CNMI from your proposed ROTHR. I will therefore leave it to them to comment in depth on possible hazardous effects to people on Tinian and Saipan from your proposed ROTHR.

I do note, however, that the opening pages of your $ROTHR^3$ Study admit that "there are few definitive sources of data for evaluating the radiation hazards identified" with the Tinian ROTHR and "little in the way of international consensus" on the dangers involved. [Please see pages 4 and 5 in your $ROTHR^3$ Study.] I also note that your $ROTHR^3$ Study adopts the 1982 report by the American National Standard Institute (ANSI) as your "standards of safety" from the electromagnetic radiation which will be emitted by the Tinian ROTHR. [Please see your $ROTHR^3$ Study, page 10 & passim.]

I wish to call attention to the fact that ANSI's findings are seven years old, and to note that these ANSI findings are being challenged as questionable. Among others, Dr. Ivan A. Shulman, MD, a surgeon specializing in cancer surgery, has addressed the questionable adequacy of the ANSI study. In an article appearing in the October, 1989 issue of QST, the monthly journal of the American Radio Relay League, Dr. Shulman points out that ANSI is in the process of revising its 1982 "standards". An excerpt from Dr. Shulman's article follows.

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#268. According to the Navy Bureau of Medicine and Surgery, (see Appendix I) ANSI has completed a review of 321 of the most recent up-to-date reports on the potential health hazards of RFEMR. They have concluded that the current recommendations presented by the 1982 ANSI C95.1 remain applicable. The ROTHR program's approach to the problem of RFEMR hazards is to comply with generally recognized standards. These standards are based upon a critical, professional review of the scientific data and literature by authorities on the subject whose reputation and credibility in the field properly credential their work. The ANSI committee is such an authority. See #248.

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> In 1982, the American National Standards Institute (ANSI), a private, commercially sponsored organization, published a list of standards based upon the thermal effects of electromagnetic fields upon tissue.[29] There is much controversy regarding the validity of measuring this type of effect on biologic tissues as there is clear evidence that adverse tissue effects can occur without a detectable rise in temperature.[30] It should be noted that Australia, Sweden and the Eastern bloc countries as well as localities in the states of Oregon and Massachusetts have issued standards which recommend significantly lower exposure levels. Another voluntary standard has been proposed by the National Council for Radiation Protection and Measurement (NCRP), which is notably more stringent than the current ANSI standards.[31] ANSI is presently in the process of revising their standards. [OST, October, 1989, page 32. Emphasis added.]

Your Draft Environmental Impact Statement (page 5-23) makes the flat statement that "no hazard to living organisms exists outside the limits of this [fenced-in] zone" immediately in front of the ROTHR antennas on Tinian's North Field. In light of Doctor Shulman's quotation cited above, I submit that this is an unproved assertion on your part.

The only thing your ROTHR[3] Study proves in this regard is that there is, according to ANSI, no proven hazard to health from rise in body temperature caused by ROTHR radiation beyond the fenced-in zone on Tinian's North Field. That is all. As Dr. Shulman's article points out, even that assertion is being challenged by more recent studies.

Even granting that the main electromagnetic beam will leave the ROTHR antennas at an angle above the horizon [ROTHR[3] Study: Figure A-4, Appendix A], there will still be a powerful ground (or sea) wave which will be continually hitting the exposed west side of Saipan. It is the long-term health effects of this constant electromagnetic radiation on people here that your study should have addressed.

In my first letter to your office dated February 12, 1989 I urged that an independent research laboratory conduct an experiment using small animals such as mice or guinea pigs and a scale model of the Tinian ROTHR to see what effects constant exposure to non-ionizing radiation of this kind has on them. I did not make that suggestion facetiously. Whether this is precisely the best

kind of research to do before you proceed further with your project, I am not expert enough to say. But certainly some further, objective, up-to-date research on potential health hazards to people in the Commonwealth from this type of exposure is in order. Before you subject the people of the Commonwealth to this kind of change in their environment, you owe them at least that much.

I come now to my second concern, potential interference to officially licensed communication in the CNMI including commercial and private aircraft communications, CNMI Government radio links to the Northern Islands, emergency and civil defense radio, maritime and Coast Guard radio, telephone communications via satellite ground station, FCC licensed amateur radio, education radio networks, etc. Your Draft Environmental Impact Statement states on page vi that "the ROTHR systems will not create interference to civil defense, mobile, and HAM radio operations on Tinian and Saipan". On page 5-38 it states that "no evidence exists to indicate that the ROTHR transmitter will overload the front end of any receivers anticipated to be operated in its vicinity". [Typographical errors corrected.]

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#269. See #6.

Except for a reference to the COMSPAWAR analysis done with respect to the Saipan airport's Instrument Landing System, no evidence is given in the DEIS to support either of these statements. And the ROTHR[3] Study is not much more helpful: the five pages of Section 8 on "Electromagnetic Vulnerability" is devoted entirely to electronic systems in large, commercial aircraft. No mention is made of possible interference by the ROTHR with the other communication systems in the CNMI listed above.

So all we can do is hope and pray that what you say is correct: that your ROTHR will indeed be a "good neighbor", i.e. not interfere with licensed radio communications in the CNMI, particularly those operating in the same 5 to 30 mHz frequency range as the ROTHR.

With respect to possible adverse environmental impacts on both personnel and communications in the CNMI, especially those on Tinian and Saipan, I call your attention again to the several questions I posed to your office in my letter of August 23, 1989 regarding environmental impacts from the proposed ROTHR installation on Tinian. Based on the announcement made by the Navy representatives at the public hearings held on Saipan, please note that I asked for answers in writing to each of those environmentally related questions. I repeat that request again here, and I assume that such answers will be made available to the public in the Commonwealth. In addition I wish

COMMENT

written public responses to three additional questions relative to the possible environmental health hazards that I have discussed earlier in this present letter, and which have not yet been addressed by your environmental impact statements. These questions are as follows.

1. In light of the now questionable standards in the ANSI study relative to potential personnel health hazards beyond rise in body temperature from non-ionizing radiation created by the ROTHR, do you intend to have further, objective, up-to-date research on potential health hazards done before proceeding with the Tinian ROTHR project?

2. If yes, what kind, and by whom?

3. If no, why not?

Thank you again for sending me the ROTHR[3] Study. It reached us on September 21, 1989 which gave us only two weeks to read, research, and reply to your study on the environmental effects associated with the Tinian ROTHR, all of this with only the very limited resources available to us in this remote area. However, we have done what we could, and all of us here look forward to reviewing your written, public responses to these concerns prior to your proceeding further with this proposed project.

Sincerely,

L. J. Kaufer

Leonard J. Kaufer, Ph.D.

xc. Governor, CNMI
Lt. Governor, CNMI
Asst. Secretary, OTIA
Senator Daniel K. Inouye

RESPONSE

270 #270. See #268. No additional studies are planned for Project P-223 as the standards have been established and will be met by the ROTHR project.

(Submitted During Saipan Public Hearing)

Commonwealth of the Northern Mariana Islands
Office of the Governor
Capitol Hill, Saipan, MP 96950

Phone: 322-9881
322-9882
322-9883
Telex: 783-822 Gov. NMI
Telefax: 322-9886

06 MAR 1989

Mr. Bill Wong
Pacific Division
Naval Facilities Engineering Command
Code 09A 25C
Pearl Harbor, HI 96860-7300

Dear Mr. Wong:

This letter follows the letter from Mr. Harry R. Marien, Chief, Privatization Division, Directorate of Engineering and Services to Mr. Pete Sasamoto, Executive Director, Commonwealth Utilities Corporation, dated 17 January 1989. In that letter Mr. Marien recommended that the Commonwealth contact you regarding plans for supplying power to the Tinian ROTHR radar facilities.

Pleased be advised that the Commonwealth Utilities Corporation (CUC) is a quasi-government corporation created by law to provide electrical power to all government, commercial, and private customers on Rota, Saipan, and Tinian. All discussions regarding electrical power at the Navy's ROTHR radar facilities on Tinian conducted by any member or branch of the United States Department of Defense should be initiated through the Executive Director of CUC.

Mr. Sasamoto is prepared to enter into negotiations with you at your earliest convenience regarding power supplies to the radar facility. You may contact Mr. Sasamoto at P.O. Box 1220, Saipan, MP, 96950. His telephone number is 670 322-4033. His FAX number is 670 322 4033. The Commonwealth looks forward to a close cooperative relationship with the Navy in all facets of this radar facility.

Sincerely,

PEDRO A. TENORIO,
Acting Governor

cc: Mr. Harry R. Marien, Chief, Privatization Division
Directorate of Engineering and Services
Mr. Pedro Sasamoto, Executive Director, CUC

COMMENT

(Submitted During Guam Public Hearing)

#21. L. Martindale - Guam August 18, 1989

- name and firm - legal counsel to Guam Urunao Resort Corporation ("GURC").
- authorized to speak for GURC and Artero Family Trust with respect to Urunao Beach development.
- Artero Family Trust, and other members of the Artero family, are the owners of the Urunao Beach property - over 400 acres below the cliff line adjacent to the site of the proposed ROTHR facilities, the cliff face itself, and approximately 20 acres above the cliff line directly between one of the proposed ROTHR sites and the cliff line.
- GURC is under contract with Artero Family Trust to develop Urunao Beach as a fully integrated resort complex - hotels, condominiums and related facilities.
- Comments regarding the EIS for the ROTHR proposal re areas in which we believe the EIS is inadequate in material respects.
  - EIS fails to adequately acknowledge the prospective development of Urunao Beach and to address the impacts of the development of the proposed ROTHR facilities on the Urunao Beach development.
    - EIS is required by NEPA to address all prospective and cumulative impacts of the proposed ROTHR facilities on impacted properties. Zoning of Urunao Beach for the contemplated resort development by the legislature of Guam has been known to the military for over two years, a full development plan prepared by GURC has been disclosed to and discussed with senior officials of the Naval Facilities Command (NAVFAC) locally and in Hawaii and Washington, D.C., and officials of Department of Defense ("DOD") and U.S. Fish and Wildlife Department, the necessity of an access easement across the military base to Urunao Beach has been discussed with appropriate military authorities and Guam governmental agencies, and a formal request for location of an access easement across the military base to Urunao Beach will be submitted to the DOD designated representative within a month.
    - Although it may not be directly relevant to this EIS hearing, I note for the record that the military condemnation of Artero family land for the military base many years ago landlocked Urunao Beach, and restrictive access policies of the military over the past four decades have prevented the Artero family from the full enjoyment of its private property. Applicable legal principles clearly establish that the Artero family and GURC are entitled to reasonable access across the military base to fully utilize the Artero family property. We believe this principle will be recognized by DOD and a reasonable access easement across the base to Urunao Beach will be granted to the Artero family and GURC in the near future.
  - EIS fails to address the compatibility of the proposed ROTHR facilities with development of Urunao Beach, including necessary access to Urunao Beach across military land. Specifically:
    - the Radio Frequency Interference (RFI) Zones for Projects 223 and 225 (clear space) required for a distance of one mile from the boundary of the ROTHR facility below an elevation of 15 degrees may preclude or limit development of a significant portion of the Artero family property above the cliff line. The extent of this impact, and available reasonable mitigation measures, are not adequately addressed in the EIS, which simply states that such interference <u>may</u> exist and "acquisition of easements from private property owners <u>may</u> be necessary."
    - development of Urunao Beach may result in public access across existing Route 3 from Potts Junction to Ritidian Point adjacent to the ROTHR facilities. EIS does not adequately address potential electromagnetic interference ("EMI") or other impacts from traffic along the roadway, and reasonable mitigation measures to avoid such EMI (such as berming or other screening against EMI). This problem is discussed in the EIS in extremely vague terms which is inadequate. There is no discussion of the volume and nature of traffic which may result in unacceptable EMI, and the precise nature of shielding, berming or other mitigation

measures which will be sufficient at specified traffic volumes to insure that the ROTHR facilities will not impede development of Urunao Beach.

- although we conclude from reading the EIS that no development below the cliff line on Urunao Beach will affect or be affected by the proposed ROTHR facilities, this conclusion is not expressly acknowledged in the EIS. The EIS notes only that most residential and resort-type land uses on Urunao Beach would not affect or be affected by the ROTHR facilities provided buildings do not extend above the cliff line. For example:
  - What types of development at Urunao Beach will adversely affect the operation of the proposed ROTHR facilities?
  - Will customary and ordinary hotel, resort and residential development below the cliff line produce radio frequency or electromagnetic interference with the ROTHR facilities?
  - Will customary and ordinary satellite or microwave communication facilities be permitted at Urunao Beach?
  - Will customary and ordinary cable television and communication facilities be permitted at Urunao Beach?
- The precise location of the proposed ROTHR facilities are not specified and several alternative locations are identified. There is no comparison of the adverse impacts and reasonable mitigation measures on development of Urunao Beach based upon the alternative sites, including the Harmon Annex site at Tanguisson.
- Regarding the dump site on the cliff face which the military is charged with cleaning up by [the Armed Services Committee of Congress], the EIS states that the "military has recently decided to acquire the site." Voluntary acquisition of the dump site assumes that the owner of the property is willing to sell the property in question. The Artero family has not evidenced willingness to sell any portion of its Urunao Beach property to the military, and it is impermissable for the EIS to dismiss the issue of the cleanup of the dump site with a reference to the unilateral decision of the military to acquire the site. Furthermore, it is unclear why the acquisition of the dump site by the military would relieve the military of the obligation to clean up the dump site as directed by Congress. Finally, on this point, there must be a discussion of the effect of retaining the dump site in its present condition on the prospective development of Urunao Beach directly below the dump site.
- Although I have addressed my comments specifically to the interests of the Artero family and GURC, I suggest that the economic interest of the Government and people of Guam derived from development of Urunao Beach has not been recognized in the EIS in locating the ROTHR project at Northwest Field when other alternative locations may not have such a severe impact on development of private property. We believe that the EIS should address the balancing of the military interest in the selection of the final site for the ROTHR facilities with the interest of the Government and people of Guam in the development of Urunao Beach.
- Thank you for your consideration of our comments and questions. We look forward to receiving necessary revisions to the EIS which adequately addresses our concerns regarding the effect of the proposed ROTHR project on development of Urunao Beach.

COMMENT

3771 San Ysidro Way
Sacramento, CA 95864
July 21, 1989

Mr. James Chun
Pacific Division
Naval Facilities Engineering Command
Pearl Harbor, Hawaii 96860-7300

Dear Mr. Chun:

Thanks for the DEIS for the electronic installations proposed for the Northern Marianas.

While I have reviewed this impressive document I haven't made nor can I make a detailed study. In my review nothing egregious has caught my attention and I have been impressed by the thoroughness of the studies. I think that the proper response which I feel entitled to make would be no formal response.

Please accept this letter therefore as a notice that you can clear your files from expectation of any further commentary from me.

Very truly yours,

Charles L Sanders

Charles L Sanders
Sacramento Audubon Society
Conservation Committee

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COMMENT



Mr. James Chun (Code 2012) Pacific Div.
Naval Facilities Engineering Command
(PACNAVFACENGCOM)
Pearl Harbor, Hawaii 96860-7300

6901 Calvesten Drive, Hyattsville, Maryland 20782

July 25, 1989

Dear Mr. Chun,

After reviewing the draft EIS for the electronic installation (ROTHR) proposed for Guam, Marianas Islands, Pacific, and the Northern Marianas Islands we urge you to stop this project as it would destroy many acres of the natural habitat of the above-named islands. Respectfully yours,

Ruth W. Zeller, Robert O. Zeller

COMMENT

Post Office Box 154
Pt. Wingate, New Mexico 87316
July 31, 1989

Mr. James Chun, Code 2012
Pacific Division
Naval Facilities Engineering Command
Pearl Harbor, Hawaii 96860-7300

Sir:

May I submit the following comments on the draft EIS for ROTHR.

I would argue that the defense mission to construct and operate Relocatable Over-the-Horizon Radar, which would include antenna towers and arrays, ground screens and support facilities on Guam and Tinian, is mute.

There are no enemies to fear now, except ourselves. If we further undermine the biotic resources of life on Earth, by habitat destruction, we endanger not only other species but our own.

We need smoothly functioning ecosystems to provide homeostatic functions. Vulnerable island ecosystems are already stressed by habitat loss, but help provide fresh water and air we live by.

Abort the project. Devote some of the money to biological restoration projects, like removal of the Brown Tree Snake from Guam. Enhance our future security by training our military personnel to be ecologically-minded.

That will shore our defenses much more than a Pacific radar system in the Atomic Age, when even Russia realizes the global environment - faced with climate warming - needs to be saved.

Sincerely,

Stan Renfro

Stan Renfro

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COMMENT

Commonwealth of the Northern Mariana Islands
Office of the Governor
Saipan, Mariana Islands 96950

FOR OFFICIAL
CABLE ADDRE
GOV. NMI SAIP
REPLY TO
DEPT or ACTIV

8 August 1989

Commander E.C. Rushing
Civil Engineering Corps
U.S. Navy, Pacific Division
Naval Facilities Engineering Command
Pearl Harbor, HI 96860-7300

Dear Commander Rushing:

We received the Draft EIS for ROTHR program last week. We began reviewing it this week and found that it states that electromagnetic radiation should not be a problem for birds flying in the area. This is not explained other than to cite the following report: Department of the Navy, Space and Naval Warfare Systems Command, A study of Electromagnetic Environmental Effects Associated with the Relocatable Over-the Horizon Radar, March 7, 1989.

Many of our concerns stem for these possible effects. To see how these have been examined we will need to have a copy of the cited report. Please send us a copy of the study so we can complete our evaluation of the EIS. The sooner we receive the report the sooner our EIS comments can be sent to your office. I suspect they will not reach you by the 4 September 1989 date mentioned in your latter due to our not having access at this time to the previously mentioned study. Additionally, expecting us to review a detailed EIS of nearly 1000 pages in a month (we would have to mail our comments by 24 August to reach you) seems unreasonable.

Thank you in advance for you prompt sending of the needed report.

Sincerely,

James D. Reichel

Dr. James D. Reichel
Wildlife Biologist 3
Division of Fish and Wildlife
Saipan, MP 96950

COMMENT



Sierra, Mt. McKinley — Ansel Adams

SIERRA CLUB
LEGAL DEFENSE FUND, INC.

212 Merchant Street, Suite 202 Honolulu, Hawaii 96813 (808) 599-2436
FAX (808) 521-6841

HAWAII OFFICE
Arnold L. Lum
Michael R. Sherwood
Staff Attorneys
Marjorie F. Y. Ziegler
Research Analyst

Other Offices

SAN FRANCISCO OFFICE
2044 Fillmore Street
San Francisco, CA 94115
(415) 567-6100

ROCKY MOUNTAIN OFFICE
1600 Broadway St.
Suite 1600
Denver, CO 80202
(303) 863-9898

WASHINGTON, DC OFFICE
2536 P Street, N.W.
Suite 200
Washington, DC 20005
(202) 667-4500

ALASKA OFFICE
325 Fourth Street
Juneau, AK 99801
(907) 586-1371

NORTHWEST OFFICE
216 First Avenue, South
Suite 330
Seattle, WA 98104
(206) 343-7340

August 23, 1989

E. C. Rushing, Jr.
Commander
Civil Engineer Corps
United States Navy
Head, Facilities Planning Department

Re: Draft Environmental Impact Statement On Electronic Installations (ROTHR) In The Western Pacific, Naval Space Command

Dear Commander Rushing,

I will be submitting comments on the above Draft EIS on behalf of Marianas Audubon Society and National Audubon Society. Those organizations and individual members thereof probably will also submit comments. The current deadline for comments is September 5, 1989.

I understand that Mr. Paul Conry of the Marianas Audubon Society has requested a 45 day extension within which to submit comments, to October 20, 1989. I would like to request the same extension for National Audubon and all other commentators. Given the magnitude of the proposed project(s), the size of the Draft EIS and the complexity of the issues it raises, and the length of time that it took the Navy to prepare this draft, the six or seven weeks allotted by the Navy to comment hardly seems sufficient, and an additional 45 days seems imminently reasonable.

I look forward to your prompt reply to this request.

Very truly yours,

Michael R. Sherwood

Michael R. Sherwood

MRS:smg

COMMENT

MICRO WAVE NEWS

A Monthly Report on Non-Ionizing Radiation

Louis Slesin, Ph.D.
Editor and Publisher

August 24, 1989

Commanding Officer
Pacific Division
Naval Facilities Engineering Command
Pearl Harbor, HI 96860

Dear Commanding Officer:

Please send me a copy of the U.S. Navy's Draft Environmental Impact Statement for proposed electronic installations in the western Pacific. Those installations include Relocatable Over-the-Horizon Radar (ROTHR) systems on Tinian and on Guam.

Thank you in advance for your assistance.

Sincerely,

Jennifer Goren

PO Box 1799 Grand Central Station • New York, NY 10163 • (212) 517-2800

COMMENT

DR. E. WOODYARD, PH.D.
CLINICAL PSYCHOLOGIST
P.O. BOX 230
AGANA, GUAM 96910
TELEPHONE 477-7736

August 30, 1989

Mr. James Chun
Pacific Division
Naval Facilities Engineering Command
PACNAVFACENGCOM
Pearl Harbor
Hawaii 96860-7300

Dear Mr. Chun,

I am opposed to Northwest Field for the ROTHR proposed for Guam, Northern Mariana Islands, and Tinian, Northern Mariana Islands, due to potential damage to critical habitat for birds. I believe alternative sites should be considered.

Sincerely yours,

E. Woodyard, Ph.D.

Dr. E. Woodyard, Ph.D.

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COMMENT

September 21, 1989
9024 Shaun Park Place
Orlando, Florida
32819

Commander
Pacific Division
Naval Facilities Engineering Command
Pearl Harbor, Hawaii 96860-7300

Dear Commander,

I have moved four times since I originally wrote to you about the Navy's plans for an electronic installations in the Western Pacific and its environmental impact and unfortunately, I did not receive the DEIS, but I did receive a letter dated August 31, 1989 about attending the period of public comment regarding that impact statement.

I can't comment about the DEIS, but I would like to say that whatever the decision about those installations is, that it is a careful one that will do as little damage to all aspects of the environment and that they are truly needed. Even though you are thousands of miles from here, people do care about what happens in the Pacific.

Thank you for your time.

Sincerely,
Shari H. Sujka MD

Commonwealth of the Northern Mariana Islands
Department of Public Health & Environmental Services
Division of Environmental Quality
P.O. Box 1304
Saipan, Mariana Islands 96950
Tel.: 234-6884/6114
Fax: 234-1003

September 1, 1989

E. C. Rushing, Jr.
Commander
Civil Engineering Corps
U.S. Navy
Head, Facilities Planning department
Pearl Harbor, Hawaii 96860-7300

RE: Environmental Review of Tinian ROTHR Project

Dear Commander Rushing:

I reviewed the Draft Environmental Impact Statement for the proposed Tinian ROTHR project with considerable interest.

Essentially, the Division of Environmental Quality (DEQ) implements numerous "media-specific" programs aimed towards regulating activities which could degrade the natural resources of the CNMI. At the present time, the scope of my comments will be limited to a general description of DEQ environmental management programs which appear applicable to the proposed project.

Earthmoving and Erosion Control Permits: The CNMI Division of Environmental Quality (DEQ) implements the CNMI Earthmoving and Erosion Control Regulations. The purpose of the program is to ensure that land clearing does not increase off-site surface run-off and sedimentation. Issuance of the Earthmoving and Erosion Control Permit requires submittal of an Erosion Control Plan and supporting hydrologic calculations (eg. surface run-off) to the Division of Environmental Quality for review and approval.

CNMI Marine Water Quality Standards: Marine WQS are regulatory standards which specify allowable ambient water quality levels. Erosion control and sedimentation mitigation measures should be designed to prevent violations of these standards, particularly the turbidity standard.

Underground Storage Tanks (UST's): DEQ regulates the design, installation, and testing of UST's within the Commonwealth. Commonwealth UST standards are closely based upon the new federal UST regulations. Any UST's proposed for the ROTHR project must be designed to comply with applicable federal UST regulations.

Hazardous Materials: If applicable, hazardous materials would be regulated under applicable federal requirements contained in RCRA.

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COMMENT

Groundwater Management: DEQ regulates the siting, design construction, and testing of water wells under the authority of the CNMI Groundwater Management and Protection Act of 1988. Under that statute, no water wells may be constructed or operated without permits issued from the Division of Environmental Quality. DEQ issues (1) Well Drilling Permits and (2) Well Operations Permits which specify design, testing, and operating standards for water wells. The purpose of the permitting program is to minimize degradation of fragile basal lens aquifers due to saltwater intrusion.

CNMI Drinking Water Regulations: The Department of OPublic Health and Envirnmental Services has promulgated regulations which govern drinking water quality. These are closely tied to applicable federal drinking water standards pursuant to the Safe Drinking water Act as amended.

Air Emissions: This was addressed in the Draft EIS. DEQ will process permit applications for emissions from the power generation system and the proposed incinerator.

Thank you very much for the opportunity to provide comments regarding this draft EIS. Please do not hesitate to contact me should you have any questions.

Sincerely yours,

P. RUSSELL MECHEM II
Chief

COMMENT

GUAM ENVIRONMENTAL PROTECTION AGENCY

AHENSIAN PRUTEKSION LINA'LA GUAHAN
POST OFFICE BOX 2999 AGANA, GUAM 96910 TELEPHONE: (671) 646-8863/64/65 FAX: 646-9402

SEP 0 6 1989

Pacific Division
Naval Facilities Engineering
Command (PACNAVFACENGCOM)
Pearl Harbor, Hawaii 96860
(Attention Code -09P2)

Gentlemen:

The Agency has reviewed the "Draft Environmental Impact Statement for Electronic Installations in the Western Pacific", a project proposing the location of Relocatable Over-the-Horizon Radar (ROTHR) for Tinian and Guam. Although we have identified a number of environmental issues from our preliminary review that should be addressed in the Final EIS, we have not had sufficient time to complete our review. I am, therefore, requesting that you provide additional time for review of the Draft Environmental Impact Statement.

During the Public Hearing on August 18, 1989, the representatives of several government agencies requested the U.S. Navy to provide additional time for review and comment on the Draft EIS. Requests ranged from 30 days to over 90 days. Judging from the size and scope of the project, providing an additional comment period of 60 days until November 4, 1989, would seem reasonable.

Sincerely yours,

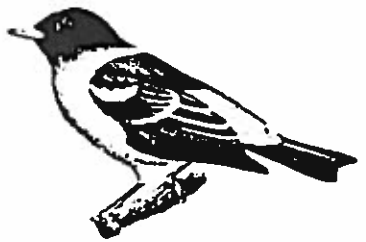
ROLAND B. SOLIVIO
Acting Administrator

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"ALL LIVING THINGS OF THE EARTH ARE ONE"

COMMENT

LOS ANGELES AUDUBON SOCIETY
[illegible]
7377 Santa Monica Boulevard
Plummer Park
Los Angeles, California 90046
[illegible]



September 30, 1989

Mr James Chun
(Code 2012)
Pacific Division
Naval Facilities Engineering Command
Pearl Harbor, Hawaii 96860-7300

Dear Mr Chun:

The Los Angeles Audubon Society would like to add its voice to those of prestigious environmental organizations that have protested the Navy's projected Relocatable Over The Horizon Radar Project installation on Guam and Tinian. The probable extinction of four species of birds and one species of bat that are on the federal Endangered Species List is reason enough for the Navy to examine alternate sites for ROTHR.

Speaking for our 3500 members, we urge you to consider the gravity of this multiple extinction. In an era when man's activities threaten the survival of thousands of life-forms, an agency of the United States government must not contribute to this tragic process.

Sincerely,

Sanford Wohlgemuth
Conservation chairman

COMMENT

ENVIRONMENTAL DEFENSE FUND

1616 P Street, NW
Washington, DC 20036
(202) 387-3500

October 2, 1989

Commander
Pacific Division
Naval Facilities Engineering Command
Pearl Harbor, HI 96860-7300

Dear Commander:

I am writing to tell you that I have read the comments of the Conservation Committee of the Marianas Audubon Society on the Navy's Relocatable Over the Horizon Radar Project (ROTHR) to be built at Andersen Air Force Base, Guam. I fully support these comments.

Sincerely,

Michael J. Bean
Chairman, Wildlife Program

10 - 166

National Headquarters
257 Park Avenue South
New York, NY 10010
(212) 505-2100

1405 Arapahoe Avenue
Boulder, CO 80302
(303) 440-4901

5655 College Avenue
Oakland, CA 94618
(415) 658-8008

1108 East Main Street
Richmond, VA 23219
(804) 780-1297

128 East Hargett Street
Raleigh, NC 27601
(919) 821-7793

Printed on Recycled Paper

COMMENT

JESUS D. CASTRO
P.O. Box 20731
GMF, GUAM 96921

October 2, 1989

CRD. E. C. Rushing, Jr.
Pacific Division
Naval Facilities Engineering Command
Pearl Harbor, Hawaii 96869-7300

ATTENTION: CODE 09P2

Re: Comments to DEIS on ROTHR Project

Dear Cdr. Rushing:

By way of introduction my name is Jesus D. Castro, a U.S. Citizen and resident of Guam. I am 63 years of age, married and have five (5) children. I also have three (3) brothers and four (4) sisters.

I am writing this letter in response to and with adamant objection to the Draft Environmental Impact Statement (DEIS) for the Relocatable Over the Horizon Radar (ROTHR) installations on Guam, but more specifically, to that planned ROTHR facility location designated as P-002.

My brothers and sisters and I, and by virtue of their inheritance, our children, are all owners of property that will be affected by the ROTHR P-002 project. That property, historically and traditionally, known as Jinapsan, or Jinapsan Beach, has been owned by my family since before 1898 or the cessation of Guam to the United States as a result of the conquest of the Spanish in the Spanish-American War, and, as far as can be ascertained, even before the arrival of Magellan who claimed the island for the Spanish Crown.

Without reservation nor qualification, I can tell you that each and everyone of us dearly love our land. This despite the fact that the United States Government, in the guise of the United States Air Force and National Security, saw fit to condemn and abscond with surrounding properties thereby landlocking our inheritance. This despite the fact that for the longest time, my family was denied the benefit and enjoyment of that land willed to us by our fathers and to them by their fathers. This despite the fact that for the longest time, we were denied our inalienable rights to our property, that right bestowed upon all men by their Creator.

COMMENT

Only recently, I, as well as, my brothers and sisters and other relatives, were called to meet with the personnel of the Commander, Naval Forces Marianas. This meeting was called to discuss our willingness to exchange the Jinapsan Beach properties with other properties "owned" by the Federal Government. It is difficult for me to understand the cold blooded lack of conscience on the part of the United States Government. First of all, the land which was offered as exchange originally belonged to some other Guam citizen. By all rights and in the name of justice, if that land is excess to the Federal Government it should be rightfully returned to the original land owners from which it was taken. Similarly, how can the Federal Government ask me or my family to accept something in exchange for our heritage and something that is someone else's, a fellow Chamorro's, heritage.

Our response then is the same as our response now and in the future - a resounding NO!!!

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Relative to the planned P-002 location for the ROTHR facility let this letter be our official protest and objection to the plans for the placement of that facility at the location directly above Jinapsan Beach. We do not doubt that should P-002 receive Congressional approval and funding that even the controlled access to Jinapsan Beach that we now have will be endangered. If this is not the case, why should COMNAVMAR go as far as to offer to exchange Jinapsan with other properties?

I am not an engineering expert, nor am I a national security expert and neither am I an environmental or wildlife expert. However, I do not need an advanced degree or license to tell you that my family will be irreversibly affected and hurt by the construction of the ROTHR facility at P-002. I do not need an advanced degree or license to tell you that my family, my children and their children will be denied their rights to their inheritance and that given to them by the blood, sweat, and tears of their forefathers.

We only ask that the United States Government exercise some element of human compassion and that its leaders be guided by some conscience and not be so simply convinced by those who lack conscience and who only wish to build and expand their military empires.

Respectfully yours,

JESUS D. CASTRO
Property Owner

cc: Congressman Ben G. Blaz
Governor of Guam
Speaker & Members, Guam Legislature

SECTIONS 11.0; 12.0; and 13.0

11.0 LIST OF PREPARERS

1. **Contracting Agency**
   Department of the Navy
   Pacific Division, Naval Facilities Engineering Command
   Pearl Harbor, Hawaii 96860-7300
   Telephone: (808) 471-3088
   Commander E.C. Rushing, Jr., Head, Facilities Planning Department
   Mr. J. Chun, Planner-in-Charge

2. **Cooperating Agency**
   Department of the Air Force

3. **Prime Consultant**
   VTN Pacific, Inc.
   2080 S. King Street, Suite 109
   Honolulu, Hawaii 96826
   Telephone: (808) 941-6121

4. **Sub Consultants**
   Environmental Assessment
   Wilson Okamoto & Associates, Inc.
   1150 South King Street, Suite 800
   Honolulu, Hawaii 96814

   John L. Sakaguchi, Planner
   B.A. Economics; MBA; 8 Years Experience in Environmental and Planning Studies

   Rodney Y. Funakoshi, Planner
   B.A. Arts/Sociology; MURP; 8 years experience in Environmental and Planning Studies

   Michael E. Baker, Planner
   B.A. Geography; MA; 3 years experience in Environmental and Planning Studies

   Patricia Lai, Planner
   B.A. Hawaiian Studies; MLIS; 1 year in Environmental and Planning Studies

   Phillip L. Bruner, Biologist
   M.S. Zoology; 12 years experience in Ornithological and Biological Studies

Botanical Analysis
Botanical Consultants
P.O. Box 90765
Honolulu, Hawaii 96835
Evangeline J. Funk, Ph.D.
Ph.D. Botany; 8 Years Experience in Botanical Studies

Biological Analysis
Mr. Leonard A. Freed, Ph.D.
University of Hawaii at Manoa
Department of Zoology
Honolulu, Hawaii 96822
Ph.D. Zoology and Ornithology; 5 Years Experience Ornithological and Biological Studies

Maile Kjargarrd
University of Hawaii at Manoa
Zoology; 5 Years Experience Ornithological Studies

Historic/Archaeological Analysis
Paul H. Rosendahl, Ph.D., Inc.
305 Mohouli Street
Hilo, Hawaii 96720

Alan E. Haun, Ph.D.
Ph.D. Anthropology (Archaeology); 12 Years Experience in Contract and Research Archaeology

Theresa K. Donham, M.A.
M.A. Anthropology (Archaeology); 14 Years Experience in Contract and Research Archaeology

Bernice Pauahi Bishop Museum
P.O. Box 19000-A
Honolulu, Hawaii 96819

Akihiko Sinoto
B.A. Anthropology; 12 Years Experience in Contract and Research Archaeology

Hiro Kurashina
Ph.D. Anthropology; 12 Years Experience in Contract and Research Archaeology

12.0 PERSONS AND AGENCIES CONTACTED

1. **U.S. Navy**

Pacific Division, Naval Facilities Engineering Command
(Pearl Harbor, Hawaii)
Mr. Yoshito Hironaka, Assistant Head, Facilities Planning Dept.
Mr. Ian Harris, Technical Support Branch, Master
Planning Division
Mr. Tom Egeland, Head, Natural Resources Management Branch
Mr. Tim Sutterfield, Biologist
Mr. Bruce D. Eilerts, Natural Resources Mgt. Spec. Intern
Dr. Robert Hommon, Archaeologist
Mr. Dennis Pacht, Head, Operations Branch, Real Estate Division

Commander, U.S. Naval Forces, Marianas (Agana, Guam)
CAPT. E.J. Lowery, Jr. Chief of Staff Base Support
CAPT. B. Giebel, Chief of Staff Base Support
CDR. D. Seiders, Staff Legal Officer
LT. D. Sisk, Deputy Assistant Chief of Staff Base Support
LT. R. Davis, Deputy Assistant Chief of Staff Base Support
Mr. Peter Toves, Assistant Staff Civil Engineer

Naval Communications Area Master Station, Western Pacific
LT. W. Davis, Staff Civil Engineer
LT. V. Racanelli, Staff Civil Engineer

2. **U.S. Air Force**

Andersen Air Force Base
Colonel S. Mugg, Base Civil Engineer
Mr. James Alexander, Assistant Staff Civil Engineer
Mr. Marion Penick, Manager Engineering and Environment
Mr. Vernon Tobey, Chief Environment and Contract Planning
Mr. John Martin, Chief, Environment and Contracting Planning
Mr. Bruce Reinhardt, Natural Resources Planner

3. **U.S. Government**

Dept. of Agriculture, Soil Conservation Service, Honolulu
Mr. Paul Bartlett, Soil Scientist

Dept. of the Interior, U.S. Fish and Wildlife Service, Honolulu
Mr. John Engbring, Biologist
Mr. Peter Stine, Biologist
Mr. Derral Herbst, (Ph.D.), Botanist
Mr. William Kramer, Biologist

Federal Aviation Administration
Mr. R. Riberal, Resident Director, Guam

4. **Commonwealth of the Northern Marianas**
Office of the Governor
Mr. David Price, Special Legal Advisor to the Governor

Coastal Resources Management
Ms. Tami Groves, Acting Administrator (former)
Mr. Robert Rudolph, Acting Administrator
Mr. John Bay, Assistant Attorney General

Division of Fish and Wildlife
Mr. Phil Glass, Wildlife Biologist

Department of Community and Cultural Affairs
Division of Historic Preservation
Mr. Jesus B. Paugelinan, Historic Preservation Officer
Mr. Scott Russell, Deputy Historic Preservation Officer

5. **Municipality of Tinian and Aguijuan**
Mr. Ignacio Quichocho, Mayor
Mr. Mike Fitzgerald, Administrative Assistant to the Mayor
Mr. Estanaislao Hocog, Historic Preservation Coordinator

6. **Government of Guam**
Office of the Governor
Ms. Bernice Carbullido, Special Assistant,
Office of Federal Programs

Bureau of Planning
Mr. Pedro Guerrero, Director
Mr. Michael Cruz, Chief Planner
Mr. Mike Ham, CZM Planner

Department of Agriculture, Aquatic and Wildlife Resources
Mr. Joaquin Naputi, Deputy Director
Mr. Bob Anderson, Assistant Director
Mr. Robert Beck, Biologist
Ms. Julie Savidge, Biologist
Mr. Carlos Noquez, Chief Forester
Mr. Paul Conry, Biologist

Department of Parks and Recreation

Environmental Protection Agency
Mr. Gary Stillberger, Program Coordinator

University of Guam, Herbarium
Dr. Lynn Raulerson, Curator

7. Final EIS Mailing List

* specifically requested copy of DEIS or to be included in review process

FEDERAL AGENCIES

1. Mr. Allan Marmelstein
   Pacific Islands Administrator
   Pacific Islands Office
   U.S. Fish & Wildlife Service
   P.O. Box 50167
   Honolulu, HI 96850

2. Mr. Ernest Kosaka
   Field Office Supervisor
   Office of Environmental Services
   U.S. Fish and Wildlife Service
   300 Ala Moana Boulevard
   P.O. Box 50167
   Honolulu, HI 96850

3. Mr. Daniel W. McGovern
   Regional Administrator
   U.S. Environmental Protection Agency Region IX
   215 Fremont Street
   San Francisco, CA 94105

4. *Ms. Jacqueline Wyland
   Chief, Office of Federal Activities
   U.S. Environmental Protection Agency Region IX
   215 Fremont Street
   San Francisco, CA 94105

5. Mr. George W. Harvey
   Pacific Area Coordinator
   Federal Aviation Administration
   U.S. Department of Transportation
   P.O. Box 50109
   Honolulu, HI 96850

6. Ms. Claudia Nissley, Acting Chief
   Western Division of Project Review
   Advisory Council on Historic Preservation
   730 Simms Street, Room 450
   Golden, CO 80401

7. Mr. Bryan Harry, Director
Pacific Area
U.S. Department of the Interior
National Park Service
300 Ala Moana Boulevard, Box 50165
Honolulu, HI 96850

GOVGUAM AGENCIES

1. The Honorable Joseph F. Ada
Governor's Office
Government of Guam
Agana, GQ 96910

2. Mr. Tony Quitugua
Director
Department of Agriculture
Government of Guam
Agana, GQ 96910

3. Mr. Peter P. Leon Guerrero
Director
Bureau of Planning
Government of Guam
Agana, GQ 96910

4. Mr. Michael Cruz
Bureau of Planning
Government of Guam
Agana, GQ 96910

5. Mr. Anthony C. Mariano, Director HPO
Department of Parks and Recreation
Government of Guam
Agana, GQ 96910

6. Mr. Fred Castro, Admistrator
Guam Environmental Protection Agency
P.O Box 2999
Agana, GQ 96910

7. The Honorable Ben Blaz
Guam Congressional Representative
U.S. House of Representatives
1130 Longworth House Office Building
Washington, D.C. 20515

8. Mr. Rufo Lujan, Chief
Aquatic and Wildlife Division
Department of Agriculature
Government of Guam
Agana, GQ 96910

9. Director
Guam Coastal Management Program Bureau of Planning
Government of Guam
Agana, GQ 96910

10. GOVGUAM Main Library or Clearinghouse

11. Senator Ted Nelson
Vice Speaker
Guam Legislature
163 Chalan Santa Papa
Agana, GQ 96910

COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS (CNMI)

1. The Honorable Lorenzo I. DeLeon Guerrero
Commonwealth of the Northern Mariana Islands
Office of the Governor
Saipan, MP 96950

2. Mr. Vincente C. Aldan
Acting Administrator
Coastal Resources Management Office
Office of the Governor (CNMI)
6th Floor, Nauru Building
Saipan, MP 96950

3. Mr. Arnold 1. Palacios, Director
Department of Natural Resources
Office of the Governor (CNMI)
6th Floor Nauru Building
Saipan, MP 96950

4. Mr. Jim Ripple
Department of Planning and Budget Office
Office of the Governor (CNMI)
6th Floor, Nauru Building
Saipan, MP 96950

5. Mr. Russell Mechem, Chief
Department of Health and Environmental Services
Office of the Governor (CNMI)
6th Floor, Nauru Building
Saipan, MP 96950

6. Mr. Michael A. Fleming
Historic Preservation Office
Office of the Governor (CNMI)
6th Floor, Nauru Building
Saipan, MP 96950

7. The Honorable James M. Mendiola
Mayor of Tinian and Aguigan
San Jose Village
Island of Tinian MP 96950

8. Mr. James D. Reichel
Wildlife Biologist II
Division of Fish and Wildlife
Commonwealth of the Northern Mariana Islands
Office of the Governor
Saipan, MP 96950

9. Mr. Jose P. San Nicolas
Tininan Municipal Council

10. CNMI Library

11. Dr. Michael Kenney
Special Assistant for Socioeconomic Planning
Office of the LT Governor
Saipan, MP 96950

12. Mr. Frank S. Rosario
Public Information Officer
Office of the Governor
Capitol Hill
Saipan, MP 96950

13. Ms Carmen Gaskins
Women's Affairs Office
2nd Floor Administration Bldg
Capitol Hill
Saipan, MP 96950

14. Mr. Edward Manibusan
Attrorney General Office
Capitol Hill
Saipan, MP 96950

15. Mr. Estanislao Hocog
Historic Preservation Coordinator
Municipality of Tinian
Tinian, MP 96957

16. Mr. Esteven King
Department of Public Works
Tinian, MP 96957

17. Mr. David Maratita
Mayor's Office
San Jose Village
Tinian, MP 96957

18. Mr. George Baldwin
Coastal Resources Management
Mayor's Office
Tinian, MP 96957

PRIVATE ORGANIZATIONS

1. Mr. Paul J. Conry
President
Marianas Audubon Society
P.O. Box 4425
Agana, GQ 96910

2. Dr. Ralph Frew, Chairman
Conservation Committee
Marianas Audubon Society
(as above)

3. Mr. Charles L. Sanders
Sacramento Audubon Society
Conservation Committee
3771 San Ysidro Way
Sacramento, CA 95864

4. Chairman
Conservation Committee
Hawaii Audubon Society
212 Merchant Street, #320
Honolulu, HI 96813

5. Mr. Peter A.A. Berle, President
National Audubon Society
National Capital Office
810 Pennsylvania Avenue, S.E.
Washington, D.C. 20003

6. *Mr. Michael R. Sherwood
Sierra Club Legal Defense Fund, Inc.
212 Merchant Street, #202
Honolulu, HI 96813

7. Mr. Michael Bean
Environmental Defense Fund
1616 P Street
Washington, D.C. 20036

8. Mr. Bill Konstant
Executive Director
Wildlife Preservation Trust International, Inc.
34th Street and Girard Avenue
Philadelphia, PA 19104

9. Mr. Don Strachan
Executive Director
Save the World
P.O. Box 84366
Los Angeles, CA 90073

10. Mr. Tim Johnson
International Council for Bird Preservation
32 Cambridge Road
Cambridge CB 3 OPJ, U.K.

11. Mr. Stanley E. Senner, Chairman
International Council for Bird Preservation
Hawk Mt. Sanctuary Association Rte 2, Box 191
Kempton, PA 19529

12. Ms. Jennifer Goren
Microwave News
P.O. Box 1700
Grand Central Station
New York, NY 10163

OTHER ORGANIZATIONS

1. Mr. S. Dilon Ripley
Secretary Emeritus
NHB Room 336
Smithsonian Institution
Washington, D.C. 20560

2. *Mr. Scott R. Derrickson, Ph.D.
Curator, Department of Ornithology
Conservation & Researach Center
National Zoological Park
Smithsonian Institution
Washington, D.C. 20008

INDIVIDUALS

1. Mr. Gary Ritchison
Richmond, KY 40475-0950

2. Mr. Robert M. Sprogell
Moylan, PA 19065

3. Mr. David Fallow
Madison, WI 53704

4. Ms. Carolyn Comstock
Tulsa, OK 74112

5. Ms. Judy Taylor/
Mr. Rodney P. Caudill
Chico, CA 94928

6. Mr. M.M. Dillon
Elma, NY 14059

7. Mrs. R.E. (Alice) Witter
Muscatine, IA 72761

8. Drs. Shari and Stan Sujka
Williamsville, NY 14221

9. Ms. Miriam Linn
Santa Fe, NM 87501

10. Ruth W. Zeller/
Robert O. Zeller
Hyattsville, ML 20782

11. *Ms. Julie A. Savidge
Lincoln, NE 68583-0819

12. Mr. Stan Renfro
Fort Wingate, NM 87316

13. Mrs. Olga M. Rosche
South Wales, NY 14394

14. Mrs. L.A. Egger
Santa Clara, CA 95051

15. Mr. Antonio Artero
Agana, GQ 96910

16. Mr. Mark Burns
Baraboo, WI 53913

17. Mr. Jose Cepeda
Agana GQ 96910

18. Mr. Eric E. Van De Genachte
Warsaw, NY 14569

19. Mr. Martin Bradley
Saipan, MP 96950

20. *Mr. Don A Farrell
Tinian, MP 96952

21. *Mr. Larry Caldwell
Hermiston, OR 97701-3254

22. *Mr. Leonard J. Kauffer
Saipan, MP 96950

23. Mr. Daniel H. MacMeekin
Washington, DC 20005

24. Mr. Bert Thompson
Saipan, MP 96950

25. Mr. Jas Phillips
Saipan, MP 96950

26. Mr. R. Jeffery Scharr
Saipan, MP 96950

27. Mr. Kevin Kerrigan
Saipan, MP 96950

28. Ms. Patty Jacobs
Saipan, MP 96950

29. Mr. Wes Goodman
Saipan, MP 96950

30. Mr. Dave Ayres
Saipan, MP 96950

31. Mr. James Gugino
Saipan, MP 95950

32. Mr. Ken Govendo
Saipan, MP 96950

33. Mr. Daniel L. Sanders
Saipan, MP 96950

34. Mr. Serafin Delacruz
Tinian, MP 96952

35. Mr. Jose M. Delacruz
Tinian, MP 96952

36. Mr. Joe D.L.C. Atalig
Tinian, MP 96952

37. Ms. Guillermina C. Cepeda
Tinian, MP 96952

38. Mr. Lino V. Lizama
Tinian, MP 96952

39. Mr. Gordon Rodda
Tucson, AZ 85721

40. Mr. Joey P. San Nicolas
Tinian, MP 96952

41. Mr. Cyrus A. Baldwin
Tinian, MP 96952

42. Flavaiano Guerrero
Tinian, MP 96952

43. Mr. Thaddeus A. Supnet
Tinian, MP 96952

44. Mr. Edwin M. Hofschneiden
Tinian, MP 96952

45. Lowell C. Martindale, Jr.
Newport Beach, CA 92660

46. Mr. Jack W. Rice
Agat, GQ 96928

47. Ms. Carmen Artero Kasperbauer
GMF Guam 96921

48. Jayne Flores & Ed Buendicho
Agana, GQ 96910

49. Mr. Donald L. Graff
San Francisco, CA 94119-3965

50. Mr. Victor Layco
Agana, GQ 96910

51. Mr. George M. Butler
Agana, GQ 96910

52. Mr. Roy Wood
Barrigada, GQ 96921

53. Mr. Willis S. Cannon
Agana, GQ 96910

54. Mr. Ovidio R.A. Calvo, Jr.
Houston, TX 77059

55. Mr. Whitney Rich
Agana, GQ 96911

56. Mr. Tony Salban
Sinajana, GQ 96926

57. Ms. Alice Hadley
GMF Guam 96921

58. Mr. Bruce Best
Mangilao, Guam 92623

59. Mr. Robert D. Anderson
GMF Guam 96921

60. Mr. Gilbert E. Robles
Yigo, Guam 96929

61. Mr. Jim Morgan
Washington DC 20547

62. Mr. Ralph J.M. Reyes
Agana, GQ 96910

63. Ms. Juliane L. Mansur
Honololu, HI 96813

64. Ms. Suzette Bronssard
Houston, TX 77219

65. Mr. James Castro
GMF Guam 96921

66. R. Beck
Yona, Guam 96910

13.0 REFERENCES

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2. Federal Register. Volume 52, No. 247, 24 December 1987.

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APPENDICES

(Appendices A Through G are in the Draft EIS)

APPENDIX H

Public Hearing Information

scoping letter will be considered in preparation of the DEIS.

Significant issues to be analyzed in the DEIS include: (1) Economic benefits of improvements, (2) acceptability of sediments for ocean disposal, (3) alternative dredging and disposal methods, (4) impacts to fishes and benthic resources, and (5) impacts to cultural resources.

The lead agency for this project is the Wilmington District, Corps of Engineers. Cooperating agency status has not been assigned to, or requested by, any other agency.

The DEIS is being prepared in accordance with the requirements of the National Environmental Policy Act of 1969, as amended, and will address the relationship of the proposed action to all other applicable Federal and State laws and Executive Orders.

The DEIS is currently scheduled to be available in October 1990.

Dated: July 6, 1989.

Paul W. Woodbury,

Colonel, Corps of Engineers District Engineer.

[FR Doc. 89-17233 Filed 7-20-89; 8:45 am]

BILLING CODE 3710-GN-M

Department of the Navy

Public Hearings and Availability of the Draft Environmental Impact Statement for Electronic Installations in the Western Pacific

Pursuant to Council on Environmental Quality regulations (40 CFR Parts 1500-1508) implementing procedural provisions of the National Environmental Policy Act, the Department of the Navy has prepared and filed with the U.S. Environmental Protection Agency a DRAFT Environmental Impact Statement (DEIS) for proposed electronic installations in the western pacific. The DEIS has been distributed to various federal, state and local agencies, local elected officials, interest groups, the media and local libraries. A limited number of copies of the DEIS to fill single copy requests are available from the Commanding Officer, Pacific Division, Naval Facilities Engineering Command, Pearl Harbor, HI 96860.

Public hearings to inform the public of the DEIS findings and to solicit comments will be held on:

16 August 1989
2:00 pm in the Governor's Conference Room, Saipan, CNMI.

16 August 1989
7:00 pm at the Garapan Elementary School, Saipan, CNMI.

17 August 1989
1:00 pm in the Mayor's Office, San Jose Village, Tinian, CNMI.

18 August 1989
2:00 pm in the Governor's Conference Room, Guam, Marianas Islands.

18 August 1989
7:00 pm in the Governor's Conference Room, Guam, Marianas Islands.

These hearings will be conducted by the U.S. Navy. All interested parties are invited and urged to be present or represented at these hearings. This includes representatives of federal and non-federal agencies; commercial, business, and civic groups; ecological and environmental groups, fish and wildlife organizations; concerned citizens and other interested groups. All parties will be afforded full opportunity to express their views; however, in order to allow all present an opportunity to speak, statements will be limited to five (5) minutes. If longer statements are to be presented, they should be delivered in writing either at the hearing or mailed to the Commanding Officer, Pacific Division, Naval Facilities Engineering Command, and summarized at the public hearing. All written statements must be postmarked by September 5, 1989 to become part of the official record.

Oral statements will be heard and transcribed by a stenographer, to assure accuracy of the record all statements should be submitted in writing. All statements, both oral and written, will become part of the public record on this study. Equal weight shall be given to both oral and written statements.

The public hearings will be reported verbatim. Copies of the transcript of the proceedings may be purchased at the cost of reproduction and will be available three weeks from the date of the hearings. In addition, copies of the transcript will be made available for public review during normal working hours at Pacific Division, Naval Facilities Engineering Command.

As discussed in the DEIS, the Navy proposes to construct and operate up to three electronic installations, which are Relocatable Over-the-Horizon Radar (ROTHR) systems, on Tinian, Commonwealth of Northern Marianas Islands, and on Guam, Marianas Islands. Each installation would include antenna towers and arrays, ground screens and support facilities sited on each island. Transmitter facilities would be located on Tinian, receiver and operational control center facilities would be located on Guam.

The proposed installations would be constructed over a period of years with the first to be funded in FY 90. Construction of the other two ROTHR systems would depend on Congressional approval and funding. Each ROTHR system is a stand-alone project and would operate independently. Collocation of the systems is not an operational necessity; however, collocation would permit sharing of some facilities.

Each transmitter would consist of 24 vertical antenna towers, including the sounder antenna, and 24 vertical support poles. Maximum height above ground level would be 125 feet, total length of the antenna array would be 285.5 feet. Each transmitter system could produce up to 200 kilowatts of power, which will be radiated only in the direction of its orientation. The antenna array and ground screen would be fenced with a wire fence on four sides. The fenced area, called the radiation hazard area or exclusion fence area, would extend a maximum of 1,058 feet in front and 200 feet behind the antenna array. The fence would be posted with signs warning of radiation hazard from the antenna array. Beyond this fence, there would be no hazard from radio frequency radiation from the transmitter. The transmitter would be operated by civilian contractor personnel on a 24-hours per day, 7 days per week basis. No military personnel will be permanently located at the transmitter site. A total of approximately 62 civilian personnel will be required to operate the three transmitters, if collocated.

Each receiver would consist of 372 pairs of aluminum monopole antennas (a total of 744 poles), each about 18 feet tall and 6 inches in diameter. These pairs would be sited about 23 feet apart. Total length of the receiver antenna array would be about 8,600 feet; width of the receiver antenna array would be about 800 feet. Each receiver would require an operation control center consisting of operational vans, equipment shelters, and other support facilities. The receivers would be operated by military and civilian contractor personnel on a 24-hours per day, 7-days-per-week basis. A total of 218 military and 69 civilian personnel would be required to operate three receivers.

Surveillance of critical areas is required to detect aircraft and ships coming from eastern Asia. To meet this operational siting requirement, ROTHR systems must be sited in the Marianas Islands. In addition, technical siting requirements necessitate that the transmitter and receiver be separated by 50 to 100 miles to permit their concurrent operation. A site of about 100 acres is necessary for the transmitter and about 200 acres for the receiver; however, the transmitter can be accommodated on a site of 68 acres and the receiver on a site of 172 acres.

Based on these two primary criteria, a number of islands were evaluated for development of ROTHR systems, including island combinations involving Guam, Tinian, Rota, Saipan, and Anatahan. Saipan and Anatahan do not possess sufficient land areas for ROTHR development. The covenant between the U.S. Government and the Commonwealth of Northern Marianas Islands requires military facilities be sited on the military lease area of Tinian, if at all possible, before considering acquisition of rights to use of other areas. Thus, only sites on Guam and Tinian were considered.

Other active and passive surveillance systems were considered prior to initiation of development of the ROTHR system, including radar satellite systems and aircraft surveillance. Current technology will not permit the development of a radar satellite which can be launched into stationary orbit where it could continuously monitor areas of interest. Aircraft surveillance would not provide the same coverage as the proposed ROTHR system; moreover, the land area required to base sufficient surveillance aircraft would be much greater than the area required for the proposed ROTHR systems.

The DEIS provides a comprehensive analysis of primary issues identified during the scoping process, including endangered or threatened species, air pollution, historic resources, and the effect of high frequency radiation generated by the transmitters on the environment and human health.

The U.S. Fish and Wildlife Service intends to designate portions of Guam as critical habitat for four species of endangered birds. The Navy would initiate a Memorandum of Agreement with the U.S. Fish and Wildlife Service to minimize impacts to this habitat should proposed receiver sites on Guam be included in the critical habitat area.

Transmitters would require continuous on-site generation of electrical power. Calculations of controlled air pollution emissions indicate operation of all three transmitters would create sufficient pollutants to be considered a major stationary source according to CNMI Air Quality Regulations, thus requiring a permit from the CNMI Department of Public Health and Environmental Services.

One transmitter and some support facilities would be located in the North Field National Historic Landmark, which is listed on the National Register of Historic Places. The Navy would initiate a Memorandum of Agreement with the CNMI Historic Preservation Officer and the President's Advisory Council on Historic Preservation to identify measures to protect this historic site.

A series of detailed studies evaluating hazards from radio frequency radiation were prepared by the Navy. Results of these studies indicate no restrictions of access outside the fenced exclusionary zone would be necessary.

Questions regarding this notice may be directed to Mr. Gordon Ishikawa at (808) 471-3068.

Date: July 18, 1989.

Sandra M. Kay,

Department of the Navy, Alternate Federal Register Liaison Officer.

[FR Doc. 89-17153 Filed 7-20-89; 8:45 am]

BILLING CODE 3810-AE-M

DEPARTMENT OF EDUCATION

National Assessment Governing Board; Meeting

AGENCY: National Assessment Governing Board.

ACTION: Amendment of notice of open meeting.

SUMMARY: This amends the notice of an open meeting of the Mathematics and Technical Methodology Standing Committees of the National Assessment Governing Board published on Tuesday, June 27, 1989 in Vol. 54, No. 122 at page 27048. This notice reschedules the meeting originally scheduled for July 11, 1989.

Date: July 24, 1989.

Time: 11:00 a.m.

Location: U.S. Department of Education
National Assessment Governing Board Suite 4000, Mary E. Switzer Building, 330 C Street, SW., Washington, DC. 20202-7563

FOR FURTHER INFORMATION CONTACT: Roy Truby, Executive Staff Director, National Assessment Governing Board, U.S. Department of Education, Suite 4000, Mary E. Switzer Building, 330 C Street, SW., Washington, DC 20202-7563. Telephone: (202) 732-1824.

SUPPLEMENTARY INFORMATION: Due to technical telecommunications problems, the telephone conference originally scheduled for July 11, 1989 was not completed. The meeting of the Mathematics and Technical Methodology Standing Committee of the National Assessment Governing Board via teleconference is rescheduled for Monday July 24, 1989 from 11:00 until completion of business. The agenda remains the same.

Bruno V. Manno,

Acting Assistant Secretary for Educational Research and Improvement.

[FR Doc. 89-17218 Filed 7-20-89; 8:45 am]

BILLING CODE 4000-01-M

DEPARTMENT OF ENERGY

Office of the Secretary

Public Hearing To Solicit Views From Public Officials and the General Public on the Development of a National Energy Strategy

AGENCY: Office of the Secretary, DOE.

ACTION: Notice of Meetings to invite public officials and the general public to provide comments on the development of a National Energy Strategy.

SUMMARY: The Department of Energy will conduct a series of public hearings throughout the country soliciting comments from interested parties on a wide range of energy issues and recommended solutions.

In order to develop a comprehensive National Energy Strategy which properly balances the concerns of all segments of our society, the Department seeks to broaden its knowledge and garner consensus among frequently competing interests. Specifically, the Department seeks comments on how we can best achieve ample supplies of competitively priced energy in an environmentally sensitive manner.

It is the intent of the Department to conduct an initial series of public hearings in different parts of the country beginning in early August and ending in early September. The Department wants to understand each region's unique energy needs and constraints.

Dates and Procedures: The first public hearing is scheduled for August 1, 1989 at the J.W. Marriott in 1331 Pennsylvania Ave., NW., Washington, DC. Persons wishing to submit testimony to DOE in conjuction with this hearing should forward written comments to Ruth Burns, Office of Policy, Planning and Analysis, Department of Energy, Forrestal Building, Room 7H-034, 1000 Independence Avenue SW., Washington, DC 20585.

Individuals interested in testifying at this hearing should contact Ruth Burns, Office of Policy, Planning and Analysis, Department of Energy at (202) 586-4787 no later than 4:00 p.m., Friday, July 28, 1989.

DRAFT PRESS RELEASE ON

NAVY ANNOUNCES PUBLIC HEARINGS FOR SAIPAN, TINIAN, AND GUAM

Members of the public are invited to attend hearings on a draft environmental impact statement (DEIS) which has been prepared by the Navy for the proposed Electronic Installations Program in the Western Pacific. The purpose of the hearings is for the Navy to receive comments on this DEIS. The DEIS describes the Relocatable Over-The-Horizon Radar (ROTHR) installations being proposed for Guam and Tinian. Significant comments received from the public scoping meetings held on Guam, Saipan and Tinian during February 1988 have been addressed in this DEIS.

The ROTHR installations would detect, track and estimate the composition of groups of aircraft or ships coming from beyond the horizon towards Guam. Each system provides coverage of a fixed section of the horizon of about 60 degrees in width. The three systems, if installed, would provide early warning information in the directions of Russia, China and Vietnam. The first proposed project covers a northwesterly direction towards China, Korea and Japan. The second proposed project looks in a more southwesterly direction towards Vietnam, the Philippines and China. The third project looks towards the northeast and Russia.

The proposed action addressed in the DEIS is the construction and operation of antenna arrays, ground screens, and support facilities for radar operations necessary for the national defense. The transmitters are being proposed for installation on Tinian while the receivers are being proposed for installation on Guam.

The DEIS is comprised of two volumes. Volume I addresses the overall program which is the potential installation of three ROTHR systems in the Western Pacific. Volume II addresses the environmental impact of the first ROTHR project, P-223, in detail and the work necessary to start the design for P-225, the second ROTHR project.

For the Navy to receive comments on the DEIS, public hearings have been scheduled as follows:

Wednesday, August 16, 1989, Saipan, 2 PMGovernor's Conference Room
7 PM Garapan Elementary School

Thursday, August 17, 1989, Tinian, 1 PM Mayor's Office, San Jose Village

Fridays, August 18, 1989, Guam, 2 PM Legislative Session Hall
7 PM Legislative Session Hall

You are cordially invited to attend these public hearings and present your comments orally or in writing. The closing date for acceptance of written comments is September 4, 1989. These written comments should be sent to: Mr. James Chun, (Code 2012), Pacific Division, Naval Facilities Engineering Command (PACNAVFACENGCOM), Pearl Harbor, Hawaii 96860-7300, telephone (808) 471--3931.

For further information, please call LT Kenneth Stagg at Commander Naval Forces, Marianas (COMNAVMARIANAS) at 349-5241 or Mr. Gordon Ishikawa at the Pacific Division, Naval Facilities Engineering Command (PACNAVFACENGCOM) (Hawaii) at (808) 471-3088.

mmunity/Life Style Page 22 The Guam Tribune Thursday, Aug. 3, 1989

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PACIFIC DAILY NEWS, Saturday, August 5, 1989

PUBLIC HEARINGS

NAVY ANNOUNCES PUBLIC HEARINGS FOR SAIPAN, TINIAN, AND GUAM

Members of the public are invited to attend hearings on a draft environmental impact statement (DEIS) which has been prepared by the Navy for the proposed Electronic Installations Program in the Western Pacific. The purpose of the hearings is for the Navy to receive comments on this DEIS. The DEIS describes the Relocatable Over-The-Horizon Radar (ROTHR) installations being proposed for Guam and Tinian. Significant comments received from the public scoping meetings held on Guam, Saipan and Tinian during February 1988 have been addressed in this DEIS.

The ROTHR installations would detect, track and estimate the composition of groups of aircrafts or ships coming from beyond the horizon towards Guam. Each system provides coverage of a fixed section of the horizon of about 60 degrees width. The three systems, if installed, would provide early warning information in the directions of Russia, China and Vietnam. The first proposed project covers a northwesterly direction towards China, Korea and Japan. The second proposed project looks in a more southwesterly direction towards Vietnam, the Philippines and China. The third project looks towards the northeast and Russia.

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The DEIS is comprised of two volumes. Volume I addresses the overall program which is the potential installation of three ROTHR systems in the Western Pacific. Volume II addresses the environmental impact of the first ROTHR project, P-223, in detail and the work necessary to start the design for P-225, the second ROTHR project.

For the Navy to receive comments on the DEIS, public hearings have been scheduled as follows:

WEDNESDAY, AUGUST 16, 1989, SAIPAN,	2PM GOVERNOR'S CONFERENCE ROOM
	7 PM GARAPAN ELEMENTARY SCHOOL
THURSDAY, AUGUST 17, 1989, TINIAN,	1 PM MAYOR'S OFFICE, SAN JOSE VILLAGE
FRIDAY, AUGUST 18, 1989, GUAM,	2 PM LEGISLATIVE SESSION HALL
	7 PM LEGISLATIVE SESSION HALL

You are cordially invited to attend these public hearings and present your comments orally or in writing. The closing date for acceptance of written comments is September 4, 1989. These written comments should be sent to: Mr.James Chun, (Code 2012), Pacific Division, Naval Facilities Engineering Command (PACNAVFACENGCOM), Pearl Harbor, Hawaii 96860-7300, telephone (808) 471-3931.

For further information, please call LT Kenneth Stagg at Commander Naval Forces, Marianas (COMNAVMARIANAS) at 349-5241 or Mr. Gordon Ishikawa at the Pacific Division, Naval Facilities Engineering Command (PACNAVFACENGCOM) (Hawaii) at (808) 471-3088.

LOCATION CHANGE FOR DEIS PUBLIC HEARINGS

The location for the public hearings on the Draft Environmental Impact Statements (DEIS) for the proposed Electronic Installations Program in the Western Pacific to be held on Guam has been changed.
The hearings will be held at the Piti Middle School cafeteria on Friday, August 18 at 2 and 7 p.m. The hearings were originally scheduled to be held at the Guam Legislative Session Hall.

H - 3

Tribune, 17 Aug. 89

LOCATION CHANGE FOR DEIS PUBLIC HEARINGS

The location for the public hearings on the Draft Environmental Impact Statements (DEIS) for the proposed Electronic Installations Program in the Western Pacific to be held on Guam has been changed.

The hearings will be held at the Piti Middle School cafeteria on Friday, August 18 at 2 and 7 p.m. The hearings were originally scheduled to be held at the Guam Legislative Session Hall.

ON ROTHR DEIS
EXTENDED FOR 30 DAYS

THE DUE DATE FOR COMMENTS ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS) FOR THE PROPOSED INSTALLATION OF THE RELOCATABLE OVER-THE-HORIZON RADAR (ROTHR) ON GUAM AND TINIAN HAS BEEN EXTENDED FROM SEPTEMBER 5, 1989 TO OCTOBER 6, 1989.

COMMENTS MUST BE POSTMARKED BY OCTOBER 6TH AND SENT TO:

COMMANDER, PACNAVFACENGCOM
FACILITIES PLANNING DEPT-ROTHR DEIS
PEARL HARBOR, HI 96860-7300

PACIFIC DAILY NEWS, Thursday, September 14, 1989

DUE DATE FOR COMMENTS
ON ROTHR DEIS
EXTENDED FOR 30 DAYS

PDN SEPT 15, 1989

THE DUE DATE FOR COMMENTS ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS) FOR THE PROPOSED INSTALLATION OF THE RELOCATABLE OVER-THE-HORIZON RADAR (ROTHR) ON GUAM AND TINIAN HAS BEEN EXTENDED FROM SEPTEMBER 5, 1989 TO OCTOBER 6, 1989.

COMMENTS MUST BE POSTMARKED BY OCTOBER 6TH AND SENT TO:

COMMANDER, PACNAVFACENGCOM
FACILITIES PLANNING DEPT-ROTHR DEIS
PEARL HARBOR, HI 96860-7300

DUE DATE FOR COMMENTS
ON ROTHR DEIS
EXTENDED FOR 30 DAYS

THE DUE DATE FOR COMMENTS ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS) FOR THE PROPOSED INSTALLATION OF THE RELOCATABLE OVER-THE-HORIZON RADAR (ROTHR) ON GUAM AND TINIAN HAS BEEN EXTENDED FROM SEPTEMBER 5, 1989 TO OCTOBER 6, 1989.

COMMENTS MUST BE POSTMARKED BY OCTOBER 6TH AND SENT TO:

COMMANDER, PACNAVFACENGCOM
FACILITIES PLANNING DEPT-ROTHR DEIS
PEARL HARBOR, HI 96860-7300

17 PACIFIC DAILY NEWS, Saturday, September 16, 1989

APPENDIX I

Bureau of Medicine and Surgery Study

DEPARTMENT OF THE NAVY

BUREAU OF MEDICINE AND SURGERY
WASHINGTON DC 20372-5120

IN REPLY REFER TO

6470/1
Ser 21/0077

12 FEB 1990

From: Chief, Bureau of Medicine and Surgery
To : Commander, Space and Naval Warfare Systems Command (PMW-148)

Subj: BIOLOGICAL EFFECTS OF ELECTROMAGNETIC RADIATION AND THE RELOCATABLE OVER THE HORIZON RADAR (ROTHR)

Ref: (a) Your ltr 9451 Ser PMW 144-1/241 of 17 Nov 89
(b) Mr. Leonard J. Kaufer ltr dtd 02 Oct 89
(c) Dr. Michael L. Kenney, Special Assistant for Socioeconomic Planning, Commonwealth of the Northern Marianas Islands, ltr on Draft Environmental Impact Statement for the Over-the-Horizon Radar Installation Proposed for Tinian, undated.
(d) ROTHR E^3 Study, Volume 1, 1 Aug 89.
(e) DODINST 6055.11
(f) OPNAVINST 5100.23B

Encl: (1) Response to Inquiries

1. Reference (a) requested our review of the biological effects and human health issues associated with the Navy's proposed overseas siting of the Relocatable Over the Horizon Radar (ROTHR), specifically addressing references (b) and (c); our comments are provided in enclosure (1).

2. In studying the human health impact from ROTHR, we have reviewed reference (d) and have consulted with technical experts from the Electromagnetic Engineering and Analysis Division, Naval Electronic and Engineering Command, Charleston, the Naval Aerospace Medical Research Laboratory; and Space and Naval Warfare Systems Command, (PMW 148-8). It is our conclusion that, when operated in compliance with the permissible exposure levels of references (e) and (f), exposure to radiofrequency electromagnetic fields from the ROTHR does not present an increased risk of acute or latent effects and that exposure is not hazardous to human health.

3. My point of contact is Lieutenant Commander H. F. Kerschner, MSC, USN (BUMED 2122). He may be reached at AUTOVON 294-1182 or commercial (202) 653-1182.

W A Buckendorf

W. A. BUCKENDORF
Assistant Chief for Fleet
Readiness and Support

Copy to:
CNO (OP-45)
COMNAVFACENGCOM Washington DC
COMPACDIVNAVFACENGCOM, Makalapa HI
NAVMEDRESCHCOM Bethesda, MD
NAVAEROMEDRESCHLAB Pensacola, FL
NAVELEXCEN Charleston, SC

Response to Inquiries Concerning the Biological Effects of the Relocatable Over-the-Horizon Radar (ROTHR)

Mr. Kaufer and Dr. Kenney have expressed common concerns in references (b) and (c) about the human health of persons working and living in the vicinity of the ROTHR. Before discussing the specific aspects of their letters, a general description of nonionizing radiation is provided, as follows.

Radiation, ionizing or nonionizing, is of two basic types, particulate (consisting of atoms or subatomic matter) and electromagnetic (consisting of photons, i.e., quanta of "light" or wave-energy packets). Particulate radiations are not produced by radar transmitters, thus we are concerned with the latter, photons. Photons, light waves, can possess an extremely wide range of energies, extending from almost nothing to enormous values. Photons of sufficient energy can cause ionization, however, here we are only concerned with nonionizing electromagnetic radiation. Radiofrequency radiation (RFR) is the term generally applied to propagating electromagnetic waves of frequencies between ten kilohertz (kHz) and 300 Gigahertz (GHz). The energy contained in an energy packet or photon of RFR is directly proportional to the frequency of that photon. Photons of visible or higher frequencies (ionizing radiation) have enough energy to knock electrons out of atoms or molecules, while photons of radiofrequency do not. A photon of 300 GHz has only one ten-thousandth as much energy as a visible photon. RFR photons are restricted in their effects to those which can arise from vibrating or rotating atoms and molecules producing an associated thermal result, rather than the direct breaking of chemical bonds. Essentially, all of the absorbed power is eventually converted to thermal energy.

Much of the public concern with RFR centers on the low frequency aspect, namely extremely low frequency (ELF) and very low frequency (VLF) radiations - primarily because of the fear of tumor induction, reportedly caused by an "athermal" effect. For many years, there has been ongoing scientific controversy, fueled by the popular press and news media, regarding the possibility that chronic exposure to ELF electromagnetic radiation (EMR) can lead to adverse health effects. The debate focuses on human exposures to 50 and 60 Hz electric power distribution lines (such as those from the Piti Power Plant), which have associated magnetic fields.

A number of laboratories have claimed biological effects from 60 Hz and other low frequency electric and magnetic fields; however, these effects have not been independently replicated. The reputed biological effects cannot be explained with current knowledge and theories. Similarly, several epidemiological studies appear to show an association between cancer and exposure to low-level low frequency nonionizing radiation. The evidence for health effects is far from conclusive. In 1986 the National Research Council (NRC) issued a report on Nonthermal Effects of Nonionizing Radiation[1]. The report summarizes that:

- There are abundant reports on a wide variety of individual responses to low-level nonionizing radiation. However, the various experimental findings have not yet led to a comprehensive conceptual structure for the reported phenomena, one sufficient to test the several suggested theories.
- Few studies have been exactly and independently evaluated or replicated. The epidemiology suffers from difficulties in measuring dose.
- There is no comprehensive theory for a rational mechanism of action consistent with known physical, chemical, and biological principles.

Recently the International Radiation Protection Association (IRPA) published guidelines for exposures to 50 and 60 Hz electric and magnetic fields[2]. In its concluding remarks, IRPA states that: " Although some epidemiological studies suggest an association between exposure to 50 and 60 Hz fields and cancer, others do not. Not only is this association not proven, but present data do not provide any basis for health risk assessment useful for the development of exposure limits. Current laboratory studies are testing the hypothesis that 50 and 60 Hz fields may act as, or with, a cancer promoter. These studies are still exploratory in nature and have not established any human risk from exposure to these fields."

Apparently the concerns about low frequency radiofrequency radiation have led to implausible association that high frequency transmissions from the ROTHR could produce "athermal" biological effects. The ROTHR emits RFR in the high frequency (HF) range between 5 to 32 MHz. Comparing the biological effects from ELF to those of the ROTHR's HF emissions would be like comparing the relationship between EMR emitted from a microwave oven with radiation in the visible spectrum. Although both of these forms of EMR are readily described by the same physical theories, the two are not directly comparable when we consider biological mechanism of injury.

Specific to Mr. Kenney's letter, the references on pages 2 and Chattopadhyay, cite ELF electric and magnetic field studies. Again these studies have no relevance to the known biological effects of HF transmissions of 5 to 32 MHz.

To further clarify, the Brown and Chattopadhyay review shows no relationship between cancer and RFR causation. For example, several cited studies (Daley et al, 1985; Friedman, 1981; Steneck, 1984) all deal with small population relationships, yet the large population studies (Robinette, et al, 1980), which show no association of radiation and acute latent effects, are underemphasized. Also, the section on carcinogenesis in whole animals refers to one study demonstrating an effect at 9.27 GHz (with a power density 100 mW/cm^2) and another showing a delay of tumor development at 2.45 GHz. Another study was reported to show an acceleration of skin cancer in mice. None of these articles reported cancer production. A study with multiple stressors (Szmigielski, et al, 1982) reported that exposure to 2.45 GHz at 5 mW/cm^2 and higher power densities increased breast tumors and skin cancer in mice. The tumor development was positively correlated with power density. The lowest power density only produced effects similar to confinement-crowding chronic stress. The effects of RFR on teratogenesis and reproduction depended on animals bodies being heated at relatively high power densities (greater than 10 mW/cm^2). But lower levels of exposure produced no effects in these areas. To quote Brown and Chattopadhyay, on page 302,: "The protected position of the mammalian embryo is consistent with many reports indicating that teratogenic effects are generally found only at higher intensities than are ordinarily associated with environmental exposure.". They continue on page 303: "Despite its critical position in the development of neoplasia, and the availability of many EM-field exposures studies, the immune system and blood forming elements' susceptibility to nonionizing radiation remains difficult to evaluate with respect to cancer." Only at extraordinary high power densities have effects been observed on the blood forming elements and the immune system, as shown in Table 1 of the Brown and Chattopadhyay report in the frequency range relevant to the ROTHR (ten to 27 MHz, greater than 800 mW/cm^2). Even in the whole animal enzyme studies (page 309) effects have generally been dependent upon power density greater than 0.1 mW/cm^2 and were reversible in the absence of RFR. The review concludes (page 326): " With the demonstration of frequency-, intensity-, and waveform- specific interactions of EM fields with biological material, it is difficult to see merit for cancer risk evaluations in any present governmental safety standard."

Both Dr. Kenney and Mr. Kaufer refer to Dr. I. A. Shulman, a general surgeon and amateur radio operator, who reviewed the literature on biological effects of nonionizing radiation for the readers of the amateur radio operator's publication OST. OST is not a peer reviewed scientific journal.

We disagree with the Shulman statement (page 5, Kenney) regarding biological effects in living organisms: there is no clear evidence that adverse tissue effects can occur without a detectable rise in temperature.

Presently, there are no federal guidelines for personnel exposure to radiofrequency radiation. Since 1982, there has been national and international consensus that specific absorption (SA) is the basic dosimetric parameter for defining hazards to humans from radiofrequency radiation from 100 kHz to 300 GHz. Within this frequency range, the specific absorption rate (SAR) of 4.0 Watts/kg has been recognized as the threshold for adverse biological effects. These adverse effects are due to a measured thermal rise in body tissue. By "thermal" one means an effect which is explained by virtue of heat resulting from the absorption of electromagnetic energy. The effect would be the same if some other agent had conceivably produced the same distribution of absorbed energy[3]. Recently, the American National Standards Institute (ANSI) C95.1 Risk Assessment Committee completed a literature review of 321 peer reviewed papers and reaffirmed the 4.0 W/kg criterion[4]. The ANSI committee also reaffirmed that a safety factor of ten can be applied for establishing a safe personnel exposure SAR of 0.4 W/kg. This criterion is the current basis for establishing human exposure guidelines to radiofrequency radiation for both industry and the Department of Defense (DoD), and it is expected to be the basis for new ANSI RFR guidance to be issued this year.

Thus, DoD issues regulations, based on ANSI recommendations in lieu of federal non-existant guidelines or regulatory law. In addition to using these basic dosimetric parameters, personnel exposure limits issued by ANSI and the Navy also take into account whole-body resonance and the frequency dependency of human exposure to RFR. Importantly, these personnel exposure limits reflect that human physiological response is not only a function of body orientation and size but must also take into account the frequency and power of incident electric and magnetic fields.

As further explanation of the basis of our limits in the frequency range of 100 kHz to 300 GHz, whole-body SARs at or greater than 4.0W/kg have been cited for eliciting observable behavioral and physical biological effects, in animals and humans. What does 4.0W/kg mean? In terms of human metabolic heat production, 4.0W/kg represents a moderate activity level, i.e., housecleaning or driving a truck and falls well within the normal range of human thermoregulation[5]. As previously mentioned, this is the traditional threshold criterion for development of our personnel exposure guides.

Personnel exposure limits have been revised to reflect the physiological frequency dependency cited above, for frequencies of 3 KHz to 100 KHz.

For these frequencies the SAR corresponding to thresholds for excitable cell stimulation decreases almost directly with the square of the frequency, therefore a constant SAR value cannot be used. The basic dosimetric parameter for biological effect is indeed internal current density. Although personnel exposure to very low frequency (VLF) fields, even intense ones, produce relatively inconsequential amounts of absorbed thermal energy, electric shocks and RF burns may occur when an exposed person is coupled with ungrounded objects. Above 6.0 GHz human tissue is moderately opaque to RFR, therefore, SAR does not apply.

For a complete summary of the biological effects of RFR, we recommend the review article by Roberts, Michaelson and Lu[6].

Concluding remarks:

Contrary to some widely held notions, a large body of data exists on the biological effects of exposure to radiofrequency electromagnetic fields. This data has been judiciously applied to the development of safe exposure guidelines for personnel. It should be noted that there are no verified reports of personnel injury or adverse effects when exposures to radiofrequency electromagnetic radiation are maintained within the specified ANSI and DoD limits. The Institute of Electrical and Electronic Engineers (IEEE) Committee on Man and Radiation states that"... based on the present base of knowledge, prolonged exposure at or below the permissible levels recommended by the American National Standards Institute is not likely to be hazardous to human health"[7].

To date there is no reliable scientific data from which it can be inferred that:

- Certain subgroups of the population are at more risk than others.
- That damage from radiofrequency radiation is cumulative.
- Nonthermal or nonthermal modulation-specific radiofrequency radiation can adversely affect the health of humans.

The health hazards of human and animal exposure to five to 32 MHz RFR have been extensively studied by the Air Force[8,9]. The Navy's personnel exposure standards have consistently proven to be safe in protecting both its employees and the general public. These exposure limits are in agreement with the recognized consensus guidelines published by ANSI and are in fact lower than those set by most other countries. Finally, the Navy has had for many years a well structured program to monitor the hazards to personnel from electromagnetic radiation, including site surveys and reviews of administrative and engineering controls.

1. Commission on Life Sciences, National Research Council. National Academy Press. Nonthermal Effects of Nonionizing Radiation, Final Report. Advisory Committee on the Nonthermal Effects of Nonionizing Radiation, Board on Radiation Effects Research. 1986.

2. IRPA. Interim Guidelines on Limits of Exposure to 50/60 Hz Electric and Magnetic Fields. International Nonionizing Radiation Committee of the International Radiation Protection Association. Health Physics, Vol. 58, No. 1 (January), pp 113-122, 1990.

3. Michaelson, Sol. Unpublished notes.

4. Standards Committee SCC 28 on Non-ionizing Radiation Hazards. Final Ballot on Proposed Revision of ANSI C95.1-1982. November 29, 1989.

5. Ibid.

6. Roberts, et al. "The biological effects of radiofrequency radiation: a critical review and recommendations", in International Journal of Radiation Biology Vol. 50:379-420, 1986 379-420. 1986.

7. IEEE Committee on Man and Radiation. Draft Entity Position Statement on Human Exposure to Microwave and Other Radio-Frequency Electromagnetic Fields. November 8, 1989.

8. Heynick, L.N.: Critique of the Literature on the Bioeffects of Radio Frequency Radiation: A Comprehensive Review Pertinent to Air Force Operations. SRI International for the U.S. Air Force School od Aerospace Medicine. 1987.

9.. Durney, C.H., Massoudu, H., Iskander, M.F.: Radiofrequency Radiation Dosimetry Handbook. (4th edition). USAFSAM-TR-85-73 Electrical Engineering Department, The University of Utah for the U.S. Air Force School of Aerospace Medicine. 1986.

APPENDIX J

Review/Evaluation

9 April 1990

REVIEW/EVALUATION OF ALTERNATIVE SITES

I. PURPOSE

The purpose of this review is to compare the siting alternatives for the ROTHR transmitters and receivers discussed in the Draft Environmental Impact Statement (DEIS), other site suggestions received during the comment period for the DEIS; and to identify which of the various sites satisfy the technical requirements for ROTHR operational feasibility.

II. SCOPE OF REVIEW

This review addresses all suggested locations for the ROTHR installation on Guam and Tinian for satisfaction of the technical siting requirements for accomplishing the ROTHR function. Other islands in the Mariana Islands are not evaluated for the reasons discussed in the DEIS. The ROTHR site requirements including size, physical obstruction, line of sight and terrain features required for satisfactory operations are first explained. Then the ROTHR alternative schemes for each location are evaluated against the criteria.

III. ROTHR SEPARATION REQUIREMENT

This requirement refers to the separation of the transmitter from it's designated receiver. The desired distance is 50 to 100 miles. This separation is necessary for the ROTHR to operate continuously, sending and receiving, referred to as bistatic operation. Since Guam is only 30 miles long, the 50 mile minimum requirement precludes both the transmitter and the receiver from being located on Guam. Similarly, the maximum 100 miles would be the extent that the transmitter should be distant from the receiver.

Islands combinations considered for the ROTHR in Section 2.5.1 of the DEIS are summarized as follows:

Island Combination	Separation Distance
Guam-Tinian	105
Guam-Rota	43
Guam-Saipan	118
Guam-Anatahan	190
Tinian-Saipan	10
Tinian-Rota	60
Tinian-Anatahan	85
Rota-Anatahan	145
Rota-Saipan	70
Saipan-Anatahan	75
Babelthaup-Peleliu	38

As shown above, only the combinations of Tinian/Rota, Tinian/Anatahan, Rota/Saipan and Saipan/Anatahan would meet the criteria. Combinations which included Anatahan were eliminated since the four mile long volcanic crater island has no sizeable level land to place a transmitter or receiver. Since the Guam/Tinian distance is only 105 miles and the Guam/Saipan 118 miles, these combinations were included in the acceptable island combinations as well as the Guam/Rota which was 43 miles. The combinations for further evaluations are the following:

Guam-Tinian
Guam-Saipan
Guam-Rota
Tinian-Rota
Rota-Saipan

It should be noted that Saipan/Rota and Guam/Saipan were not included in the DEIS because there was no large level area on Saipan for the land requirement of the transmitter or receiver except for the area between Suicide cliff and Banzai cliff at the northern end of Saipan.

IV. SITING CRITERIA (GENERAL)

1. Communication Facilities

Criteria for communication sites such as the Navy's communication station at Finegayan (receiving) and Barrigada (transmitting) are established to ensure that sites are compatible for transmit and receive operations. The criteria at receive sites are critical since electromagnetic or radio frequency interference created near the receive site can make distinguishing incoming signals difficult. The reference used for site planning is attachment 1, Communications Distance Separation, from the Navy's facilities planning manual "P-80, Facility Planning Criteria for Navy and Marine Corps Shore Installations". The ROTHR transmitter and receiver also operate on the same concept as the communication site except that it receives it's own signals.

There has been miscommunication between the information stated in the DEIS about the 15 mile isolation and the 2 mile RFI free zone. The 15 mile isolation distance refers to high power transmitter stations such as the Navy's NAVCAMS WESTPAC communication transmitters at Barrigada, Guam. These high power transmitters emit radio energy that could interfere with military communication receivers operating in the vicinity. This is the reason that the NAVCAMS WESTPAC receivers are located to the north at Finegayan and away from Barrigada.

The Radio Free Zones of 1 and 2 miles mentioned in the DEIS refer to low level interference that would affect the ROTHR receiving capability. This specific requirement was established to provide a criteria for acceptable land use development near a ROTHR receiver site. It is important to note that the requirement for RFI free zones is established in the general planning criteria of attachment 1. Some of the similar requirements are listed as follows for easy reference:

High, Medium, and Low Frequency Receiver Site from:

Main highways	3000 feet
Over head power lines (over 100 KV)	2 miles
Habitable areas	1 mile
Light industry	3 miles
Heavy industry	5 miles
Primary power plants	5 miles

2. Ammunition Facilities

Certain military installations have ammunition or other ordnance either in storage, maintenance, transshipment or aboard ships/aircraft. Specific safe distances have been established by the Department of Defense for which all facilities housing personnel (occupied structures) must meet. The term used is Explosive Safety Quantity Distance or ESQD. ROTHR facilities, especially those that house personnel, must be sited outside of the ESQD. Additionally, ordnance susceptible to electromagnetic radiation must be kept a safe distance from the source of radiation, such as the ROTHR transmitters. Electrical overload of the firing or detonating mechanism can cause malfunction or even premature ignition. Military bases with ordnance activities include Andersen AFB, Naval Magazine, NAS Agana, Naval Station, and the ammunition wharf at Apra Harbor.

V. ROTHR TRANSMITTER SITE CRITERIA

The transmitter site criteria are shown in the ROTHR Antenna Site Criteria of attachment 2. The criteria will be discussed under the category of size, levelness, and clearance.

1. Size

The transmitter area is shaped like a trapezoid with the width of the base 1300 feet where the antennas are located and the width at the far out antenna field about 5,000 feet. The area of the antenna field is 217 acres. The camp for personnel facilities and the power plant would require about 10 acres for a total of 227 acres.

2. Levelness

Ground levelness ensures that the outgoing signal is not interrupted as it must be sent low to the horizon for maximum distance into the target area. Ground roughness for the first 1,000 feet, or the ground screen area, is $\pm$ 6 inches. From 1,000 feet to 3,000 feet, the roughness allowance increases from $\pm$ 15 inches to $\pm$ 30 inches. Ground roughness behind the antenna varies from 12 inches to 48 inches.

3. Clearance

Beyond the forward edge of the ground screen, there should be no obstacle protruding above a 1 degree upward slope. This slope extends for 3,000 feet where the criteria is then based on a 2 degree slope from the ground screen. This requirement is necessary to ensure no disruption of the low angle signals that attain the maximum range into the target area.

4. Special Requirement of ROTHR Transmitters

The Department of Defense has directed that Over the Horizon high frequency backscatter transmitter radars, such as the ROTHR, must be located 100 miles from CDAA (Circularly Disposed Antenna Array) operations. A CDAA, also known as the Wullenweber facility, is located at NAVCAMS WESTPAC communications receiver area at northern Guam. This 100 mile separation requirement precludes the ROTHR transmitter from being sited on Guam or Rota. However this review will cover the sites on Guam for record purpose since this separation information was not stated in the DEIS.

VI. ANALYSIS OF TRANSMITTER SITES

1. Guam Sites (See sketch 1.)

a. Northwest Field. There is adequate land to locate all three ROTHR transmitters. However Navy communications receiver antennas are located in the area and would be severly impacted by the ROTHR transmission.

b. South Finegayan/Former FAA. This location can fit three ROTHR transmitters. However this location is only three miles from the NAVCAMS WESTPAC receiver antennas and the ROTHR transmission would severely impact the communication receiving operations.

c. Harmon Annex. This location can fit three ROTHR transmitters. However this location is only five miles from the NAVCAMS WESTPAC receiver antennas and the ROTHR transmission would severely impact the communication receiving operations.

d. Barrigada. This location can fit three ROTHR transmitters. However Mt. Barrigada will block portions of the P-223 and the P-002 look direction. Also ordnance operations at NAS Agana will be affected by the electromagnetic radiation.

e. NAS Agana. This location can fit three ROTHR transmitters. However there are no vacant land as discussed in the siting for the receiver. Additionally, ordnance operations at NAS will be affected by the electromagetic radiation.

f. Nimitz Hill/Lonfit. This location can fit two transmitters on the Navy property. Three transmitters could be sited in the area if extended into adjacent private property. This area is hilly and the transmitter would have to be built on the mountain ridges to maintain line of sight. Construction would be difficult to attain the required clearance.

g. Orote Point. This location can fit three ROTHR transmitters. However the ROTHR transmitters would not be compatible with the ordnance operations at the new ammunition wharf at Adotgan Point and would require closing of the only ammunition port on Guam. Additionally, manned facilities cannot be sited within the ESQD arc from the ammunition wharf, which covers all the unused and open areas of Orote Peninsula.

h. NAVMAG. Locating a high power transmitter in this area is not allowed due to the unsafe condition created by the ordnance maintenance and storage conducted at the magazine facility. Additionally, manned facilities such as the ROTHR vans and support buildings are not allowed to be built within the ESQD arc from the ordnance storage facilities.

i. Dandan. This location can fit three ROTHR transmitters. The area within the Dandan estate is reasonably level.

j. Bubulao. This location can fit three ROTHR transmitter. However this location is very hilly and construction would be difficult to attain the required line of sight clearance over the next mountain in the foreground.

k. Pulantat. The location can fit three ROTHR transmitters. However Mt. Alutom and Mt. Macajna would partially block the line of sight, and the hilly terrain makes construction difficult to attain clearance over the next mountain in the foreground.

l. Andersen South/Marbo Annex. This location can fit three transmitters. However this location is only five miles from the NAVCAMS WESTPAC receiver antennas and the ROTHR transmission would severely impact the communication receiving operations.

2. Tinian Sites

a. Northern sites. This area can fit three ROTHR transmitters for three alignments as shown in sketch 2. The land is level with no terrain obstructions in front of the antennas.

b. Northern sites out of the National Historic Landmark. Only two ROTHR transmitters can be sited in the level area back from the shore line as shown in sketch 3. It should be noted that a transmitter cannot be in the rear of another ROTHR transmitter due to residual back reflection of the radiated energy which would impact the transmission signals.

c. Eastern site. This location is on a plateau which can fit one ROTHR transmitter. The area is bordered on three sides by steep slopes which restrict the alignment to P-002 as shown in sketch 4.

d. Western site. This location is on gently sloping terrain and can fit three ROTHR transmitters. However the P-002 line of sight would be partially blocked by Mt. Lasso. Therefore only the P-223 and P-225 would be feasible from this location as shown in sketch 5.

3. Saipan Site

The only level and vacant area that can fit the ROTHR transmitter is on the northern end of the island. This area, called Banadera, is located between two significant World War II historical sites on Saipan. On the north is Banzai cliff and on the west, Suicide cliff. Both are major tourist attractions. Three transmitters can be sited, but Suicide cliff on the west partially obstructs the P-225 line of sight as shown in sketch 6. The size of the area would also limit the siting to one transmitter, either P-223 or P-002, since the shape of the parcel would have one either in the rear or in the front of the other as shown in sketch 6, which is not operationally acceptable.

VII. ROTHR RECEIVER SITE CRITERIA

The receiver site criteria are shown in the ROTHR Antenna Site Criteria of attachment 2 and will be discussed under the category of size, levelness, and clearance.

1. Size

a. Length. The length of the antenna array is 8574 feet, which consist of 372 antenna poles spaced 23 feet apart, about the length of the runway at Guam International Airport and the Saipan International Airport.

There will be two rows of antenna poles for a total of 744 poles. The length of the antenna array gives the system the reception capability to cover the low to high frequency wave range, with the advantage of utilizing different frequencies to find and differentiate between targets and false targets caused by the atmospheric conditions between the ROTHR site and the coverage area beyond the horizon.

b. Width. The width of the receiver site is 1000 feet as shown in attachment 2. It consist of a 135 feet ground screen which includes the two rows of antennas, 535 feet of reflecting area in front of the antenna ground screen, and 300 feet of reflecting area behind the ground screen. This width is necessary to ensure the accurate reception of the returning signal from the target area.

2. Levelness

a. Ground levelness ensures that the returning signals are not distorted when they reflect off the ground at the receiving antennas. The deviation acceptable under the ground screen is the strictest at $\pm$ 1 inch within 20 feet of the antenna. The total area covered by the 8,574 feet long by 1000 feet wide footprint must be within specified levelness. The most difficult requirement is the allowable deflection of the antenna pole which is 1 inch from a straight line extending 8,574 feet, from the first antenna pole to the 372nd pole. This means that each antenna cannot be 1 inch higher or lower than the straight line between the first and last antenna pole more than 1 1/2 mile away.

3. Clearance. This requirement refers to obstacles in the line of sight starting from the forward edge of the ground screen. For the first 3,000 feet, there should be no obstacles protruding above a 1 degree upward slope from the front edge of the ground screen. From 3,000 feet forward, there should be no obstacle protruding above a 2 degree upward slope from the ground screen. This means for example that at 1,000 feet in front of the ground screen, there should be no building, hill or wooded forest 17 feet higher than the ground elevation at the ground screen. At 3,000 feet it would be 52 feet, and at one mile it would be 184 feet. This clearance is necessary to prevent blockage or distortion of the returning radio signals so precise information of the target area is received.

VIII. ANALYSIS OF RECEIVER SITES

1. Guam Sites are the only ones actively considered because of the reasons specified in Section V. These sites are:

a. Northwest Field and NAVCAMS Finegayan. Sketch 7 shows the alternative sites that were in the DEIS. The area is generally level.

The sites in this area meet the criteria for ROTHR since this area is already the communication receive or quiet area. There are some restrictions that must be met to avoid interference with existing operations. These include the Navy Security Group operations at the Wullenweber Antenna facility and the Air Force Satellite communications facility at Northwest Field.

Located at the northwest and the northeast coast, snuggled between the Navy and Air Force lands are two private properties which are currently undeveloped. These two estates utilize military roads for access through Air Force lands. The Artero estate uses the perimeter road that routes within one mile of the Wullenweber facility and the NAVCAMS WESTPAC receiver antennas. Existing military operations and the proposed ROTHR project will not prevent the development of the Artero and Castro property located below the cliff line based on development plans disclosed to date.

b. South Finegayan/Former FAA. This area is generally level but is minimal in length. It can fit one ROTHR of the P-225 alignment as shown in sketch 8. Existing residential housings are located within one mile in front of the receiver. A two story FAA headquarters building is located in the center of the area and will protrude into the ROTHR line of sight.

c. Harmon Annex. This area is large but can fit only one ROTHR of P-223 or P-225 alignment. The third alignment, P-002, would cross Route 3, a major highway as shown on sketch 9. At the west boundary is the Navy Tanguisson power plant, less than one mile from the center of the Harmon Annex. Power distribution line run through the western part of the area which would be in front of the ROTHR's look direction. Also located in the parcel is the GOVGUAM sewage treatment plant. The plant and high ground is not expected to protrude into the ROTHR line of sight. The land is generally flat but has depressions in the mid-eastern section of the area.

d. Barrigada. This area can fit one ROTHR of three alignments as shown in sketch 10. However the following items preclude satisfactory ROTHR operation:

(1) Existing Navy communication transmitters on this parcel will interfere with the ROTHR receive capability.

(2) Mount Barrigada, which borders the parcel on the north, blocks the look direction of P-223 and P-002.

(3) Route 16, a major highway, borders the western side and would interfere with the ROTHR receive capability. Civilian development exists on the western boundary which is a possible source of RF interference.

e. NAS Agana. The air station runways are also used by the Guam International Airport. The air station, including the runways, has the land area for one ROTHR of the P-225 alignment as shown on sketch 11. The site is not logical for locating a ROTHR because the receiver would completely overlay the runway and permanently close the airport. Other factors adversely affecting the ROTHR operation are the highway and existing developed commercial industries surrounding the air station.

f. Nimitz Hill/Lonfit. The military lands at Nimitz Hill do not have the land area for even one ROTHR as shown in sketch 12. The alignments shown extend into private lands. However, since the private lands are undeveloped, the area would be ideal for the ROTHR except for the mountainous terrain with elevation difference of 300 feet. To site a ROTHR in this type of terrain, the 8,600 feet long antenna plane would have to be constructed on the mountain ridges to attain a clear line of sight over the next mountain. The enormity of filling in valleys of 100-300 feet makes this location infeasible.

g. Orote Point. This site can fit just one ROTHR for the P-002 alignment as shown in sketch 13. The P-223 and P-225 alignments would extend either into the ocean or into Apra Harbor. The P-002 alignment would be on generally vacant land. This vacant appearance is due to the area being within the ESQD arc from the new ammunition wharf at Adotgan Point located on the north side of Orote Peninsula. All inhabited buildings, such as the ROTHR vans and support building, not associated with ordnance operations cannot be sited on the Peninsula as explained in Section IV. Therefore, this location is not acceptable since the ROTHR vans must be sited in the center of the antenna array.

h. NAVMAG. The ammunition storage area can fit two alignments as shown in sketch 14. However, this area is encumbered by the ESQD arcs from the ordnance storage operations and therefore this area is not acceptable for safety reasons. Additionally, the area is hilly with mountains blocking the western and northern directions which makes the location unacceptable for ROTHR operations.

i. Dandan. This site can fit three ROTHRs for three alignments as shown in sketch 15. The site is fairly level in the center section of the Dandan estate but is hilly on the north, west and south boundaries. The location is ideal since the adjoining areas are undeveloped and with little or no significant vehicular traffic. To accommodate three ROTHR receivers, the three receivers would be off the middle section of the Dandan estate and partially into the hilly area as shown in sketch 15. In 1989, there has been interest by land developers to acquire lands at Dandan and vicinity for construction of resort complex with hotels, condominium and golf courses. The effect of electromagnetic interference to ROTHR cannot be ascertained at this time.

j. Bubulao. This site could fit three ROTHRs for three alignments as shown in sketch 16. The area is away from urban development that could affect the ROTHR receive operations. This area is northwest of Dandan and in the hilly central area of southern Guam. For this same reason the ROTHR receiver would have to be built nearly on the top of hills and span across the valleys in order to maintain line of sight over the mountains in front. Therefore this area is not considered feasible for the ROTHR receiver due to the hilly terrain. Additionally, construction at this site would affect Ugum River and it's tributaries.

k. Pulantat. This site could fit three ROTHRs for three alignments as shown in sketch 17. The location is away from urban development which could affect the ROTHR operations but is extremely hilly. Additionally the west direction is blocked by Mt. Alutom and the northwest by Mt. Macajna.

Only the P-002 direction is clear of mountains in the front but the hilly terrain makes construction at this location difficult to attain the required clearance.

l. Andersen South/Harbo Area. This site can fit the three ROTHR alignments as shown in sketch 18. However all alignments would be affected by the vehicular traffic on the major highway on the north boundary and the highway on the south which routes through the south portion of the area. Mount Barrigada, located two miles west, would block portions of the line of sight for the P-225 alignment. This location is not operationally acceptable due to electromagnetic interference from heavy vehicular traffic.

IX. Summary

All locations presented are summarized with the effect of the siting criterion to the proposed ROTHR system(s) and/or to existing operations as follows: (0) no affect, (1) some limitation, (2) significant limitation and (3) major problem

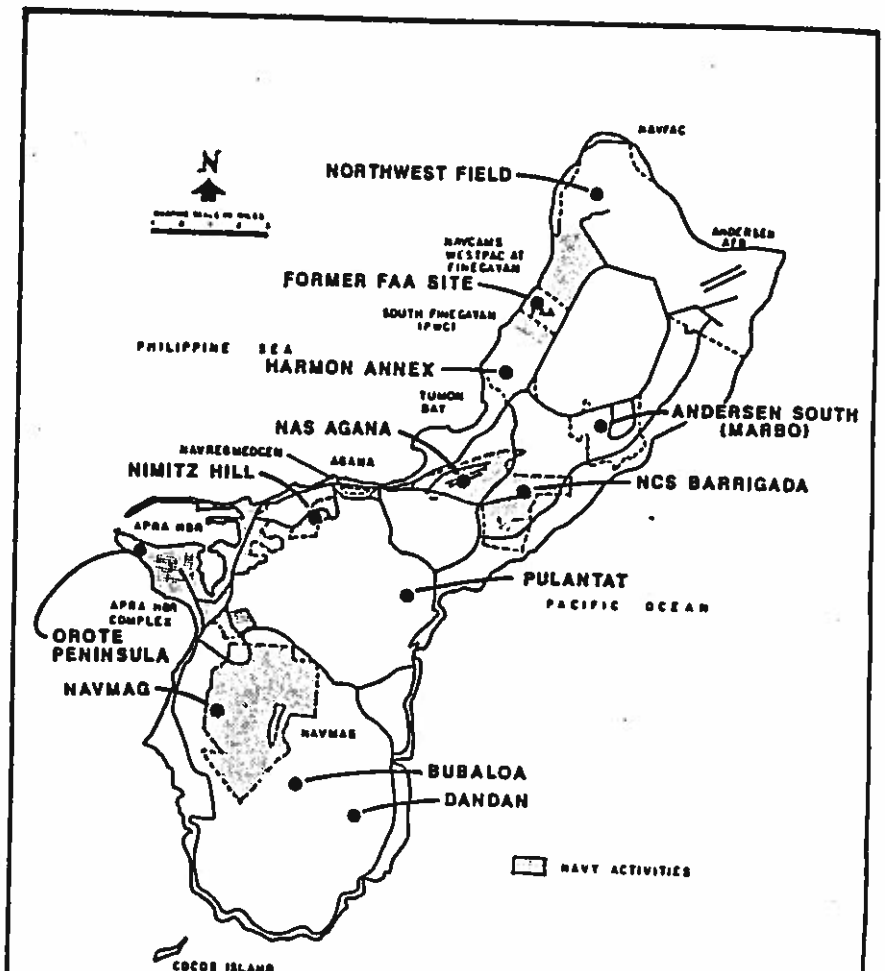
RECEIVER ALTERNATIVES

Location	Siting Criteria				
	Size	Levelness	Clearance	RFI	Exp Safety
Northwest Field	0	0	0	0	1
South Finegayan	1	0	1	1	0
Harmon Annex	1	0	0	1	0
Barrigada	1	0	2	3	0
NAS	2	0	0	3	0
Nimitz Hill	1	3	1	0	0
Orote Point	2	0	0	0	3
NAVMAG	0	2	2	0	3
Dandan	0	1	0	0	0
Bubulao	0	3	1	0	0
Pulantat	0	3	2	0	0
Andersen South	0	0	1	3	0

TRANSMITTER ALTERNATIVES

Location	Siting Criteria				
	Size	Levelness	Clearance	RFI	Exp Safety
Northwest Field	0	0	0	3	3
South Finegayan	0	0	0	3	0
Harmon Annex	0	0	0	3	0
Barrigada	0	0	2	0	3
NAS	2	0	0	0	3
Nimitz Hill	0	3	1	0	0
Orote Point	0	0	0	0	3
NAVMAG	0	2	2	0	3
Dandan	0	1	0	0	0
Bubulao	0	3	1	0	2
Pulantat	0	3	2	0	0
Andersen South	0	0	1	3	0
Tinian Northern	0	0	0	0	0
Tinian Eastern	2	1	0	0	0
Tinian Western	0	0	1	0	0

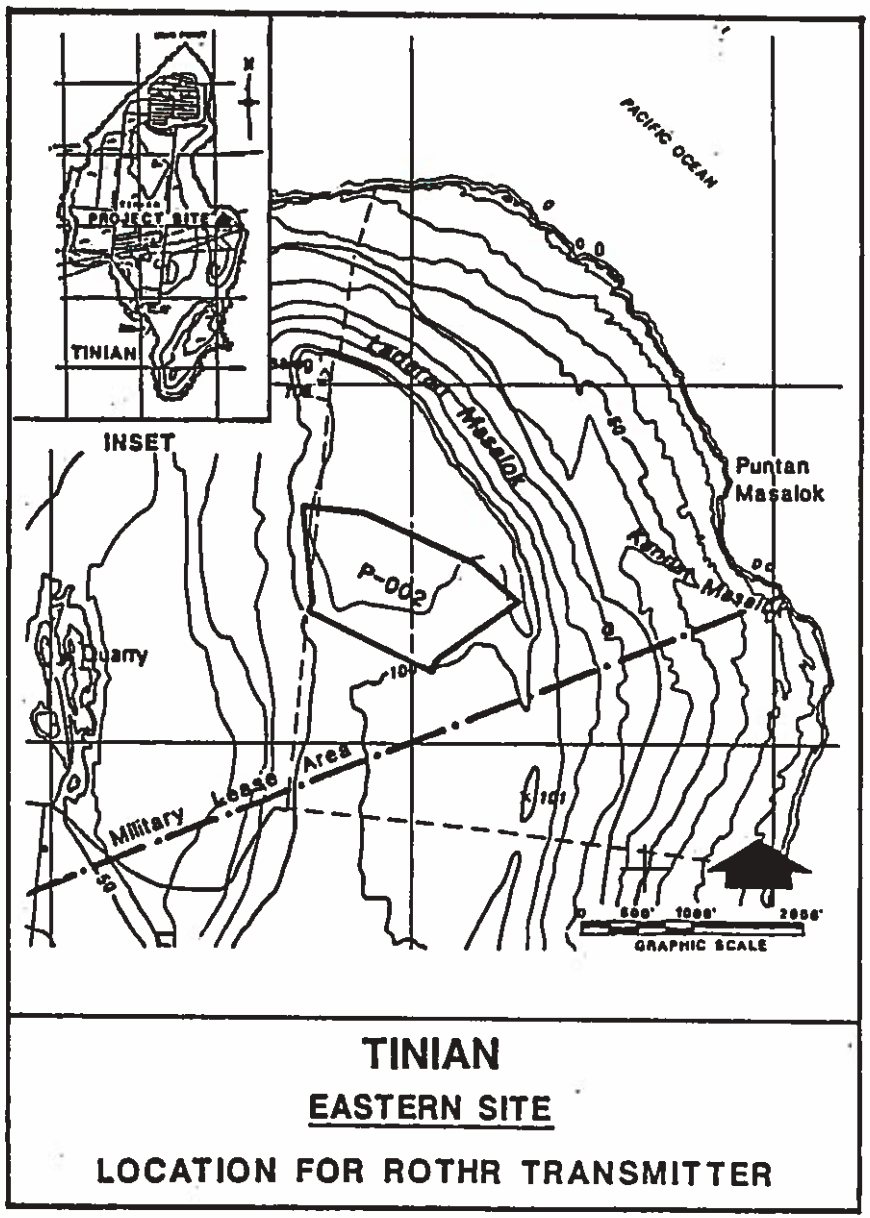
As shown by the foregoing narrative and tabular comparisons, placing the transmitter on Northern Tinian and the receiver at Northwest Field on Guam, while not meeting all stated criteria, (e.g. 100 mile maximum separation) represents the best available solution, within the limits posed by technical requirements.



GUAM

ALTERNATE ROTHR TRANSMITTER SITES

SKETCH 1

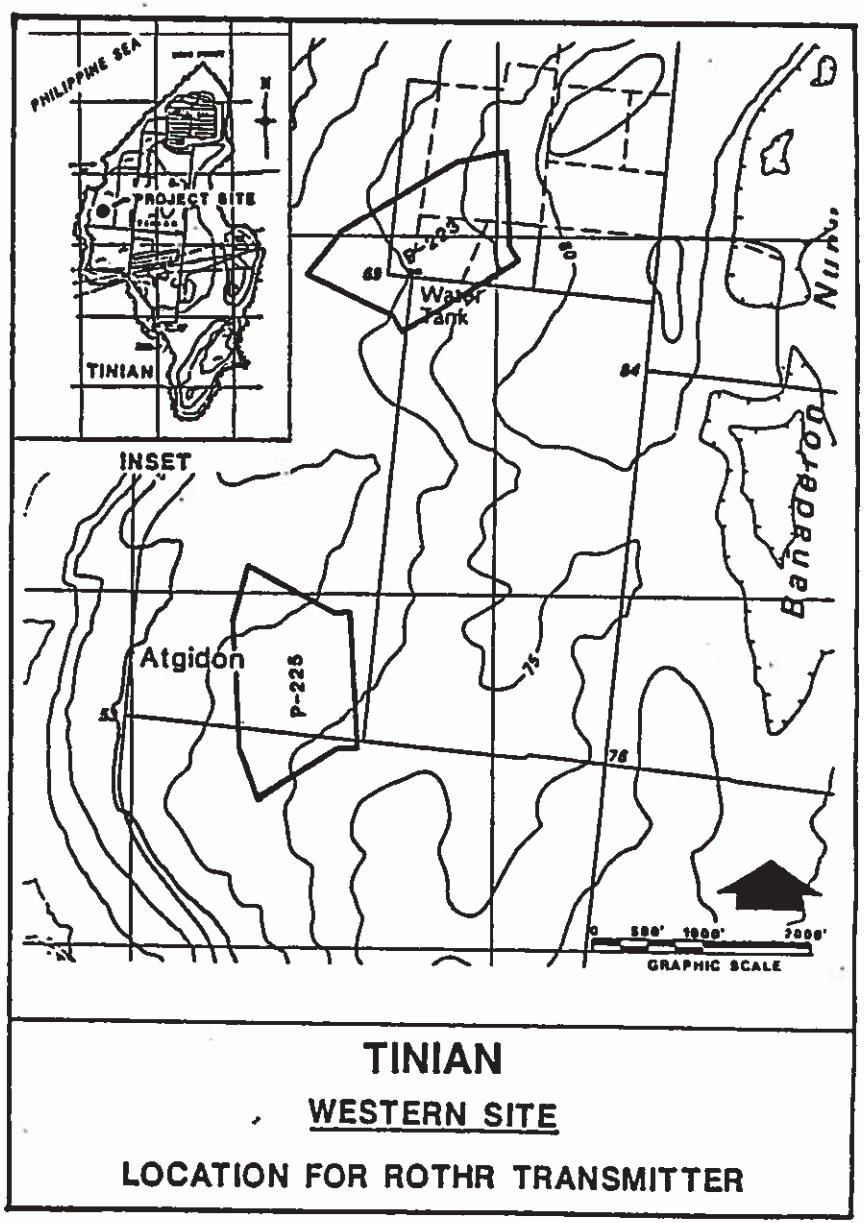


TINIAN

EASTERN SITE

LOCATION FOR ROTHR TRANSMITTER

SKETCH 4

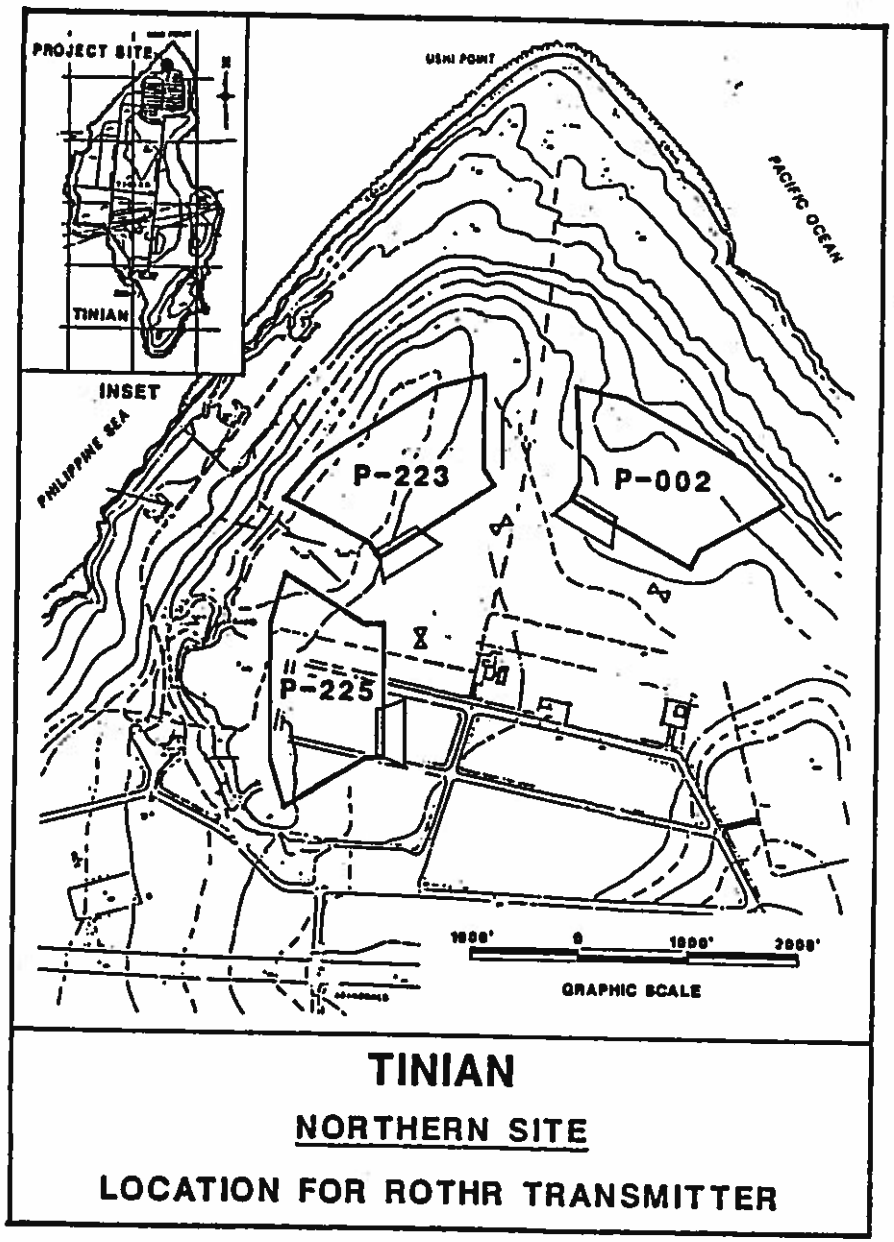


TINIAN

WESTERN SITE

LOCATION FOR ROTHR TRANSMITTER

SKETCH 5

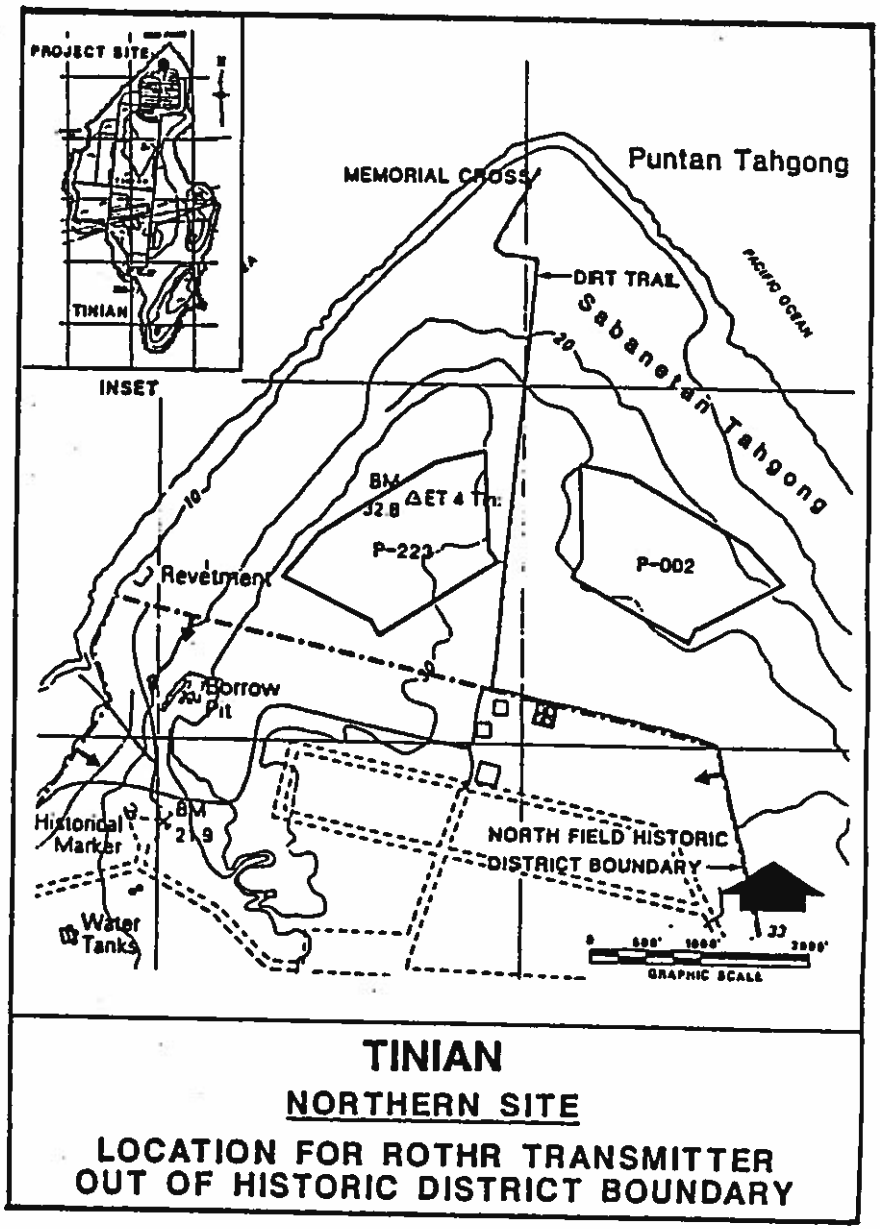


TINIAN

NORTHERN SITE

LOCATION FOR ROTHR TRANSMITTER

SKETCH 2

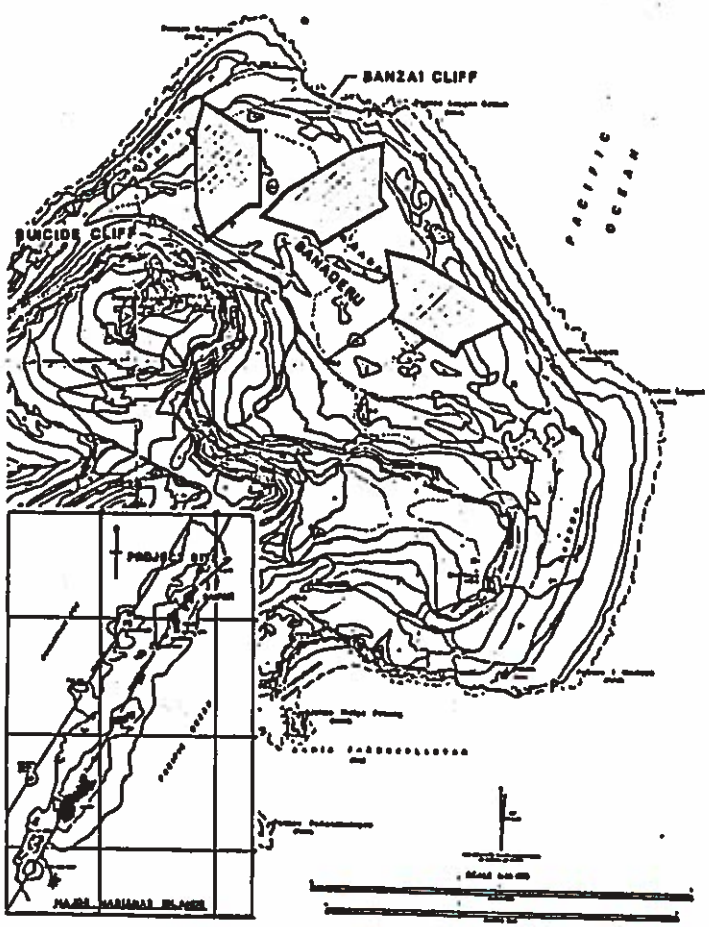


TINIAN

NORTHERN SITE

LOCATION FOR ROTHR TRANSMITTER OUT OF HISTORIC DISTRICT BOUNDARY

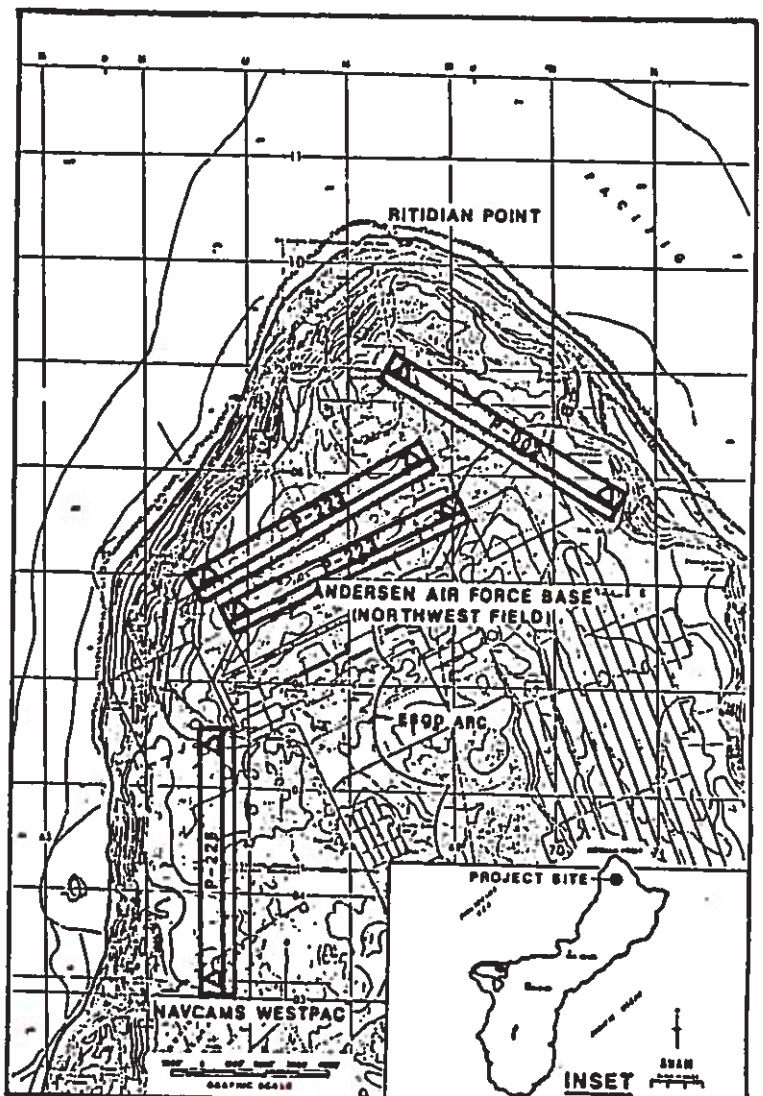
SKETCH 3



SAIPAN

LOCATION FOR ROTHR TRANSMITTER

SKETCH 6

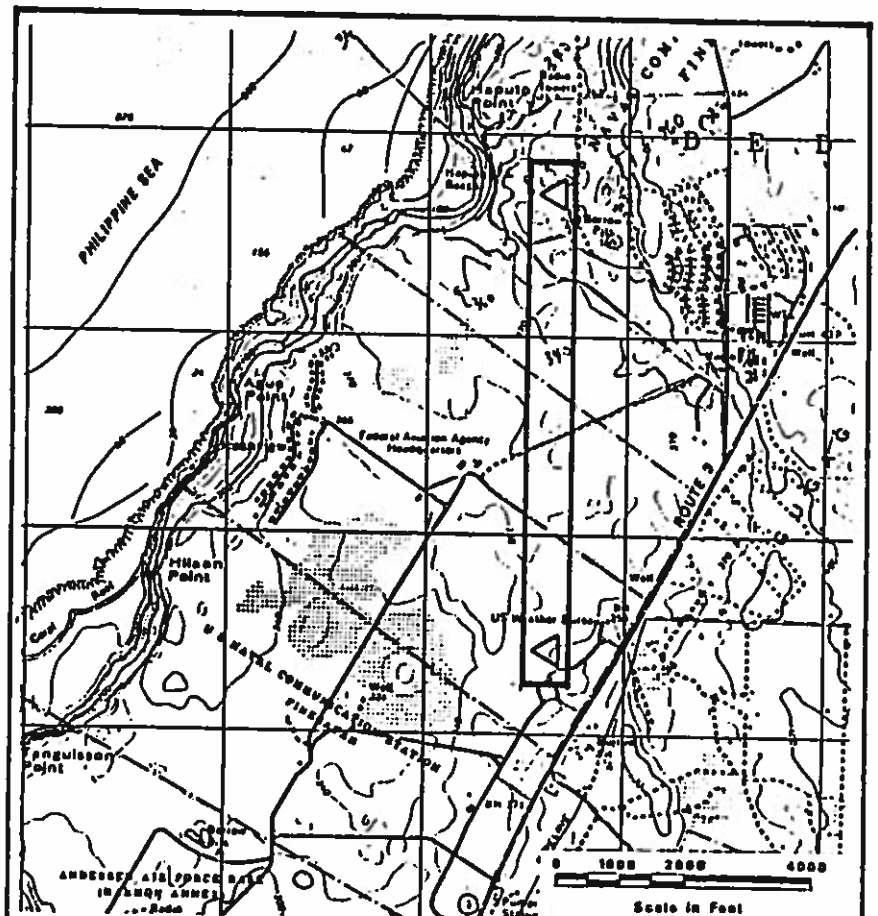


GUAM

NORTHWEST FIELD

LOCATION FOR ROTHR RECEIVER

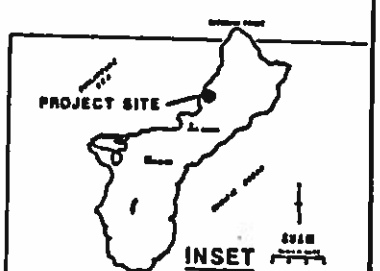
SKETCH 7



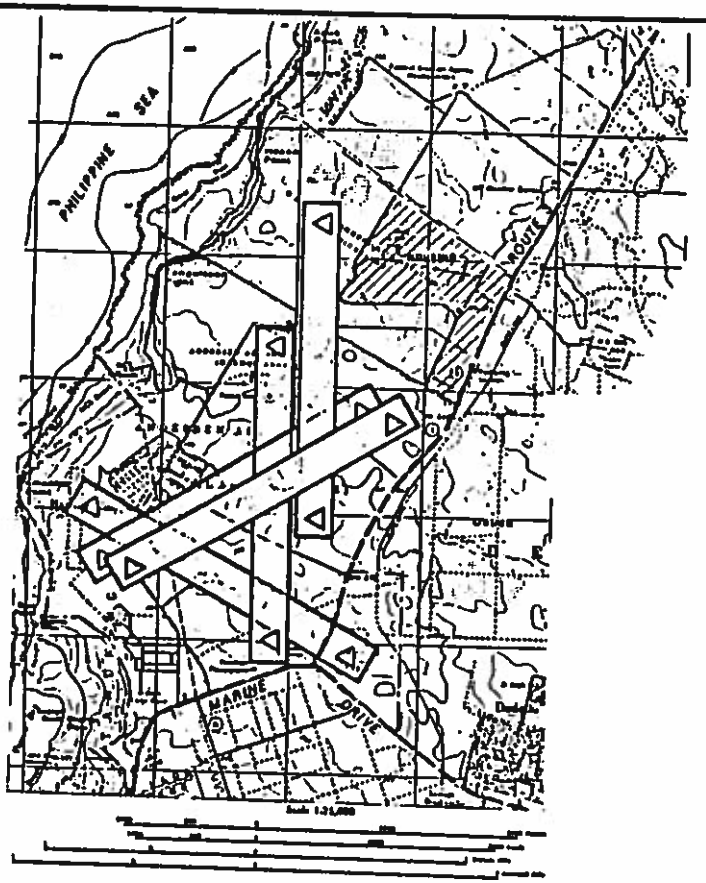
GUAM

SOUTH FINEGAYAN

LOCATION FOR ROTHR RECEIVER



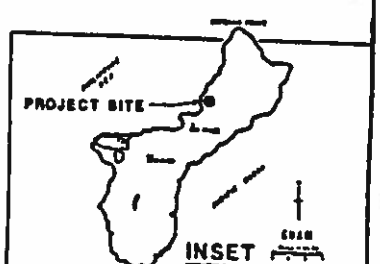
SKETCH 8



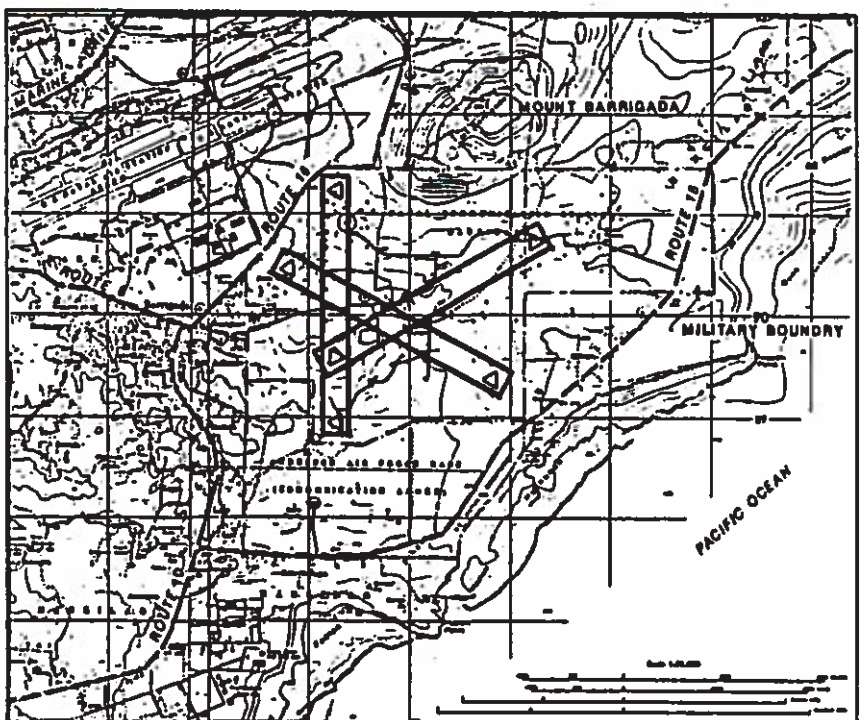
GUAM

HARMON ANNEX

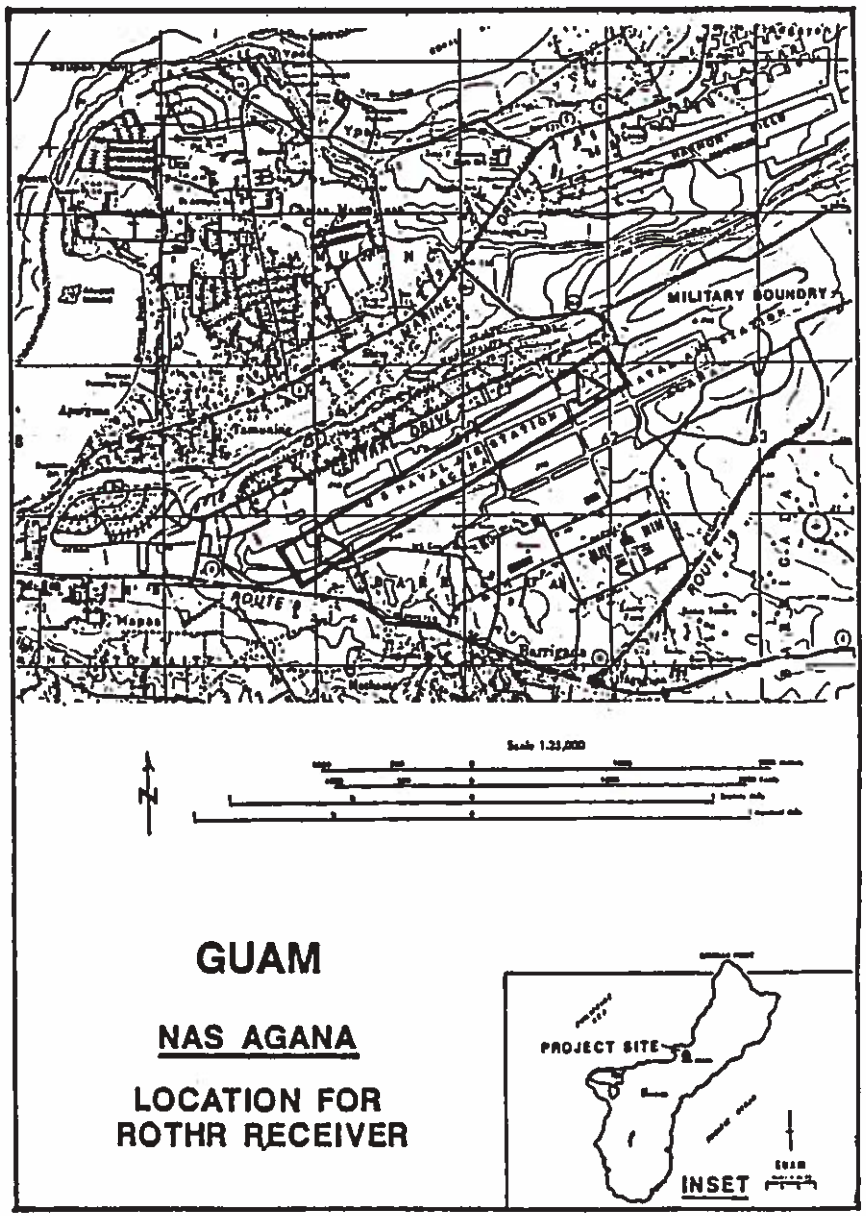
LOCATION FOR ROTHR RECEIVER



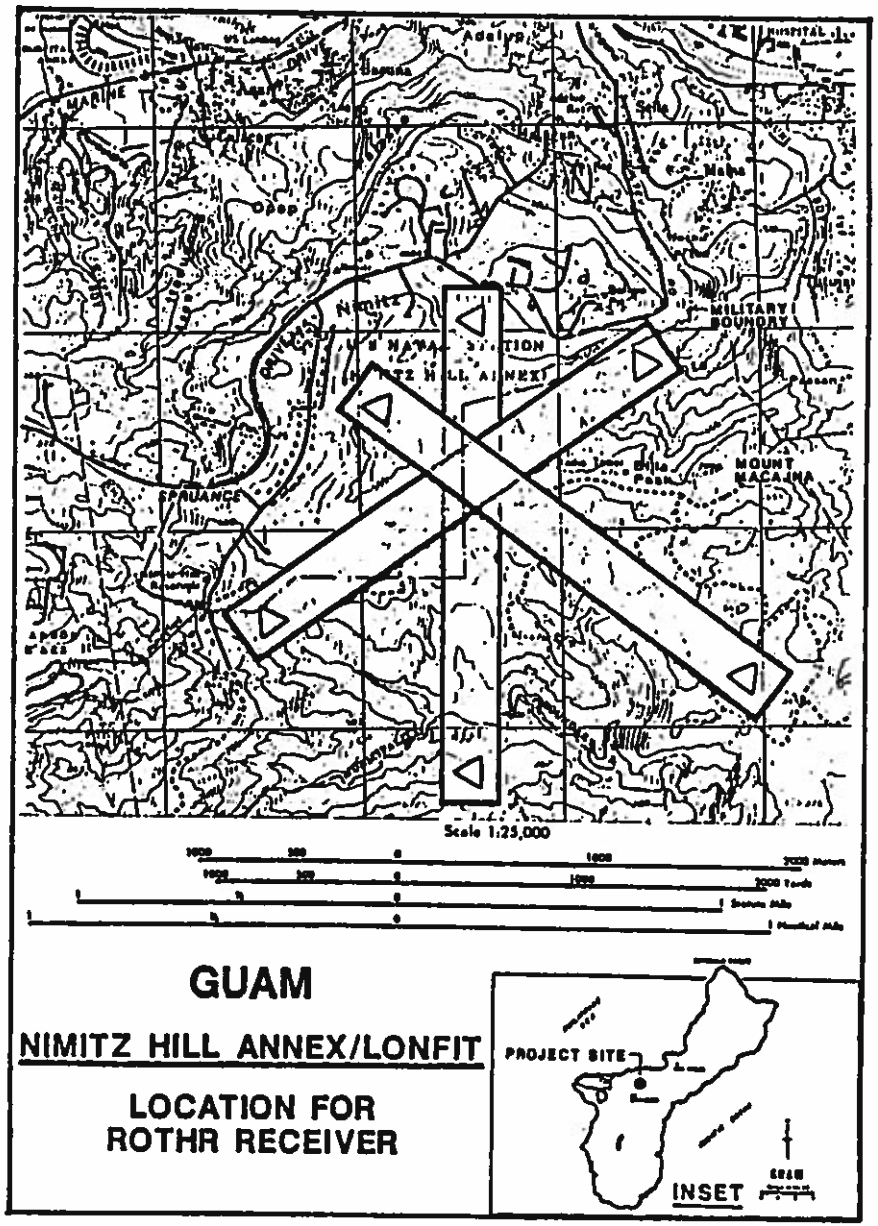
SKETCH 9



SKETCH 10



SKETCH 11

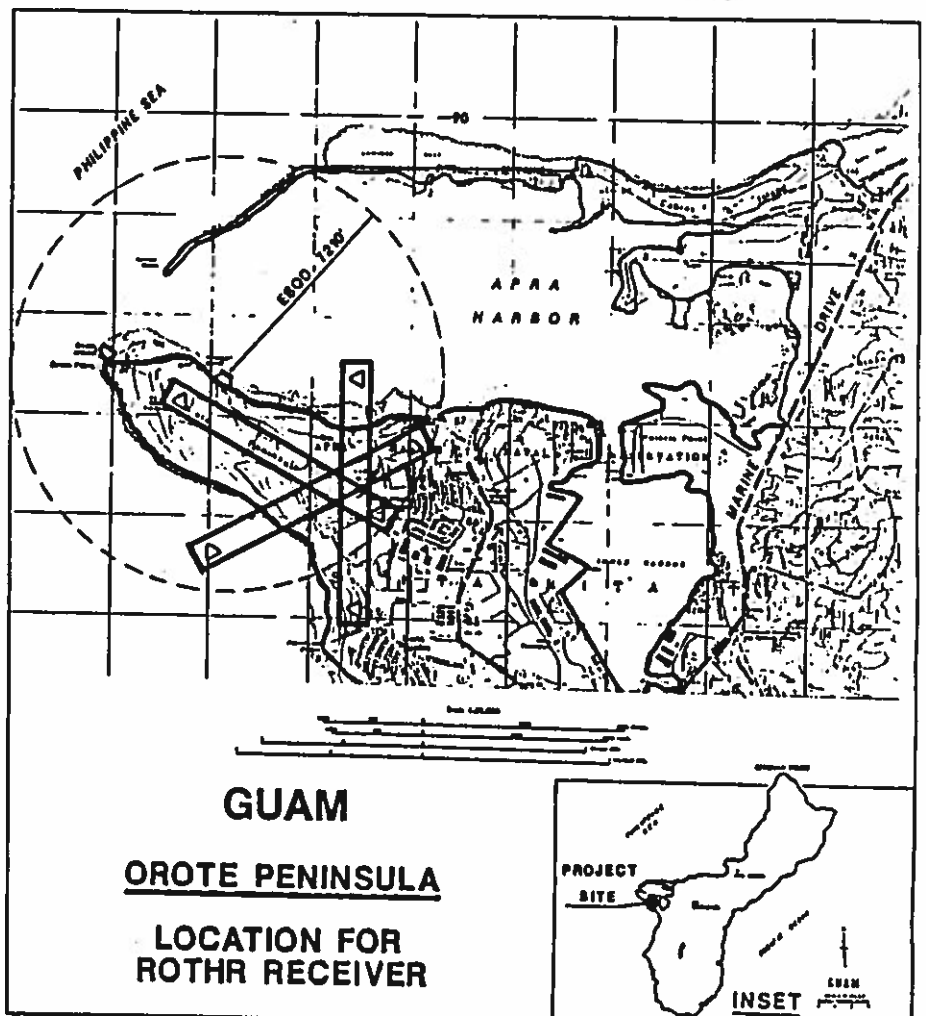


GUAM

NIMITZ HILL ANNEX/LONFIT

LOCATION FOR ROTHR RECEIVER

SKETCH 12

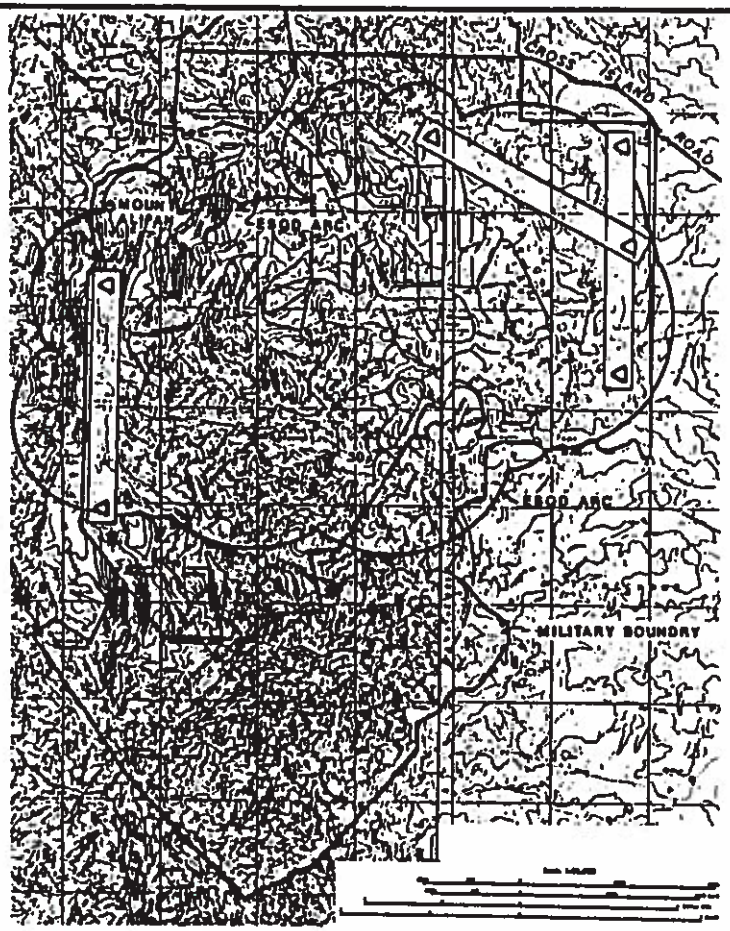


GUAM

OROTE PENINSULA

LOCATION FOR ROTHR RECEIVER

SKETCH 13

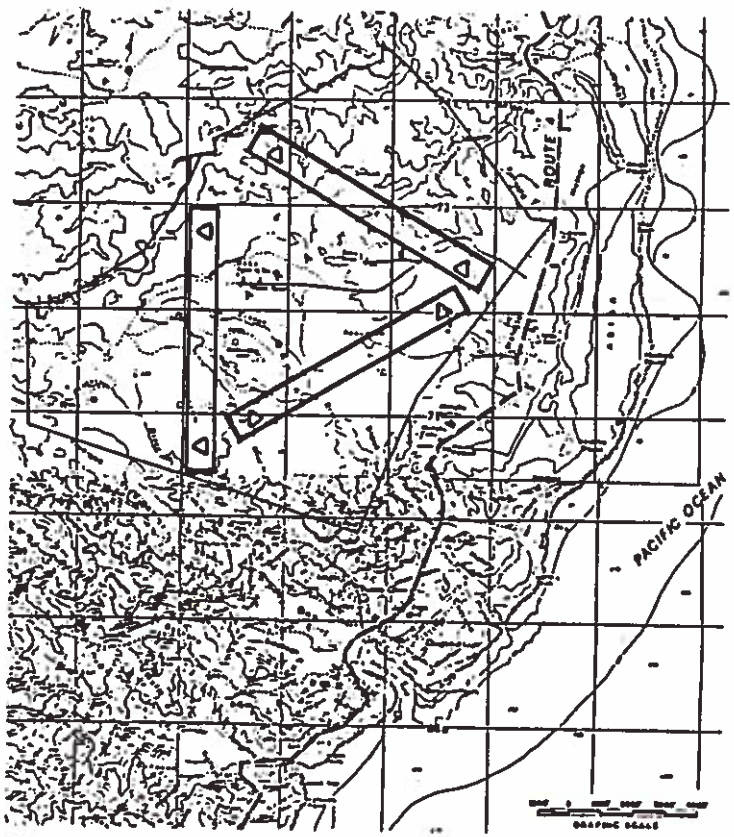


GUAM

NAVAL MAGAZINE

LOCATION FOR ROTHR RECEIVER

SKETCH 14

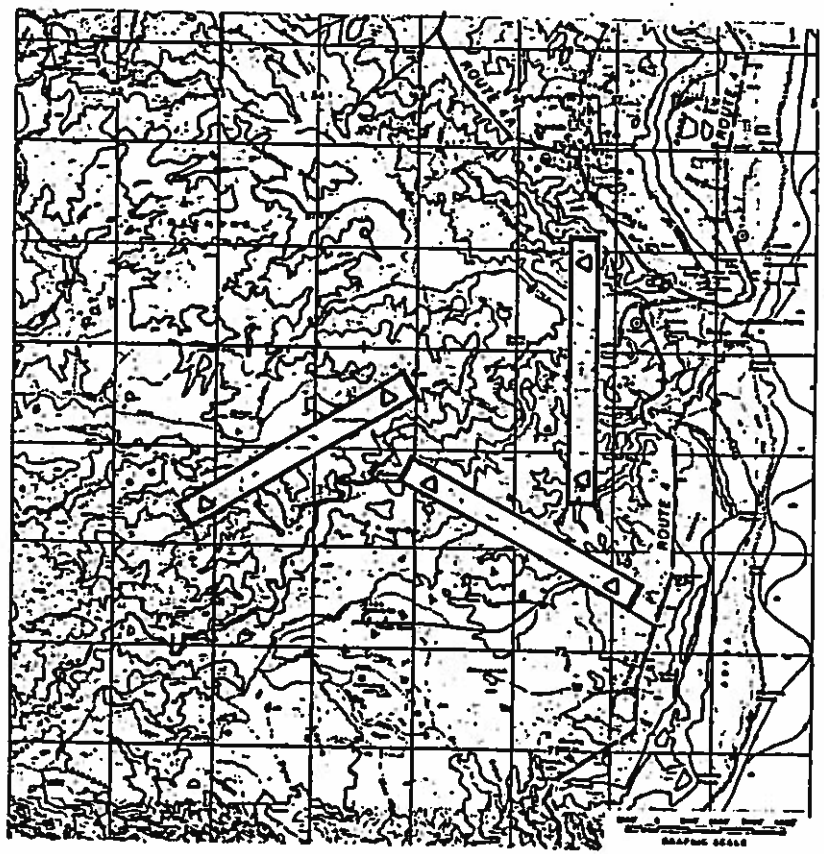


GUAM

DANDAN

LOCATION FOR ROTHR RECEIVER

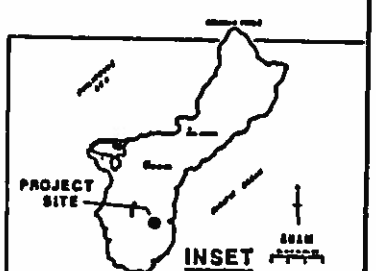
SKETCH 15



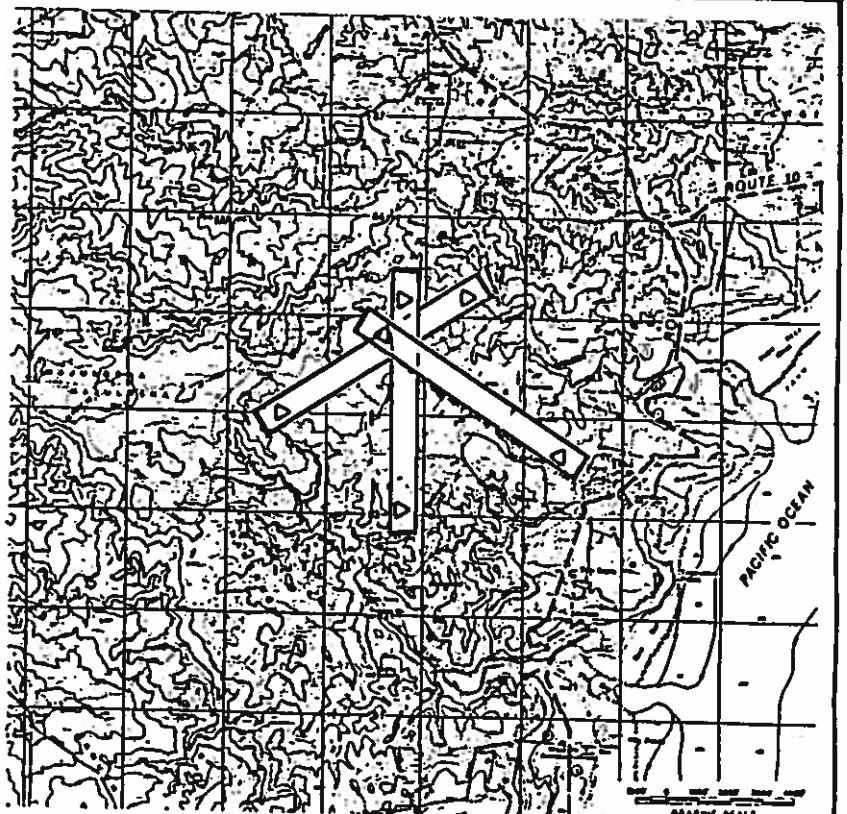
GUAM

BUBULAO

LOCATION FOR ROTHR RECEIVER



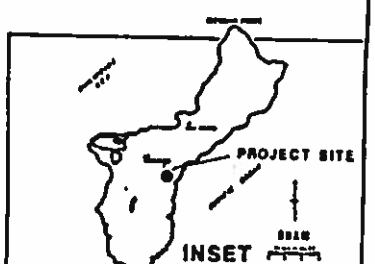
SKETCH 16



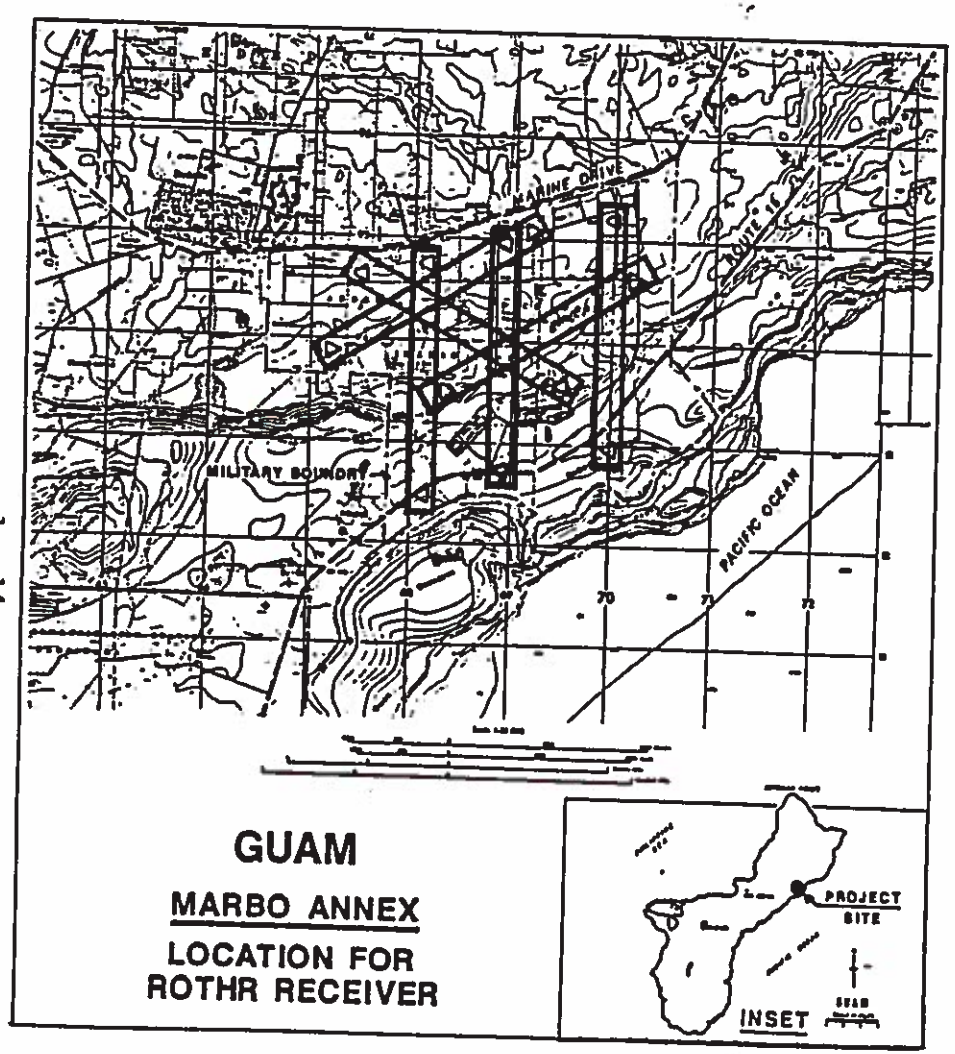
GUAM

PULANTAT

LOCATION FOR ROTHR RECEIVER



SKETCH 17



SKETCH 16

TABLE 131

COMMUNICATIONS DISTANCE SEPARATIONS

Minimum isolation distances for communications sites have been established by NAVELEXSYSCOM as follows:

HIGH, MEDIUM AND LOW FREQUENCY RECEIVER SITE FROM:

HIGH POWER, VERY LOW FREQUENCY (VLF) TRANSMITTER STATIONS	25 MILES
HIGH POWER, LOW FREQUENCY (LF) AND HIGH FREQUENCY (HF) TRANSMITTER STATIONS	15 MILES
TRANSMITTER STATIONS NOT UNDER NAVY CONTROL (FIELD INTENSITIES ALSO GOVERN-SEE NAVELEX 0101,103)	5 MILES
RUNWAYS AND GLIDE PATHS	
AERONAUTICAL RECEIVERS	1,500 FEET
GENERAL COMMUNICATIONS RECEIVERS	5 MILES
TELETYPE AND OTHER ELECTROMECHANICAL SYSTEMS	
LOW LEVEL OPERATIONS	80 MINIMUM
HIGH LEVEL OPERATIONS IN SHIELDED ROOM	80 MINIMUM
HIGH LEVEL OPERATIONS IN UNSHIELDED ROOM-LARGE INSTALLATION (COMMUNICATIONS CENTER)	2 MILES FROM NEAREST ANTENNA
-SMALL INSTALLATION (1 TO 6 INSTRUMENTS)	200 FEET FROM NEAREST ANTENNA
MAIN HIGHWAYS FROM NEAREST ANTENNA (MAXIMUM HOURLY TRAFFIC COUNT OVER 1200)	3,000 FEET
OVERHEAD HIGH TENSION POWER LINES AND RECEIVING STATION FEEDERS-(LESS THAN 100KV)	1,000 FEET FROM NEAREST ANTENNA
-(OVER 100KV)	2 MILES FROM NEAREST ANTENNA
HABITABLE AREAS (BEYOND LIMITS OF RESTRICTION)	1 MILE
AREAS CAPABLE OF INDUSTRIALIZATION (BEYOND LIMITS OF RESTRICTION)	
LIGHT INDUSTRY	3 MILES
HEAVY INDUSTRY	5 MILES
RADAR INSTALLATIONS	SEE NAVELEX 0100,103 TABLE 6-1
PRIMARY POWER PLANTS	5 MILES

HIGH, MEDIUM AND LOW FREQUENCY TRANSMITTER SITE FROM:

TRANSMITTER STATIONS NOT UNDER NAVY CONTROL	3 MILES
RUNWAYS AND GLIDE PATHS FOR AERONAUTICAL TRANSMITTING AT AIR STATIONS	1,500 FEET
MAIN HIGHWAYS	3,000 FEET
HABITABLE AREAS (FROM NEAREST ANTENNA)	
HF TRANSMITTER	0.5 MILE
LF/HF TRANSMITTER	1 MILE
OVERHEAD HIGH TENSION POWER LINES (FROM TRANSMITTER STATION FEEDERS)	1,000 FEET

REMOTE VHF/UHF TRANSMITTER BUILDING FROM:

OPERATIONS BUILDING AND CONTROL TOWER	1,000 FEET
VHF/UHF RECEIVER BUILDING AND HOUSING AREA	1,500 FEET

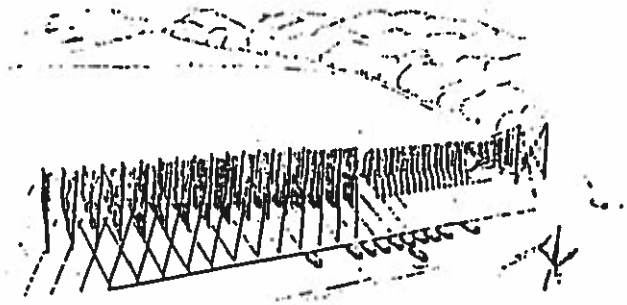
REMOTE VHF/UHF RECEIVER SITE FROM:

VHF/UHF TRANSMITTER SITE	1,500 FEET
HIGHWAYS, INDUSTRIAL AND HOUSING AREAS	1,000 FEET
RADAR INSTALLATIONS	1,500 FEET

WULLENWEBER ANTENNA FACILITY

NO OBSTRUCTION SHOULD PROTRUDE ABOVE A THREE DEGREE ANGLE OF ELEVATION MEASURED FROM THE BASE OF THE HIGH BAND ANTENNA ELEMENTS.

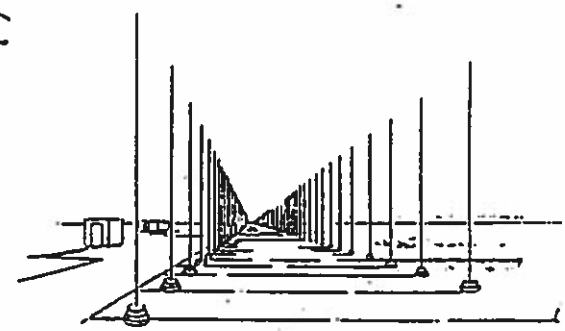
SEPARATION DISTANCES FROM POSSIBLE SOURCES OF INTERFERENCE ARE SIMILAR AS FOR OTHER HIGH, MEDIUM, AND LOW FREQUENCY RADIO RECEIVER SITES. FOR SPECIFIC GUIDANCE, SEE NAVELEX SHORE CRITERIA SECURITY GROUP STATIONS 0101,100.



ATTACHMENT 7

ROTHR ANTENNA SITE CRITERIA

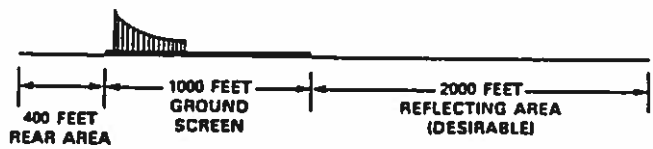




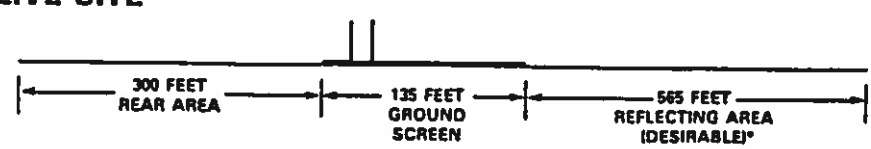
RU-0385-A258

GROUND SCREEN AND ADJACENT AREAS

a. TRANSMIT SITE



b. RECEIVE SITE

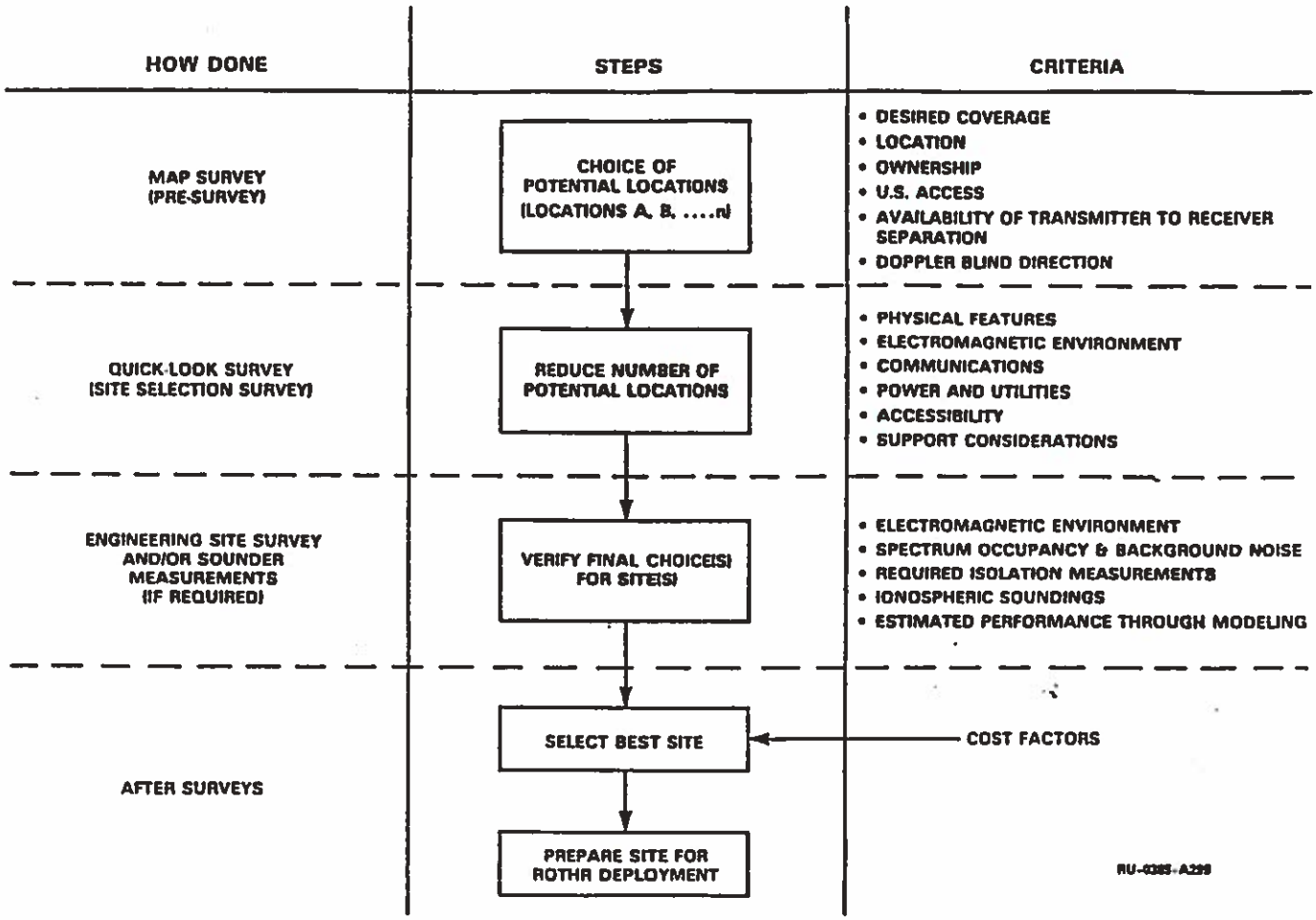


* NOTE: WHERE PARAMETER CANNOT BE MET, ADDITIONAL ANALYSIS WILL BE REQUIRED

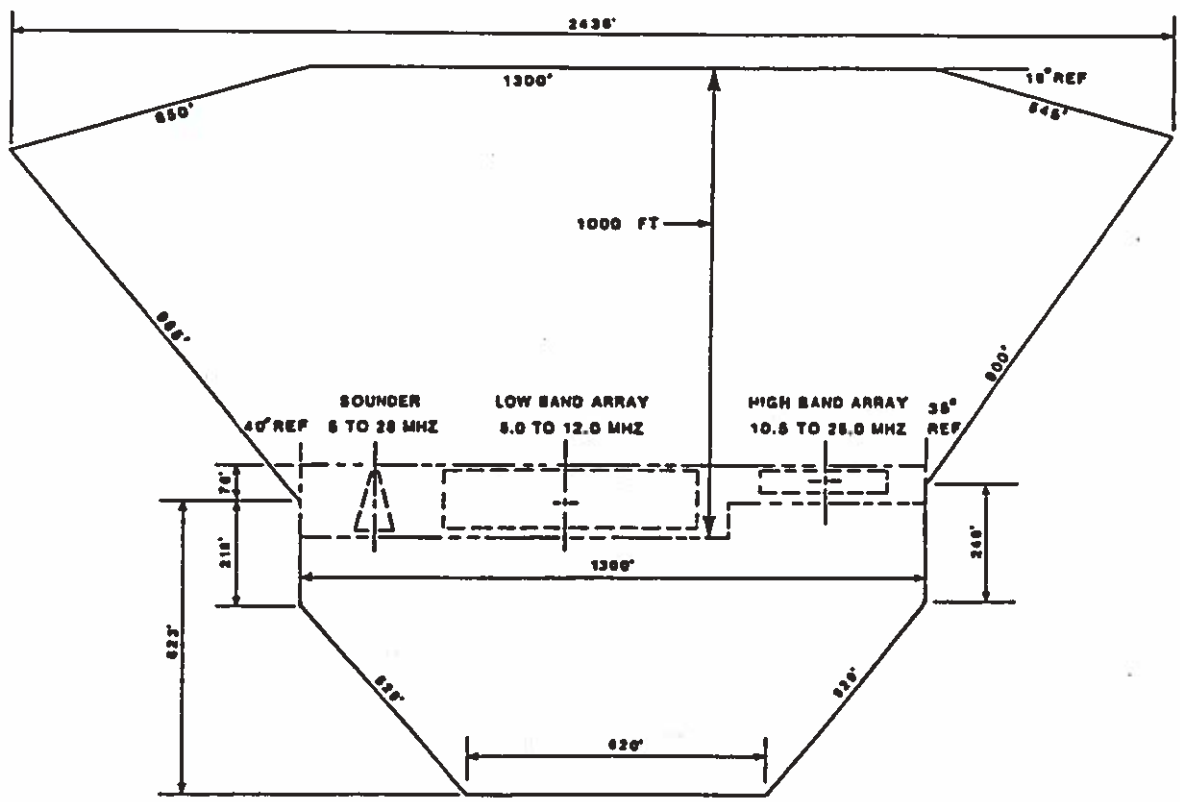
FIGURE 1

RU-0385-A247

DECISION FLOW FOR SITE SELECTION



ROTHR TRANSMIT SITE DIMENSIONS



ANTENNA SITE CRITERIA

TRANSMIT SITE

A. SIDE TILT OF GROUND PLANE:
5 DEGREES MAXIMUM

B. MAXIMUM DEFLECTION OF POLES FROM STRAIGHT LINE:
±1 INCH (FRONT POLE POSITIONING)

C. GROUND SCREEN ROUGHNESS, AREA COVERED BY GROUND SCREEN
±6 INCHES

D. TERRAIN ROUGHNESS AREAS, BEYOND GROUND SCREEN
2000 FEET BEYOND GROUND SCREEN, FORWARD; SEE FIGURES 1a & 5
400 FEET BEYOND GROUND SCREEN, BEHIND; SEE FIGURES 1a & 7

E. FORWARD CLEARANCE BEYOND REFLECTING AREA:
CLOSE-IN OBSTACLES: SEE FIGURE 2a
FAR-OUT OBSTACLES: SEE FIGURE 3a

F. REAR CLEARANCE REQUIRED:
REQUIREMENTS ARE SITE-SPECIFIC AND ARE TO BE DETERMINED FOR EACH SITE

G. FRONT-TO-BACK TILT:
MAXIMUM FORWARD TILT: SEE FIGURE 4
NO BACKWARD TILT

RU-0388-A245

ANTENNA SITE CRITERIA

RECEIVE SITE

A. SIDE TILT OF GROUND PLANE:
5 DEGREES MAXIMUM

B. MAXIMUM DEFLECTION OF POLE FROM STRAIGHT LINE:
±1 INCH (POLE POSITIONING)

C. GROUND SCREEN ROUGHNESS, AREA COVERED BY GROUND SCREEN
±1 INCH WITHIN 20 FEET OF ANTENNA ELEMENTS
±6 INCHES ELSEWHERE OVER THE GROUND SCREEN

D. TERRAIN ROUGHNESS, AREAS BEYOND GROUND SCREEN
565 FEET BEYOND GROUND SCREEN, FORWARD; SEE FIGURES 1b & 6
300 FEET BEYOND GROUND SCREEN, BEHIND; SEE FIGURES 1b & 8

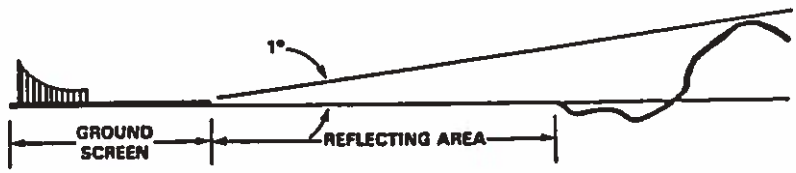
E. FORWARD CLEARANCE BEYOND REFLECTING AREA:
CLOSE-IN OBSTACLES: SEE FIGURE 2b
FAR-OUT OBSTACLES: SEE FIGURE 3b

F. REAR CLEARANCE REQUIRED:
REQUIREMENTS ARE SITE-SPECIFIC AND ARE TO BE DETERMINED FOR EACH SITE

G. FRONT-TO-BACK TILT:
MAXIMUM FORWARD TILT: SEE FIGURE 4
NO BACKWARD TILT

FORWARD CLEARANCE REQUIRED
(CLOSE-IN OBSTACLES)

a. TRANSMIT SITE



b. RECEIVE SITE

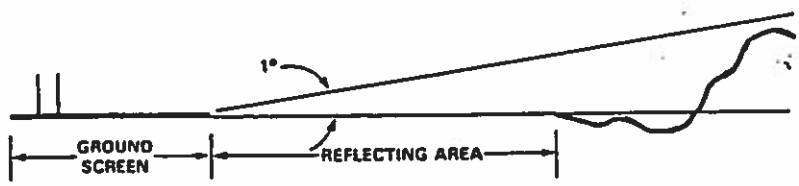
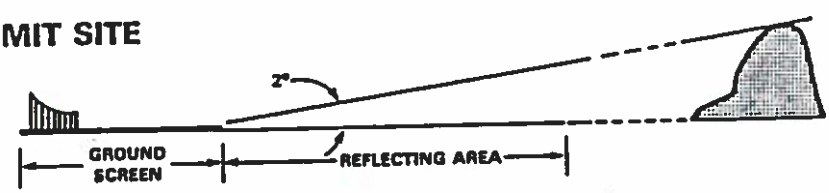


FIGURE 2

RU-6385-A348

FORWARD CLEARANCE REQUIRED
(FAR-OUT OBSTACLES)

a. TRANSMIT SITE



b. RECEIVE SITE

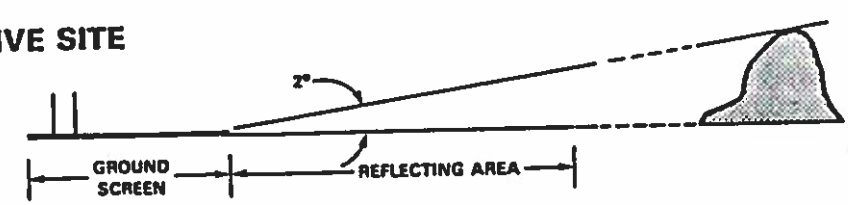
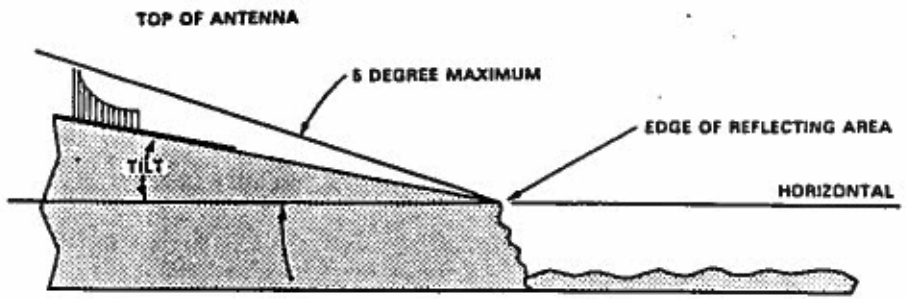


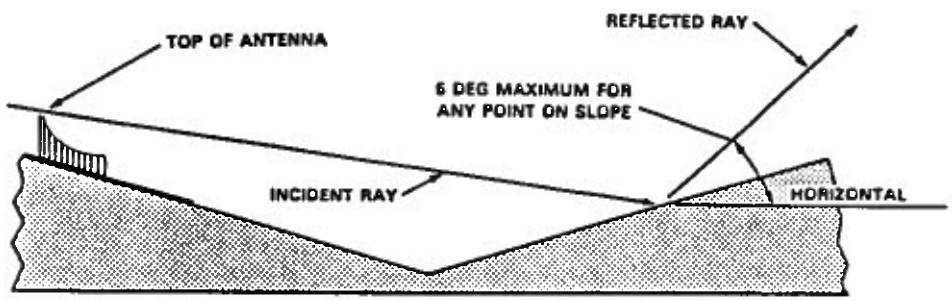
FIGURE 3

RU-6385-A348



TO AVOID DIRECT RAY MULTIPATH PATTERN DEGRADATION BELOW 5 DEGREES FOR SITES NEAR THE OCEAN, THE GROUND TILT AND ANTENNA GEOMETRY MUST BE AS INDICATED IN THE FIGURE ABOVE.

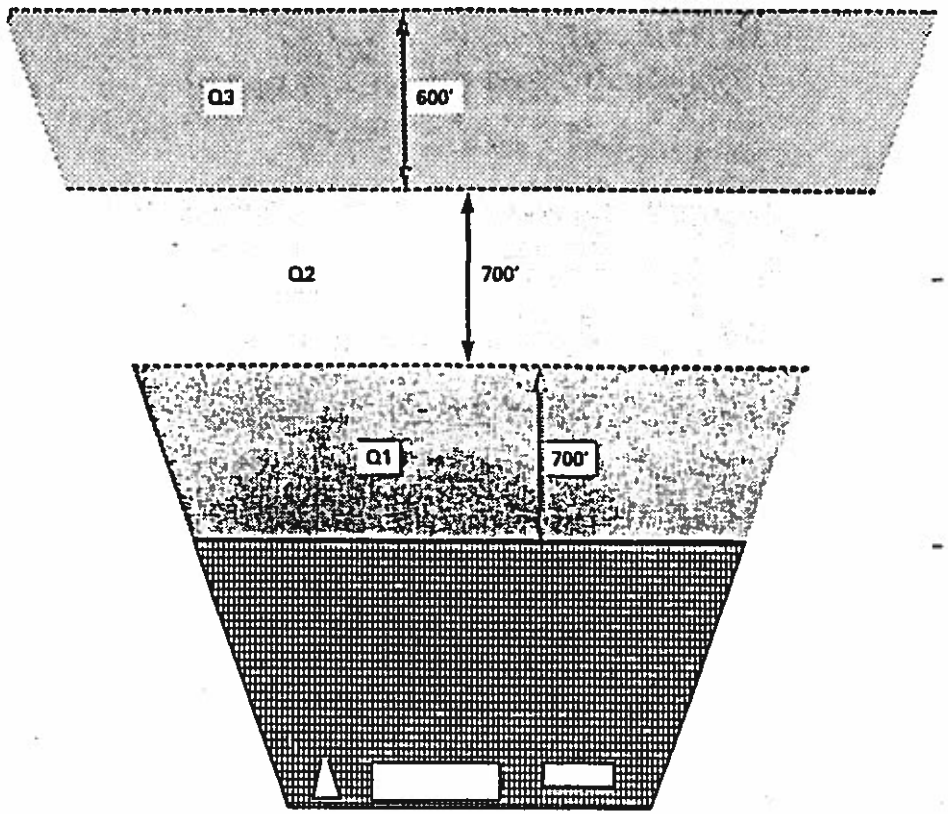
FIGURE 4a



TO AVOID DIRECT RAY MULTIPATH PATTERN DEGRADATION BELOW 5 DEGREES FOR SITES NEAR UPWARD-TILTED GROUND, THE SITE GEOMETRY MUST BE AS INDICATED IN THE FIGURE ABOVE.

FIGURE 4b

RU-0385-A250



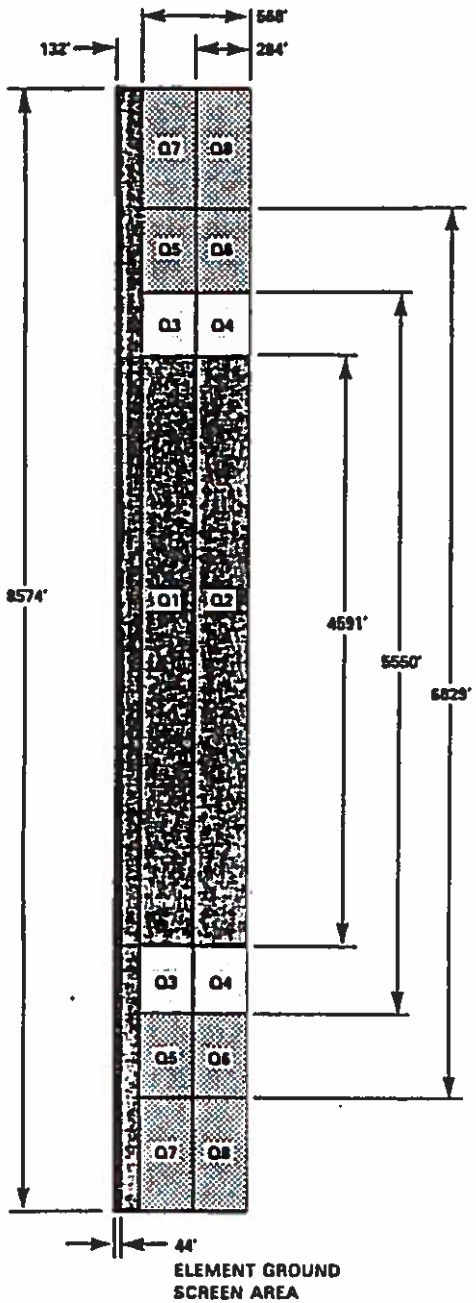
Q1: EARTH FLAT TO WITHIN ±15 INCHES
Q2: EARTH FLAT TO WITHIN ±20 INCHES
Q3: EARTH FLAT TO WITHIN ±30 INCHES

TRANSMIT SITE

SURFACE CONDITIONS FOR REFLECTING AREA FORWARD OF GROUND SCREEN

FIGURE 5

RU-0385-A251



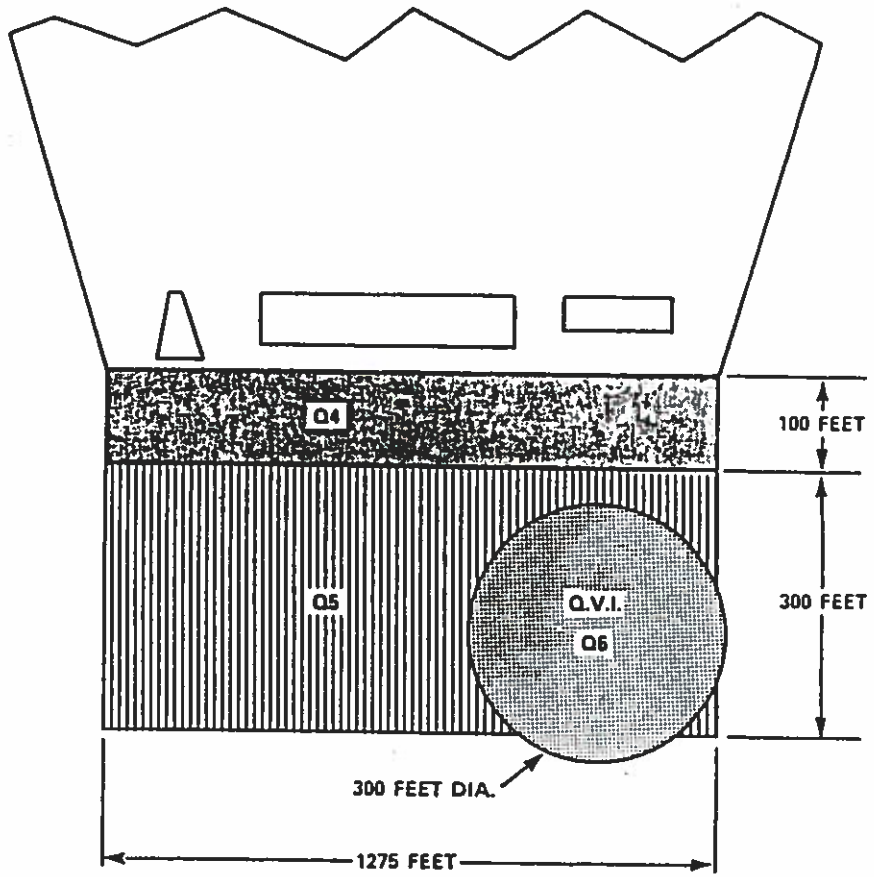
ZONE	GROUND CONDITIONS
Q1	SMOOTH WITHIN ±24 INCHES
Q2	SMOOTH WITHIN ±48 INCHES
Q3	SMOOTH WITHIN ±30 INCHES
Q4	SMOOTH WITHIN ±54 INCHES
Q5	SMOOTH WITHIN ±36 INCHES
Q6	SMOOTH WITHIN ±66 INCHES
Q7	SMOOTH WITHIN ±42 INCHES
Q8	SMOOTH WITHIN ±84 INCHES

RECEIVE SITE

SURFACE CONDITIONS FOR REFLECTING AREA FORWARD OF GROUND SCREEN

FIGURE 6

RU-0385-A252



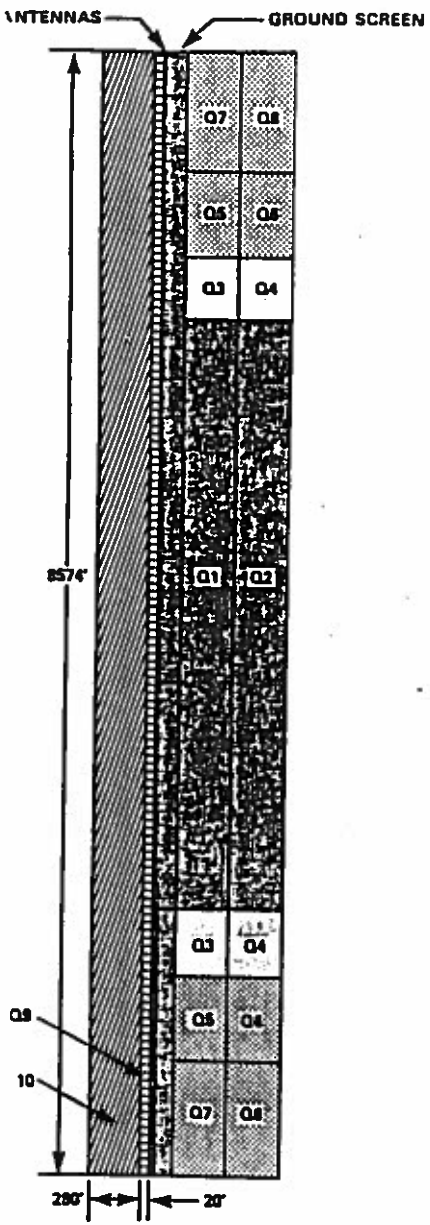
Q4: EARTH FLAT TO WITHIN ±12 INCHES
Q5: EARTH FLAT TO WITHIN ±48 INCHES
Q6: EARTH FLAT TO WITHIN ± 6 INCHES

TRANSMIT SITE

SURFACE CONDITIONS FOR AREA BEHIND GROUND SCREEN

FIGURE 7

RU 0385 A253



ZONE	GROUND CONDITIONS
Q9	SMOOTH WITHIN ±12 INCHES
Q10	SMOOTH WITHIN ±48 INCHES

RECEIVE SITE

SURFACE CONDITIONS FOR AREA BEHIND GROUND SCREEN

FIGURE 8

RU-6386-A254

APPENDIX K

Biological Opinion
(Project P-223)

United States Department of the Interior
FISH AND WILDLIFE SERVICE
PACIFIC ISLANDS OFFICE
P O BOX 50167
HONOLULU, HAWAII 96850

10 DEC 1987

Mr. J. L. Busekrus
Head, Facilities Planning Department
Pacific Division, Naval Facilities
Engineering Command
Pearl Harbor, Hawaii 96860-7300

Reference: 11015.4GI
Ser 24B:TS/5758

Subject: Interagency Endangered Species Consultation 1-2-88-F-51R
Construction and Operation of Relocatable Over-The-Horizon Radar on Tinian, Commonwealth of the Northern Mariana Islands and Guam; Navy Designation P-223.

Dear Mr. Busekrus:

This further responds to Mr. Hironaka's December 9, 1987 request for reinitiation of formal consultation 1-2-87-F-051 as directed by Section 7 (Interagency Cooperation) of the Endangered Species Act (Act). Unless future new information requires the reinitiation of consultation, this letter constitutes our final biological opinion on the project.

Under consideration are the possible impacts of the Navy's proposed Relocatable Over-The-Horizon Radar (ROTHR) Project P-223 (P-223) on endangered and threatened species. The project has two major components: (1) construction and operation of a radar transmitter on the island of Tinian, Commonwealth of the Northern Mariana Islands (Commonwealth), and (2) construction and operation of a radar receiver antenna field located on Guam. This pair of facilities will function as a unit. They will survey, by radar, a specific 60-degree arc of air and surface space, monitoring the movement of airborne and surface craft within that area. Information gathered on such movements will be coordinated with other radar and observation reports to give a clearer picture of the types of craft or vessels, their trajectory, speed, and other data.

This opinion addresses possible impacts of P-223 on five listed species:

On Tinian:

Mariana common moorhen (Gallinula chloropus guami - endangered
Tinian monarch (Monarcha takatsukasae) - threatened

On Guam:

Guam Micronesian kingfisher (Halcyon cinnamomina cinnamomina) - endangered
Mariana crow (Corvus kubaryi) - endangered
Mariana fruit bat (Pteropus mariannus mariannus) - endangered

No critical habitat has been designated or proposed to be designated on either island. An administrative record of this consultation and related documents are maintained in this office.

Biological Opinion

It is our biological opinion that the construction and operation of P-223 at the transmitter site on Tinian identified in Figure 3.2 of the Draft Environmental Impact Statement for Electronic Installations in the Western Pacific of July 1989 (Draft Statement) as the "Northern Site" and the construction and operation of P-223 at the receiver site on Guam identified in Figure 3.6 of the Draft Statement as the "Runway Site" will not be likely to jeopardize the continued existence of any listed species. This includes the Mariana crow, Mariana fruit bat, Guam Micronesian kingfisher, Mariana common moorhen, and Monarch flycatcher.

Background Information and Scope of This Consultation

-The Navy initiated consultation on project P-223 on June 23, 1987. That consultation was completed and our September 15, 1987 biological opinion (1-2-87-F-051) concluded that the P-223 project would not be likely to jeopardize the continued existence of any listed species.

Letters from both the Acting Director, Guam Department of Agriculture (October 28, 1987) and the Chief of the Commonwealth's Division of Fish and Wildlife (Commonwealth Division) (November 30, 1987) provided comments on our biological opinion. They recommended our reconsideration of our conclusions based on a reanalysis of the data considered in that opinion coupled with newer biological information. Additionally, one of the conservation recommendations provided in our September 15, 1988 biological opinion was for the Navy, in cooperation with the Guam Division of Aquatic and Wildlife Resources (Guam Division) and this Service, to attempt to capture any Micronesian kingfishers which may be in the proposed project site for use in an existing captive propagation program. The Navy was unable to accomplish this recommendation; the Guam Division was unable to provide support for the field work involved, and, more importantly, more recent surveys for the kingfisher had failed to find any in the project area.

-On December 9, 1987 the Navy reinitiated consultation to address (1) new information pertinent to the impact of the project on listed species, and (2) the possible impact of the Navy's not being able to carry out one of the conservation recommendations provided in our September 15, 1987 letter.

-Our February 25, 1988 letter to you concurred with your February 23, 1988 request that the conclusion of formal consultation be postponed pending the completion of, at that time, future, biological surveys of the project areas.

Subsequently, the Navy conducted additional biological surveys on Guam. It was hoped that the surveys would provide more up-to-date information for assessing (1) the use of the proposed project area on Guam by kingfishers, crows, and bats, and (2) the abundance of brown tree snakes in that area, and how their abundance there relative to other nearby locations may or may not make the project area especially suited for the survival and recovery of the listed species. Ornithological and herpetological surveys were completed, and results of each were sent to us on May 23, 1988 and June 1, 1988 respectively.

-As the Navy was proceeding toward the completion of an environmental impact statement which would further discuss the results of the biological surveys and, possibly, present new information regarding impacts to listed species, we proposed in our August 8, 1988 letter to you that the consultation be continued until completion of the draft impact statement. You concurred with this recommendation on September 7, 1988.

-We received a copy of your Draft Environmental Impact Statement For Electronic Installations On Tinian And Guam, 100% Submittal of October 1988 (100% Draft) on November 15, 1988. The 100% Draft included the Draft Supplemental Environmental Impact Statement (EIS) For Electronic Installations Western Mariana Islands Milcon Project P-223 (Draft Supplement).

In part due to changes in the alignment and positioning of the P-223 receiver field which would be expected to alter the impact of the project on listed species, the Navy decided to complete the Draft Statement and allow us to consider information in the document in our consultation. The Draft Statement was printed in July 1989, and we received a copy on July 14, 1989. Your letter of July 18, 1989 requested that we complete the consultation and provide you with our final biological opinion. Your letter was specific in requesting that we address the impacts of the northern site for the transmitter on Tinian and the runway site for the receiver on Guam only and not other possible alternative locations or alignments.

Description of the Proposed Action

A detailed description of the action is provided in the Draft Statement. The proposed project is to construct and operate Project P-223, which consists of one transmitter on the island of Tinian, Commonwealth of the Northern Mariana Islands (the Commonwealth) and one receiver and Operation Control Center (to be located near the receiver) on the island of Guam.

On Tinian:

Tinian is the second largest island in the Commonwealth, lying about 3 miles south-southwest of Saipan and about 100 miles northeast of Guam. It is approximately 12.5 miles long by 6 miles wide and has a total land area of about 25,000 acres. The transmitter would be located on the northern portion of the island within lands currently leased by the military. The site lies north of the North Field runways and is referred to as the Northern Site. A map of the area from pages 3-3 and 3-4 of the Draft Statement are enclosed (Enclosure 1).

The transmitter portion of the project will require the clearing, grading, and installation of facilities on 58 acres of Tinian. The transmitter will require the erection of 68 vertical towers and poles. As described on page 1 of the Draft Statement, the low band antenna portion of the transmitter will consist of 16 125-foot high towers and 16 45-foot high support poles sited 35 feet apart. The total length of the low band antenna array is 525 feet. The high band portion of the transmitter will consist of 16 71-foot high towers and 16 16.5-foot support poles spaced 17.5 feet apart. The total length of the high band antenna field is 262.5 feet. Each transmitter will consist of 16 transmitter units, each capable of transmitting with power of 5 to 20 kilowatts. The antenna array and ground screen will be fenced with a wire fence on four sides.

On Guam:

Guam is the southernmost and largest of the Mariana Islands. It is approximately 30 miles long and varies from approximately 4 to 12 miles wide. It has a land area of about 212 square miles (135,680 acres).

The receiver is proposed to be located on a portion of Northwest Field at Andersen Air Force Base, Guam (Enclosure 2, from pages 3-8 and 3-9 of the Draft Statement). Several possible locations of the rectangular receiver area are considered in the Draft Statement; you have asked us to consider only the location referred to as the "runway site" in our analysis of possible impacts to listed species in this consultation. (Note: Your selection of any of the other alternative sites may require reinitiation of consultation to address possible impacts to listed species of development on those properties.)

As described on page 2-8 of the Draft Statement, the receiver will consist of 372 pairs of aluminum pole antennas, each about 18 feet high and 6 inches in diameter. The antenna poles will be bolted to concrete anchor bases; guy wires will not be used. The total length of the antenna array will be 8,600 feet. The width of the field will be approximately 800 feet. Other facilities to be constructed or sited include 4 operational vans, 13 receiver equipment shelters, a van support building, an emergency generator building, and an above-ground fuel storage tank.

The receiver on Guam will require 172 acres of land for the installation. In areas of this site not already free of vegetation, clearing will be required.

The area of land required for P-223 has decreased since our September 15, 1987 biological opinion. At that time, the Navy estimated that P-223 would require 104 acres on Tinian and 500 acres on Guam. (The original estimate for Guam included 200 acres of clear-cut and leveled land plus approximately 300 additional acres of land which would be required to be trimmed to restrict vegetation height. Such trimming is no longer needed outside of the 172 acres now required.) The Runway Site on Guam was not considered as an alternative in our 1987 analysis. It overlies, in part, an existing airstrip. As little or no vegetation grows on the paved area, the area of vegetation required to be cleared for this site is further reduced. You have estimated that the area of vegetation now required to be cleared for the receiver (at the Runway Site) is approximately 110 acres, as opposed to the 500 acres originally proposed to be cleared.

The Draft Statement addresses the construction of three pairs of radar transmitters and receivers; these are referred to as P-223, P-225, and P-002. You have made it clear in the Draft Statement and other documents and correspondence (such as the Space Warfare Systems Command message to you of August 11, 1987 and your letters to us of August 25, 1987 and July 8, 1988) that, for the purposes of this consultation and other reasons, the projects are "stand-alone," independently operating systems. The Draft Statement states that co-location of the three systems is not an operational necessity, and that the construction of one or two of the pairs does not require the construction of all three to be of benefit to the overall Relocatable Over-the-Horizon Radar system. As such, we have agreed to consider the impact of P-223 as a separate project, and will not address possible impacts of P-225 or P-002 in this consultation.

However, the Navy will be required to initiate formal Section 7, Endangered Species Act, consultation in the future on P-225 and P-002 should it be determined that either project may affect listed species or designated critical habitat. Similarly, the Navy may be required to "confer" with the Service should either project be likely to jeopardize the continued existence of any species proposed for listing as endangered or threatened or should the project likely result in the destruction or adverse modification of any area proposed for critical habitat designation (50 CFR subsection 402.10). As a result of such future consultations and/or conferences, modifications to those projects may be required or suggested which may decrease the financial or operational efficiency of the overall Over-the-Horizon array. As you are aware, areas of Guam including portions of Andersen Air Force Base are currently under consideration for critical habitat designation. It is likely that a formal proposal will be published in the Federal Register to designate these lands as critical habitat for several of Guam's endangered forest birds and bats.

Members of this Service have visited both the Northwest Field, Guam site at Andersen Air Force Base and the northern Tinian site specifically for this consultation.

Effects of the Proposed Action on Listed Species

On Tinian:

There are four types of impacts which have been considered as possibly affecting listed birds on Tinian: 1) clearing 58 acres of land predominantly vegetated by tangentangen (Leucaena leucocephala); 2) radiation from the transmitter; 3) the accidental introduction of the brown tree snake from Guam; and 4) collisions with transmitter antennas or their supporting cables by listed birds.

1. Clearing 58 acres will have little effect on moorhens because they do not depend on that type of habitat for feeding, roosting, or other habits. They may fly over the proposed project area, but there are no reports of their having landed there. Moorhens congregate in wetland areas. The Hagoi wetland, the largest on Tinian, would not be affected by the project.

Although tangentangen forest provides the primary habitat for the Tinian monarch, the clearing will remove less than 1% of the tangentangen island-wide. While the loss of the 58 acres will adversely affect the monarch by decreasing the amount of available nesting and feeding habitat, it would not be sufficient to jeopardize their continued existence. Surveys conducted as part of project planning estimated a monarch density that would predict a population of about 24 birds in the 58 acres to be cleared. Surveys conducted by this Service in 1982 (Micronesian Forest Bird Survey, 1982: Saipan, Tinian, Agiguan, and Rota, 1986) estimated that there were 11,733 monarchs in approximately the northern third of the island, with an island- wide population estimated at 40,000. We have no evidence which would suggest that densities have decreased since 1982, although the overall population may have declined slightly due to some clearing of forests. The loss estimated due to the clearing of the project area constitutes only a small fraction of one percent of the island's population of 40,000. Should all of the birds

residing in the area to be cleared die as a result of the stress of displacement and should their nests, if any, be destroyed as a result of the clearing of 58 acres, the impact on the total population would be extremely small (a loss of probably less than 0.1% of the total population).

((Note: The Draft Statement presents a figure of 58 acres needed to be cleared on Tinian for the transmitter. In more recent discussions with members of your staff, a slightly larger area (perhaps an additional acre) may be required to allow for the planting of trees as recommended in the Incidental Take statement of this letter.)

2. A discussion of the possible impact of radiation on listed species is presented in the Draft Supplement and the Draft Statement. They conclude that the proposed transmitter's radiation will not have any adverse effect on birds. Our discussions with some of those familiar with the radiation and its possible impact on wildlife (Larry Adams, Naval Security Group Activity, Chesapeake, Virginia and Mr. Ching of your staff) lead us to the same conclusion. The wave length and intensity of transmission do not pose a threat to animals with a very small body weight, such as the Tinian monarch, or those with a slightly greater mass, such as the moorhen. Radiation would be hazardous to animals of larger mass (e.g., humans).

3. The threat of an introduction of brown tree snakes to Tinian was discussed in our previous opinion, and the devastating impact of such an introduction to the island's wildlife cannot be over-stressed. Native species, especially birds, which have evolved on islands free of predators have generally not evolved the survival adaptations needed to survive such introductions. The stark example provided by the extinction of much of Guam's native avifauna over a very short number of years by the predator, the ineffectiveness of our currently known measures to control the snake once it has become established, and the snake's ability to spread to other islands via exported cargo emphasize the potential for serious and damaging biological consequences. Almost any shipment from Guam has the potential to spread the snake; cargo flown or barged to Tinian as part of the P-223 project is no exception.

The Draft Statement has addressed this threat on pages 5-47 to 5-49 (Enclosure 3). The construction contractor(s) and the operations contractor of the transmitter project will be required to prepare a snake inspection protocol to prevent the accidental introduction of the snake to Tinian. This protocol will be modeled after a plan previously approved by the Commonwealth of the Northern Marianas Islands and will meet requirements which may be set by them. Such a plan will be modeled after the snake prevention protocol developed by Black Micro Construction Company. This protocol was followed during the construction of the Air Force's PACBAR III construction project on Saipan. The protocol is comprehensive and incorporates recommendations made by this Service. While it is impossible to guarantee that adherence to the Commonwealth's and the Black Micro Construction Company's snake control measures will prevent the accidental introduction and establishment of the secretive snake, we believe it will substantially decrease the chances for such occurrences.

4. The project calls for numerous towers, poles, and anchoring wires distributed over the 58-acre area; 16 antenna towers will be 125 feet tall. The density of towers, poles, and support structures poses a physical hazard to birds; they could fly into the structures and be injured or killed.

We would not expect monarchs to collide with either the antennas or their supporting cables; they are diurnal, keen sighted, and would be expected to be able to avoid the wires should they fly into the area.

The previously cited Micronesian Forest Bird Survey, 1982 surveyed the Hagoi area of Tinian for the Mariana common moorhen. The Hagoi wetland appears to be the only location on Tinian where moorhen congregate, and estimates of their numbers there at any one time have ranged from zero to 120. Moorhen are routinely observed on Lake Susupe, on Saipan, and their numbers there also fluctuate. The 1982 survey estimated their numbers at Susupe to be between 90 and 120. The bird is also found on Guam, where its population is estimated to be between 100 and 200 (Federal Register, August 27, 1984, page 33883), but it is not believed that the birds fly between Guam and the Commonwealth islands.

Susupe lies approximately seven miles northeast of Hagoi across open ocean. Although data demonstrating that the moorhens fly between Saipan and Tinian are not available, it is possible that such flights may occur. The number counted at Hagoi has been as low as zero and as high as over 100, and it has been speculated that the birds are on Saipan when not at Hagoi; (such survey data are confounded by the often secretive nature of the moorhen, often making them difficult to detect). Movement between the islands may be in reaction to differing water conditions (low or high water levels) at Susupe and Hagoi. There is no indication of any regular, short-term migration measured in periods of days, weeks, or even months. It is more likely that movements may be sporadic or seasonal, although this, too, is unconfirmed.

K-4

Although no moorhens were observed within or near the P-223 site during ornithological surveys for the project, the site lies near a straight line between Hagoi and Susupe. If the birds do fly between the two wetlands, their flight may cross through an area about 1/4 mile from the proposed transmitter site. This area is located approximately 1.5 miles north of Hagoi. Should such flights actually pass through the antenna field at low elevations in the dim light conditions of early morning, evening, or at night, moorhens may collide with the antennas or their guy-wires.

The following factors were considered during our analysis of the potential for collisions at the transmitter site jeopardizing the continued existence of the Mariana moorhen:

a. Should birds be flying from Hagoi to Susupe, their flight path would very likely be near the P-223 transmitter site. A straight line between the northwestern extremes of the two wetlands passes approximately 1/4 mile to the southeast of the closest point of the antenna field. We have no information on the exact path(s) the birds may take during such a flight as there have not been any reports of observations of moorhens flying between Saipan and Tinian. No information is available which would show how many birds may participate in any one such flight (i.e., solitary fliers or flocks).

However, we recognize that should the birds fly through the area during evening, night, or early morning hours (the times such movement would be expected), there is only a small chance that they would be observed. No data exist on the specific flight characteristics of the Mariana common moorhen, but the Florida gallinule, another subspecies of Gallinula chloropus, has been described as a powerful flier when flying from one pond to another, flying at a "reasonable height" with a direct and fairly swift flight (Bent 1926).

For the purposes of this consultation, we are assuming that some moorhens may occasionally fly near or directly over the antenna site and that they adjust the speed and height of their flying in response to weather, terrain, and visible obstacles.

b. The 58-acre site which will be cleared by the P-223 project contains no wetlands and is not used by the moorhens. Likewise, the 1.5 miles of tangentangen thickets and clearings between the project site and Hagoi is not used by the bird. They have not been reported on the ground at or near the site; knowledge of the habits of moorhen suggests that they generally remain in, or very near to, wetlands. As such, there is no known feature of the P-223 site which would be especially attractive or useful to the birds.

c. Similar antenna arrays, transmission lines, and towers are found in other areas where Mariana common moorhens, other moorhen subspecies, or other larger waterbirds (ducks and geese) fly. We contacted personnel at the Navy's Chesapeake, Virginia over-the-horizon radar facility regarding the impact of that facility on waterbirds there and members of this Service's Anchorage, Alaska Regional Office regarding the Air Force's radar antenna field in Amchitka, Alaska. Both of these facilities have large antenna arrays similar to that proposed for Tinian. Neither had any history of bird-radar antenna collisions. At Chesapeake, the antennas are located in areas of high concentrations of ducks and geese and public hunting is conducted nearby. On Saipan and Tinian, we know of no moorhens injured or killed as a result of their flying into antennas, towers, guy wires, or similar structures. On Guam, a moorhen was found dead under a roadside transmission line with head and neck injuries which could have resulted from collision with the wires. Another moorhen was found dead on Guam with injuries most likely resulting from its flying into a building. We recognize that all moorhens injured through such collisions may not be found, reported, and recorded for our consideration.

From this information, we have concluded that a possibility does exist that moorhens traveling through a dark antenna field on northern Tinian at night or during other times of decreased visibility may strike the antennas or guy wires and sustain possibly fatal injuries. This is based on the dusk, dawn, and night-flying habits of the bird, the proximity of the antenna site to a possible route they may take between Susupe and Hagoi, and the evidence that the bird has struck permanent structures.

Measures serving to decrease the chances for such collisions are provided in the Draft Statement. It proposes the development of "shielding obstacles," such as tall trees. This is suggested in the Fish and Wildlife Service's 1978 publication Impacts of Transmission Lines on Birds in Flight.

The publication states:

"If wires can be screened by trees, billboards, or other man-made structures, it is quite likely collisions can be reduced or prevented. Many bird species are reluctant to fly under objects, and ducks in particular begin gaining altitude well ahead of an obstacle in their path. These flight path barriers could probably be effective even if much lower in height than conductors or if some distance from the right-of-way, provided they are located optimally along the flight path of the birds."

Two potential problems exist with the use of existing trees or fences on Tinian for screens. First, if the tangentangen forest around the antenna field is of uniform height, there is no incentive provided which would cause the birds to gain altitude as they approach the much higher transmitter antennas. Tangentangen trees in the vicinity of the P-223 transmitter site may reach 20 to 30 feet. Trees higher than the predominant vegetation would be required for the birds to climb in altitude so as to avoid the taller antennas. Second, many types of tall fencing would most likely not be able to withstand the typhoon winds experienced in the Marianas Islands (wind speeds have exceeded 180 miles per hour in recent typhoons).

Methods for reducing the chances for antenna collisions were discussed with Mr. Thomas Egeland of your staff and Mr. James Chun, P-223 project manager, via telephone on December 15, 1988. The maintenance of existing tall trees surrounding the installation would help to decrease the chances for bird strikes. It was agreed that should there be any injury or mortality of moorhens due to collision with the antennas, wires, or other structures, then much higher shielding would be grown or erected. (Note: similar project modifications serving to decrease the chances for birds flying into the transmitter are given in the Draft Statement, page 5-49.) Taller tree species, such as ironwoods (Casuarina equisetifolia), grow on northern Tinian and elsewhere in the Mariana Islands, reach considerable height (possibly 80 feet), and are strong enough to survive most typhoons. A row or several rows of these perpendicular to the suspected flight path of the moorhens along the antenna field would encourage them to gain altitude and fly over, rather than through, the field. Chun and Egeland indicated that the project would agree to plant such trees and encourage their growth through watering and fertilizing. The specifics of monitoring moorhen injury or mortality and measures which must be taken are given in the Incidental Take section of this letter.

Additional mitigation of the possibility of bird strikes is offered in the project design by lighting the antennas and support wires at night, improving their visibility. The Draft Statement recognizes that light can also attract and confuse some birds. Some night-flying migratory birds may be attracted to lights on overcast nights, possibly mistaking the lights for stars (Avery, et. al. 1976). The judicious use of lights, employing strobes or other mechanisms which are not as attractive to birds, will be helpful in aiding moorhens to avoid collisions. Certain minimum lighting standards are required by the Federal Aviation Agency.

The project will also improve the visibility of the antennas by marking them with permanent, highly visible strips, tape, or flagging. This technique is widely used elsewhere and has been shown to be effective in reducing the incidence of birds hitting wires, poles, and similar obstacles.

K-5

Based on the information available regarding the project's location, design, and size and what we know of the population and other characteristics of the moorhens in the area, we have concluded that although chances exist for a moorhen to fly into the antenna area, neither see nor avoid the structures, and strike the structures and be injured, such a chain of occurrences would most likely be rare. Further, we have considered that should evidence of a moorhen being injured or killed by collision with the structures exist, the Navy will take additional measures to screen the area and will alter the lighting or otherwise make the wires more visible to the birds.

Moorhens are found in some wetland areas on Guam, Tinian, Saipan, and Pagan. The main threat to the health of their population is the loss of wetland habitat, and, to the best of our knowledge, collision with obstacles has not been a significant factor in their decline. As such, our conclusion is that the transmitter facility will not jeopardize the continued existence of the Mariana common moorhen through collision hazard.

The Commonwealth Division requested that impacts to the Vanikoro swiftlet also be considered in this opinion; it is listed as endangered and is found in the Commonwealth. However, only one individual swiftlet has been reported as being observed on Tinian during this decade (in 1985), and nesting has never been reported. We would not expect the project to affect this species.

On Guam:

The receiver is passive and does not emit any significant radiation or other products which may affect any listed species on Guam. The pole antennas are relatively short (18 feet high and 6 inches in diameter), and are not expected to pose any hazard to any wildlife species either. There will be no ongoing disturbance of the area once construction is completed except for maintenance activities, vehicle movement to and from the facility, and other minor noises (as compared to the disturbances generated by other types of human activities, such as manufacturing, housing, and airport operations). As such, we would expect there to be minimal impact on listed species as a result of the operation of P-223. Bats, crows, and kingfishers would not be expected to be deterred from feeding or nesting near the facility as they may be near areas of more intensive human disturbances.

As stated previously, however, the project requires a 172-acre rectangle of land with little or no vegetation taller than short or mowed grasses and similar small plants. This requirement is needed to enhance antenna reception. Originally proposed to be located in a totally forested area at Northwest Field, the Runway Site now under consideration would be positioned over an existing, but infrequently used, concrete-paved runway and a vegetated area lying between that runway and a parallel paved taxiway to the north (see Enclosure 2). Because no vegetation grows on the paved areas, the vegetation required to be cleared by the project is reduced by the area of the pavement. One hundred and ten acres of vegetated cover will be lost due to the clearing. All three listed species either use or have recently used this vegetated area for feeding or other activities, possibly including nesting. The value of this habitat to be lost to the survival and recovery of the bat, crow, and kingfisher is our main concern in evaluating the impact of the project on these species.

The "Botanical Survey Report For Northwest Field Project P-223, Runway Site, Guam" (Botanical Survey Report), prepared in March 1989 for the Draft Statement described the vegetation of the Runway Site as being "of low stature, extremely mixed with some species locally abundant. Generally, they (the forests) are. . . hard to characterize by reference to dominant or even universally characteristic species." The site contains mixed second-growth scrub, ironwood, and grassy scrub vegetation. Gagu trees (Casuarina, ironwoods) are also found in the 20-25-foot deep borrow pit located on the eastern end of the Runway site. A small grove of coconut trees was found near the center of the site near the eastern boundary. There were no emergent trees (those that protrude prominently through the canopy) in the area.

1. Mariana crow:

The Mariana crow is endemic to Guam and the island of Rota, Commonwealth of the Northern Mariana Islands. While the population of the bird on Rota appears to be stable and numbers about 1,000 (Glass, et. al. 1988), their numbers on Guam have dropped drastically over the past decade. In the June 1989 report "Current Status of the Mariana Crow, Corvus kubaryi, on Guam" (Beck 1989), it states that there are less than 50 left on that island. The report further states:

"At the end of World War II, the crow was common on Guam over the entire island in forested areas and coconut plantations except in areas of human habitation. Since the early 1950's, however, the crow has been declining in range due primarily to predation by the brown tree snake which was apparently introduced to Guam in the late 1940's. The last sightings of the crow in southern Guam were made in the mid-1960's and they have been absent from central Guam since the mid-1970's. At present, crows on Guam are found only in extreme northern Guam..."

"Their numbers are continuing to decline."

Crows can be seen flying in the Northwest Field and in the Conventional Weapons Storage Area (Weapons Area) of Andersen, including the area proposed to be cleared for the P-223 Runway Site project. The April 1988 bird survey of the 172-acre site identified approximately seven Mariana crows; a February 1989 survey identified 10 - 12 individual birds. Although no nesting in the Runway Site was observed, the crows feed on plants and insects which are found throughout forested areas of northern Guam, including the proposed P-223 site.

The Guam Division's December 14, 1987 letter to us reported the discovery of an intact Mariana crow nest in an area then under consideration for placement of P-223 (to the north of the Runway Site currently proposed). The nest had apparently been constructed relatively recently prior to that date and had apparently been blown out of a tree during a wind storm. No adult crows, young, or eggs associated with the nest were reported at that time. Up to eight crows have been seen north of the Runway Site area at one time, and nesting attempts in that area north of the Runway Site are documented. In their February 23, 1988 letter to us, the Guam Division reported another

active crow nest with incubation taking place in the northeastern part of what was then under consideration for P-223. (That area is not included in the Runway Site). Another nest was reported in the Weapons Area.

Enclosures 4 and 5 show crow sighting and nesting locations in relation to the P-223 Runway Site.

On October 27, 1988, Robert Anderson, Acting Chief of the Guam Division, reported the observation of two pairs of crows exhibiting nesting activity in the Weapons Area. On December 15, 1988, Anderson and Beck (Guam Division) reported "several active crow nests" in the area north of the Runway Site. These two nests had been "snake-proofed" by placing a sticky substance around the trunk of the nest trees to discourage snakes from climbing them; by clearing brush and surrounding trees which touch the nest tree to prevent snakes from reaching nests from adjacent vegetation; and by trapping snakes in the nest tree itself. To date, the Guam Division has tried this technique with three active nests. One nest was lost due to unknown predator(s) during incubation; a second was lost to unknown causes after six weeks of incubating and brooding of young; and a third nest successfully fledged a single young which was subsequently lost to predation after it left the protected nest tree (Beck 1989). It is assumed the young crow left the nest and glided to the ground, where it was more vulnerable to predation by snakes or monitor lizards.

Extensive field observations conducted by the Guam Division have found no evidence of successful production and survival of any young crows on Guam since 1985. There have been two unconfirmed observations of fledgling crows in northern Guam, one at Northwest Field and one at Pati Point (Guam Division's letter to the Service of November 3, 1988). The location(s) of the nest(s) producing the two fledglings is not known.

On December 20, 1988, Anderson estimated that approximately one-half of the observed crow nests occur in the Weapons Area and one-half in Northwest Field. The Guam Division is continuing their survey of northern Guam to ascertain crow distribution and the location of active nest sites. Their preliminary results indicate that the primary range of the species on Guam appears to be Northwest Field and the Weapons Area. In a December 15, 1988 telephone conversation with this office, Beck stated that the area then under consideration for P-223 (the area north of the currently proposed Runway Site) is the "center of the crows' distribution on Guam." In addition, a few crows range across Tarague Basin to Pati Point.

Of special importance to our analysis of the impact of the loss of the vegetation in the Runway Site is the characterization of the species of plants to be lost. Beck (1989) reports "Research has shown the crows prefer one species of emergent tree, Eleaocaprus (sic) sphaericus, for nesting and over 90% of the crow nests found on Guam have occurred in this species." The March 1989 Botanical Survey Report states that "such trees as dug-dug or breadfruit (Atrocarpus mariannensis Trec) and yoga (Elaeocarpus joga Merr.), which are so common and which have become so huge in other limestone forests of northern Guam, are almost entirely missing on this site. One of each was spotted and both were less than 10 m (meters) in height. In short, there are no emergent trees in this area as yet." (Note: E. sphaericus and F. joga refer to the same taxa on Guam.)

2. Guam Micronesian kingfisher:

Although no systematic survey has been conducted on northern Guam for this species since 1981, both anecdotal and confirmed reports of Guam Micronesian kingfishers document the dramatic decline in the number of the birds during the past decade. The 1984 U. S. Fish and Wildlife Service report Distribution and Abundance of the Forest Birds of Guam: Results of a 1981 Survey estimated the island-wide population of kingfishers to be 3,022. The report states, "The kingfisher remains one of the most widely distributed of all native species, and presently occupies about 40% of its 1950's range."

More recent field work and site-specific surveys conducted by the Guam Division, the New York Zoological Society, the contractors who prepared the Draft Statement, and others now indicate that the Northwest Field area of Andersen Air Force Base may contain the last remaining kingfisher(s) on Guam. From the 1981 population of slightly over 3,000, the number had dropped in 1987 to possibly less than 10. That number has continued to decline. In their October 28, 1987 letter to us concerning P-223, the Guam Division concluded that, "data suggests that a small population of kingfishers still survives only on Northwest Field primarily at the (then) P-223 site." (Note: the P-223 site at that time was located north of the P-223 Runway Site now under consideration.) There were possibly three kingfishers in the former P-223 area at the time of that report. The last confirmed sighting of a kingfisher on Guam was made in August of 1987. An unconfirmed sighting of one kingfisher was made in May 1988, and the June 1988 survey detected the call of one kingfisher in the same general area, about one mile from the closest border of the Runway Site.

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While no conclusive survey has been conducted on the number or location of remaining kingfishers, the trend in population described by their decrease in numbers from 3,022 in 1981 to perhaps one bird in 1988 demonstrates the peril of this species in the wild.

In an effort to save the species from extinction, the Guam Division has developed a captive breeding program for the kingfisher. A cooperative breeding effort was initiated among the Guam Division and several mainland U.S. zoos. Twenty-nine kingfishers were captured from the wild, many have bred successfully, and there are now over 50 captive birds. It is hoped that a larger stock of birds produced in captivity will eventually be able to be released back into the wild in Guam once the brown tree snake has been eliminated or controlled.

Our September 1987 biological opinion on the P-223 project explained that the decline in kingfishers was due to predation by the introduced brown tree snake; there are parallels in the decline of the snake's other vertebrate prey. The loss of kingfishers has been the result of predation on adult birds and their young and eggs, not a general loss of forest habitat. Since the pattern of the expansion of the snake's range on Guam was such that the northern portions of Guam were the last to be colonized by snakes, and in that the Northwest Field area was among the last area of northern Guam to be invaded by the predator, we concluded that the remaining birds were threatened primarily by the snake, not by the loss of habitat expected from the P-223 project.

In their October 28, 1987 letter to us, the Guam Division speculated that perhaps the then under consideration P-223 area (to the north of the Runway Site) had some special quality allowing the survival of the last known kingfishers remaining in the wild. They also stated that it appeared that P-223 area had a lower density of snakes than other areas in adjoining habitat of similar geology and vegetation composition where the kingfisher had already been extirpated. To follow up on this possibility, the Navy contracted Dr. Thomas Fritts, a herpetologist with this Service, to conduct snake surveys in the area. His report on the abundance and distribution of brown tree snakes concluded that no significant difference between snake densities within, and in similar habitat outside of, the project area existed. Although it is acknowledged that snake densities fluctuate in response to the availability of their prey, and thus change over time, the presence of a high density of snakes in the area at that time was documented. The densities of snakes found there could account for the decrease in the numbers of birds.

Dr. Fritts' report further noted that as evidenced by the surprisingly high snake activity on the ground at the Naval Communications facility at Andersen as opposed to its usual arboreal habits, treeless areas do not pose a barrier to snake movement. While we had previously hoped that the abandoned runway grid at Northwest Field may be a significant factor in the control of snakes, we now know that these large paved areas have not prevented the snakes from invading areas surrounded by runways.

More recently, there is evidence that the number of snakes in the area of the P-223 site has decreased (Rodda, 1989), and reports from the Guam Division indicate that in response, the populations of some bird species there and elsewhere on Guam may be increasing. However, we would not expect the snake population at the P-223 site to remain depressed without human intervention; rather, the number of snakes would be expected to fluctuate in response to the availability of their prey.

Evidence demonstrates that the brown tree snake, not the overall loss of forested habitat, has been the primary cause of the decline of crows and kingfishers on Guam. Using 1985 aerial photographs of northern Guam and 1975 aerial photographs of southern Guam we calculated that approximately 16,900 acres of habitat suitable for the crow exist in northern Guam with 13,600 acres of similar habitat available in southern Guam. The loss of 110 acres due to P-223 amounts to a loss of 0.7% of all forested habitat in northern Guam and a 0.4% loss island-wide. Further, this 110 acres is mostly second-growth vegetation, not the mature limestone forest found elsewhere on Andersen Air Force Base.

To calculate the areas of forest needed to reach the "recovered" population sizes of 500 crows in northern Guam and 200 crows in southern Guam recommended in the Draft Guam and Rota Forest Bird Recovery Plan, we have estimated that each crow requires approximately 25 acres of "good" forest habitat to support feeding, nesting, and the maintenance of territories. Good forest habitat is defined, in part, as forested areas that contain the species of food and nesting trees favored by the crow. To reach the recovery goal for northern Guam, therefore, a minimum of approximately 12,500 acres of good forest habitat is required. We have identified that an area of approximately 17,000 acres of forest on northern Guam offers forested habitat, some of which would

be considered "good" habitat for the crow. In that the Botanical Survey Report did not find the vegetation complex and stature which provide good forest habitat for the crow in the 110-acre area proposed to be cleared, we do not consider the loss of this small (0.6) percentage of forest to be of great significance.

The destruction of habitat required for P-223 at the Runway Site does not constitute a significant portion of available habitat in that sufficient habitat will remain after the installation of P-223 to allow for the recovery of the kingfisher and crow.

4. Marianas fruit bat:

In northern Guam, Marianas fruit bats forage and roost mainly in native limestone forest. Wiles (1981) and the Draft Recovery Plan for the Marianas Fruit Bat and the Little Marianas Fruit Bat on Guam (Draft Bat Recovery Plan) described the characteristics of six roosts used by colonies of Marianas fruit bats. These sites occurred in limestone forest and were found along or within 100 meters of the large 80 to 180 meter tall cliffline that fringes northern Guam. Bats prefer to roost in mature fig trees, although other species were used. They are primarily frugivorous, and bats roosting in northern Guam may forage throughout the forested areas of Andersen Air Force Base and the Naval Communications Area Master Station. No bat colonies or the vegetation normally associated with such a colony are located within or adjacent to the P-223 site, although a few solitary bats or very small groups may roost in the site on a temporary basis. The February 1989 Bird and Mammal Survey - Guam - Runway Site noted that although fruit bats have been rarely seen in the Northwest Field area for the last 10 years, a June 1988 sighting of a bat approximately 1,000 feet from the Runway Site indicates that the area close to the P-223 site is still used by the animals. Guam Division Conservation Officers have observed Marianas Fruit Bats feeding on flowers of Casuarina trees on Northwest Field, and the P-223 site contains this species of tree.

Illegal hunting by poachers and predation by the brown tree snake appear to be the two major causes of the bat's depressed population; hunting bats was outlawed in 1966. In 1984, 500 bats were estimated to exist in northern Guam; all the bats recorded during the surveys were found on Andersen Air Force Base (Draft Bat Recovery Plan). The recovery goal for the Guam population is 2,500.

As previously stated, lack of habitat does not appear to be implicated in the decline of the bat's population; losses due to poaching by humans and predation by the brown tree snake are responsible for their endangered status. There are sufficient fruit trees and roosting sites available in northern Guam to support a recovered population if illegal taking and the snake are controlled. The loss of 110 acres of bat foraging habitat resulting from P-223 will not significantly hinder the species' recovery.

The Guam Department of Agriculture's October 28, 1987 letter to us speculates that poaching bats may increase as a result of the P-223 project in that "any type of clearing in essential habitat promotes easier access by people into remote areas where bats occur.... Poaching could occur during both the initial phase of the project when the forest is being bulldozed and later after the construction of the antenna has been completed."

Extra protection against illegal activities will be provided by P-223. Currently Air Force security personnel are responsible for the Northwest Field area; after completion of the P-223 project, Navy security personnel will also patrol the project area. As the receiver will be operated throughout the full 24-hour day, every day of the year, persons with the authority to report illegal activities in the vicinity of the receiver will always be present. We would anticipate a decrease in illegal hunting as a result of the project. We also recognize that the P-223 area, although remote, is already accessible by car; the old aircraft runways provide speedy access and escape of poachers, if any, in that area. Access to the site will not be improved for trespassers. Additionally, the P-223 installation is a radar listening facility, and vehicle noises disturb the clarity of radar reception. The Navy would want to prevent poachers' or any other unauthorized vehicles from passing in front of the receiver field.

-In summary:

The overriding factor in the catastrophic decline of the kingfisher and crow on Guam is predation by the brown tree snake. While poaching is a major factor in the decline of the fruit bat, the snake is believed to have a significant role in the decline of this species as well. Should the Runway Site for P-223 at Northwest Field be selected and cleared, there are other areas for crows, kingfishers, and bats to feed and nest. Habitat availability is not the limiting factor.

Although bat colonies do not occur in the project site, they are located nearby, close to the cliff line. The bats may feed on fruit trees growing within the 110-acre area to be cleared, and a few bats have been observed roosting there. However, there is an abundance of similar feeding and roosting areas nearby which will be unaffected by the project.

Thus, it is our opinion that construction of P-223 at the Runway Site on Northwest Field will not be likely to jeopardize the continued existence of the Mariana crow, Guam Micronesian kingfisher, or the Marianas fruit bat. Some habitat which is known to currently support both the crow and bat and possibly support the kingfisher would be destroyed should the site be chosen for the project. However, clearing related to this project would represent less than 1% of forest habitat available in northern Guam and would not significantly affect the estimated core habitat necessary to sustain the recovered population goals.

Cumulative Effects

Cumulative effects are those impacts of future local government and private actions which are reasonably certain to occur. A non-federal action is reasonably certain to occur if the action requires the approval of a local resource or land use control agency, and such agencies have essentially approved the action. Activities that do not require local agency approval must be essentially ready to proceed. Future federal actions will be subject to the consultation requirements established in Section 7 of the Act and, therefore, are not considered cumulative to the proposed action.

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As was stated previously, radar projects P-225 and P-002 may require separate consultations should it be determined that they may affect a listed species or a designated critical habitat. The impacts of these projects will be addressed at that future time, and the effects of P-223 will be considered as part of the environmental baseline.

With specific respect to the rezoning of the Artero property on Guam (located within the proposed essential habitat for the crow, bat, and kingfisher) to allow for hotel/resort development, we do not believe it qualifies for inclusion as a cumulative effect. Although the property owner may have expressed an interest in development of the area, no building plans or other progress toward development has been submitted; approval for any development project has not been granted by any Guamanian government agency. More importantly, the Artero property is totally surrounded by federally controlled areas. Any access to the property requires the authorization of a federal agency. If such access or any other private action requiring federal authorization or approval may affect any listed species, the federal agency will be required to formally consult with this Service. At that time, the impact of the development on listed species will be addressed.

A Japanese investment group (Marianas Agupa Enterprises, Inc.) is asking for land on Rota on which to construct a resort community with seven hotels, three golf courses, 1,500 to 2,000 condominium apartments, and a stadium (Guam Business News, July 1989). Although neither the transmitter nor receiver portions of the P-223 project are located on Rota, approximately 1,000 Mariana crows are estimated to be found there. The island of Rota has a total area of approximately 32.8 square miles, including 23.2 square miles of habitat suitable for the crow (Micronesian Forest Bird Survey, 1982: Saipan, Tinian, Agiguan, and Rota 1986). Preliminary descriptions of the project indicate the area required to be about 1,400 acres. If the site for the resort is located entirely within crow habitat on Rota, such a development would destroy approximately 9% of the crow habitat on the island. We cannot estimate the area of the 1,400-acre site which is used by crows or the value of the habitat they do use to the overall island crow population. However, such a loss would represent a significant decrease in crow habitat on Rota, where the crow population is considered healthy. We do know that some coastal strand vegetation habitat will most likely be destroyed due to the development, and that this type of habitat is used by the crows.

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We do not know if any federal authorization may be required which would "trigger" formal Section 7, Endangered Species Act consultation with this Service. To the best of our knowledge, no Commonwealth permit has been issued allowing construction.

In evaluating the significance of such a loss of habitat on Rota to our consultation regarding the P-223 project, we considered the following:

1. Loss of habitat on Rota will not affect the individual crows remaining on Guam. However, should Rota crows be required as stock for repopulating Guam, a significant decrease in the number of crows on Rota will make it more difficult to take birds from there, negatively affecting the recovery of the species.

2. The drastic decline of crows on Guam is directly attributable to predation by the brown tree snake, not to a loss of habitat. Sufficient habitat remains on Guam to support a fully recovered crow population there.

3. Rota could be invaded and colonized by snakes. Should this occur, it would have the potential for seriously depleting the crow population there. There has been a report of what was likely a brown tree snake hidden in a ship's cargo on Rota which was killed when it was detected trying to escape.

The Rota resort development will diminish crow habitat there by possibly as much as 9%. However, this decrease will not substantially decrease the chances for the recovery of the species on Guam, its recovery there being directly dependent on control of the brown tree snake. While the loss of up to 9% of the crow habitat on Rota may equate to a loss of up to 90 birds (9% of their population of 1,000), the remaining 910 would still be sufficient to support a small-scale reintroduction program on Guam without jeopardizing the Rota population. However, a serious threat to the specie's recovery would likely result should future significant losses of habitat on Rota be sustained.

Incidental Take

Section 9 of the Act prohibits any taking (harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct) of listed species without specific exemption. Under the terms of Section 7(b)(4) and 7(o)(2), taking that is incidental to and not intended as part of the agency action (in this case, take associated with Project P-223) is not considered prohibited within the bounds of the Act provided that such taking is in compliance with the incidental take statement.

On Tinian:

1. We anticipate that Tinian monarchs will be forced from the project area as the tangentangen is removed. Surveys conducted as part of your preparation of the Draft Supplement and Draft Statement for the P-223 project estimated that there were 24 individual monarchs in the 58-acre area. Surveys of northern Tinian conducted by this Service several years ago estimated that there may be as many as 100 monarchs in a 58-acre area. However, this higher density was determined for habitat that was overall of better quality for monarchs than the habitat found in the P-223 area. We would expect fewer than 100 monarchs at the proposed 58-acre transmitter site, and your estimate of 24 is reasonable.

We would expect that the 24 monarchs would be forced into adjoining habitat or otherwise disturbed by the construction activities. Birds forced into new habitat may be stressed and would probably not survive due to lack of food or other resources claimed by the birds already existing in that new area. Because the size of the area which may be adversely affected by the project (the project site plus adjoining areas which will be affected by noise and similar disturbance) is larger than the 58 acres surveyed, it is anticipated that the project would result in the taking through harassment (possibly resulting in their death) of 40 individual monarchs. Additionally, monarch nests in the project site may be abandoned and destroyed when the land is cleared. The destruction of up to 12 Tinian monarch nests (the nests

maintained by 24 birds) and the eggs they may contain could be expected and is, therefore, also anticipated. Accordingly, the incidental take allowance is set at 40 birds and 12 nests (including eggs and young they may contain).

The island-wide population of Tinian monarchs is estimated to be about 40,000. In consideration of the fact that the possible loss of 40 monarchs constitutes only 0.1% of the total population, no jeopardy to the continued existence of the species exists if the maximum anticipated incidental take is reached. Even when the number of eggs or young which may be destroyed by clearing the site is added, the loss to the total population would be far less than .2%.

While we would expect that the incidental take level for individual birds may be reached, we would not expect it to be exceeded. This expectation is based on the previously referenced surveys. However, we recognize that it is impossible to determine the exact number of birds which may be taken.

Reasonable and prudent measures are considered necessary or appropriate to minimize the amount or extent of the anticipated incidental take of the species. To minimize the taking of Tinian monarchs on Tinian, you must (1) insure that as little vegetation is removed as is required to complete the project and (2) you must reduce the chances of monarchs being adversely affected by the project.

Terms and conditions are specific actions which must be carried out by the action agency (the Navy) to implement the reasonable and prudent measures. Incidental taking of monarchs is subject to the following terms and conditions, which must be implemented:

a. Project contractors must be made aware of the sensitivity of the area to monarchs and the Navy's commitment to further their conservation. You must insure that the contractor clears or otherwise adversely modifies only the area described in the present project documentation. Additional clearing for such uses as equipment storage, access roads, or other activities which have not been listed in the present project description and have not been subsequently reviewed by this Service as part of our Section 7 consultation are not to be allowed.

b. The Navy, project contractors, or others involved with the project must Notify the Chief of the Commonwealth Division immediately upon the discovery of any Tinian monarch injured or killed as a result of the clearing or construction activities. Their telephone number on Saipan is (670) 322-9729. The Commonwealth Division will advise on the handling and disposition of injured or killed birds (such as taking an injured bird to a veterinarian for treatment or how to preserve and forward any dead specimens).

c. This office is to be notified within three days of any project-related injury or death of any Tinian monarch. Our telephone number in Honolulu is (808) 541-2749. A written report of such an incident is to be sent to this office within five days of the incident and will contain such information as the time and date of the incident, how the injury or death occurred, the fate and present location of the bird, the name and telephone number of someone familiar with the incident, and measures implemented to prevent recurrence.

2. As previously discussed, it is possible that Mariana common moorhen may fly through the project area and be injured or killed by striking antennas or supporting cables. Based on previous moorhen population estimates on Tinian, the size of the Tinian installation in relation to the total land area of northern Tinian, the number and height of antennas and their supporting cables, and the nature of the moorhens' flight habits, an incidental take level of three birds per year injured or killed is anticipated. Should a total of three moorhens be injured or killed, the maximum level of incidental take will have been reached. If this level of three moorhens injured or killed is exceeded, consultation with this Service must be reinitiated immediately.

The population of Mariana common moorhens is estimated to be approximately 400; this includes approximately 200 in Guam and 200 in the Commonwealth. The loss of three birds constitutes a loss of 1.5% of the Commonwealth population or 0.73% of the total Marianas population. Such a loss would not jeopardize the continued existence of the species.

As reasonable and prudent measures, the Navy must assess the actual take of moorhens resulting from collisions with wires and antennas and must undertake a program to help moorhens avoid striking the wires or antennas.

The following terms and conditions must be implemented:

a. During the first year of operation, the P-223 transmitter site is to be inspected daily for injured or dead birds, and a verbal report of any found is to be made to this office (808-541-2749) within one working-day of the discovery. Any dead birds found must be frozen as soon as possible; we will advise on their disposition and will make arrangements for autopsies. (The determination of cause of death, whether by collision with structures, radiation, or other causes, may be very important.) Written reports should be submitted to this office within one week of discovery and should contain information on the date and time of the discovery, the extent of the injuries or notes on the cause of death, the location of the discovery in relation to antenna or cable placement, the name and telephone number of the person making the report, and any other pertinent information. A similar report on the discovery of dead birds found should also be made to the Chief of the Commonwealth Division at (670) 322-9729. Live moorhens found on the ground within the P-223 site are to be reported to the Commonwealth Division immediately. The Commonwealth Division will provide information on care and handling of the bird and will advise on veterinary care. After the first year of operation, we will reconsider the frequency of site inspection.

b. Personnel at the transmitter installation are to be advised of the endangered status of the moorhen and their conformance with these incidental take provisions shall be required. Any observations of moorhen flying in the vicinity of the project should be noted and reported to this office or to the Commonwealth Division. Such information as time and date of observation, number of birds seen, direction of flight, approximate altitude, and weather would be helpful to our recovery efforts.

c. To minimize the taking of Mariana common moorhen on Tinian you must incorporate some form of effective hazing tactic to discourage the birds from flying into the antennas or cables. This may take the form of visual warnings (such as reflective tape or other ornaments) to birds that the antennas and cables are present. As discussed in the Draft Statement, tall trees have been shown to be effective in either causing birds to increase their elevation to clear the trees, thus being more likely to fly over, rather than through, an antenna field, or to fly around the trees and around an antenna field. Tall trees already existing in the vicinity of the project are not be cut unless absolutely necessary due to project requirements. Such trees are to be further encouraged through fertilization, watering, pruning, or other standard techniques. Further, a tall species of tree, such as Casuarina equisetifolia (ironwood), shall be planted at close spacing along the side boundaries of the antenna site, perpendicular to the direct route moorhens may fly between Susupe and Hagoi. The trees are to be watered, fertilized, and otherwise encouraged to grow. You may wish to consult the Commonwealth's forester or another qualified aboriculturist in this regard. While we recognize that because of their initial short stature the trees planted will be of little immediate benefit in encouraging moorhens to avoid the field, their usefulness as a visual stimulus will increase as they grow.

d. As described in the Effects of the Proposed Action section of this letter, should any moorhens be injured as a result of collision with any transmitter-related structures, you must institute a more effective means of preventing moorhens from being injured by the antennas and their wires. Such other means must meet with the approval of this Service.

On Guam, it is possible that during the clearing of the P-223 area crow or kingfisher nests or a roosting Mariana fruit bat may be found. Construction-related activities prior to or during the discovery and identification of these may constitute harassment of those birds, their nests, or the bats.

Taking through harassment (not destruction) of one active crow nest (including birds tending or otherwise associated with the nest plus eggs or young) is anticipated. This number is based on the most recent data concerning the number of nests in the vicinity of the 172-acre site. Accordingly, an incidental take limit of one nest and associated birds and eggs is established.

Taking through harassment (not destruction) of one active kingfisher nest (including birds tending or otherwise associated with the nest plus eggs or young) is anticipated. Accordingly, an incidental take limit of one nest and associated birds and eggs is established.

Taking through harassment (not physical injury) of up to 10 Marianas fruit bats is anticipated. Accordingly, an incidental take limit of 10 Marianas fruit bats is established. It would be expected that the bat(s) would not remain in a tree for very long before leaving to forage or return to a colony. After the bats leave, construction activities in the vicinity of the tree(s) can be resumed.

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"Harass" in the definition of "take" in the Act is defined in 50 CFR 17.3 (1988) as an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding or sheltering. As applied to this consultation, harassment would include disturbance of listed birds or bats by the activities leading up to the discovery of the birds, their nests, or bats. This would include survey work, land clearing, and other activities in the area.

Whenever the level of allowable incidental take established in this consultation is exceeded, consultation with this Service is to be reinitiated immediately. Any nesting of either of the bird species may be very significant in their recovery.

These levels of allowable incidental take were reached based on the fact that this incidental take allowance does not allow the injury or killing of any bird or bat, but only their initial harassment by personnel or machinery in the vicinity of a nest or roosting bat. As soon as a crow or kingfisher nest or a roosting bat is detected, the human activity in the vicinity of the nest or roost (as specified below) is to cease. We do not anticipate the loss of any bats, birds or their eggs as a result of this incidental take. As such, the allowable incidental take will not jeopardize the continued existence of any of the species.

Reasonable and prudent measures are designed to minimize incidental take. For the clearing of the P-223 area on Guam, reasonable and prudent measures are those which will reduce the probability of the crows, kingfishers or bats being harassed, injured or killed by project-related activities. You are to avoid harassment of crows, kingfishers, and bats by implementing the following terms and conditions, which are required:

a. Within the month prior to the commencement of clearing operations, the area to be cleared must be surveyed for crow and kingfisher nesting activity. A report of the results of such a survey will be forwarded to the Guam Division and this office.

b. Should crow or kingfisher nesting activity be discovered in the project area before or during construction, all construction activities within 200 meters of the nest site is to be halted and the Chief of the Guam Division (671-734-3944) and this office (808-541-2749) are to be notified. A decision will be made at that time as to how to avoid harassment of the birds until the nesting activity ceases. Upon cessation of nesting activity, construction may be resumed. (For the purposes of this Incidental Take section, cessation of nesting activity means either the destruction of the nest by "natural" causes with no attempt to renest within two weeks or abandonment of the nest by the adults.)

c. Should roosting bats be found in the P-223 area, activities within 50 meters of the roost shall cease. Construction activities may begin again after the bat(s) has/have left.

Conservation Recommendations

Section 402.02 (Definitions) of Section 7 of the Act states that discretionary measures which would serve to minimize or avoid adverse effects of a proposed action on listed species or critical habitat may be recommended. These recommendations supersede those listed in our September 15, 1987 biological opinion.

1. Cut as little vegetation as is needed to reach project requirements.

2. All vegetation which will be cut or otherwise uprooted must be taken off site to an approved dump or landfill area for disposal, buried within the project site, or burned. Should the vegetation be burned, precautions must be taken to insure that the fire remains under control. No vegetation, dirt, or other materials are to be dumped or pushed into the forest outside of the defined P-223 construction site.

3. The Hagoi wetland provides a unique habitat on Tinian. It is, however, susceptible to drought conditions. While we would not expect the withdrawals of water from the project's wells to significantly affect the water levels in the wetland, approximately 2.5 kilometers away, no water should be taken directly from the wetland during the construction or operation of the facility.

4. Naval personnel, private contractors, and others working on the P-223 project may be involved in moving materials and equipment from Guam to Tinian. The introduction of brown tree snakes to Tinian could devastate listed bird species there. All should be directed to take prescribed precautions to prevent the accidental transportation of the brown tree snake to Tinian. The snake prevention measures described and referenced in the Draft Statement and those to be modeled after the Black Micro Construction contract with the Air Force for the PACBAR III project on Saipan should be acceptable. However, we request that we be allowed to review and comment on the final plan when completed.

This concludes formal consultation on this action. As cited in sub-section 402.16 of Section 7, reinitiation of formal consultation is required and shall be requested by the Federal agency (Navy) or by this Service, where discretionary Federal involvement or control over the action has been retained or is authorized by law and:

a. If the amount or extent of taking specified in the incidental take statement is exceeded;

b. If new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered;

c. If the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion; or

d. If a new species is listed or critical habitat designated that may be affected by the identified action.

Portions of Guam including the project site are under consideration for designation as critical habitat. If and when a proposal for designation of critical habitat is published, and if you determine that the project may affect that proposed critical habitat, you are required to confer with this Service as directed by Section 7. We may then recommend measures which may be taken to reduce or eliminate the impact to the proposed critical habitat. Should a final designation be made, you must reinitiate consultation if the project may affect such designated critical habitat.

Sincerely yours,

Allan Mimelstein
Pacific Islands Administrator

Enclosures

cc: Assistant Regional Director - Fish and Wildlife Enhancement, Region 1, Portland, Oregon

A Partial List of References Cited or Consulted

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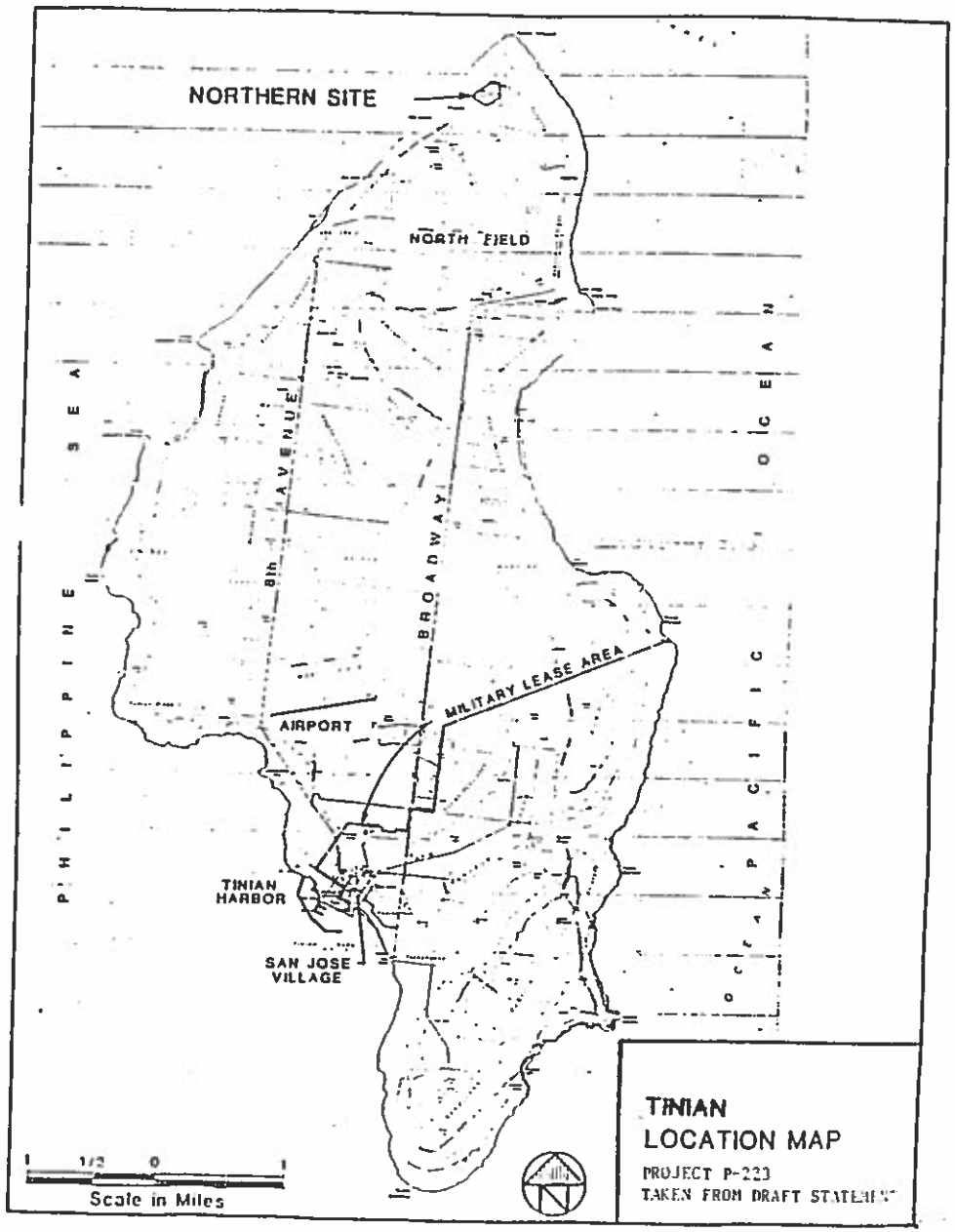
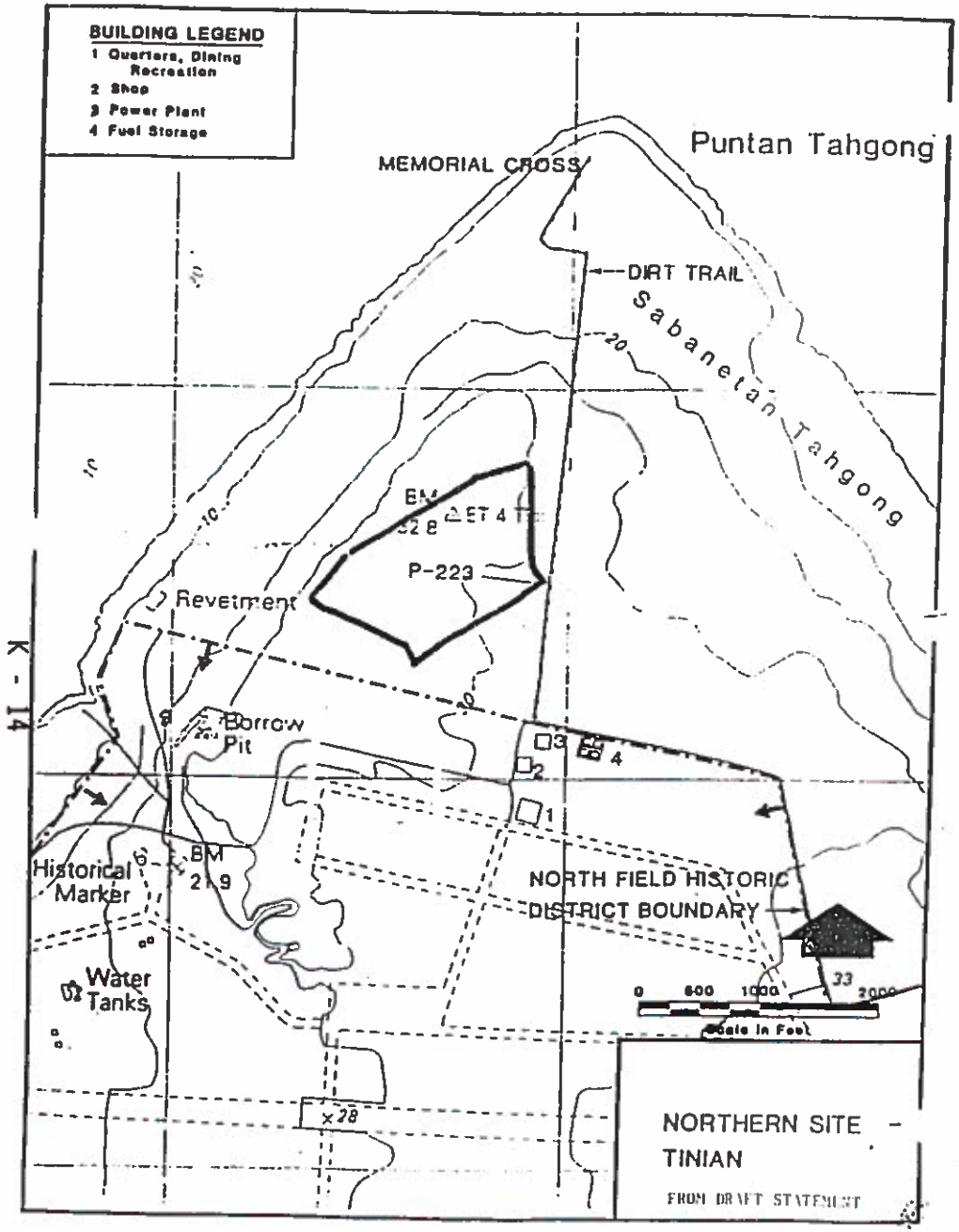
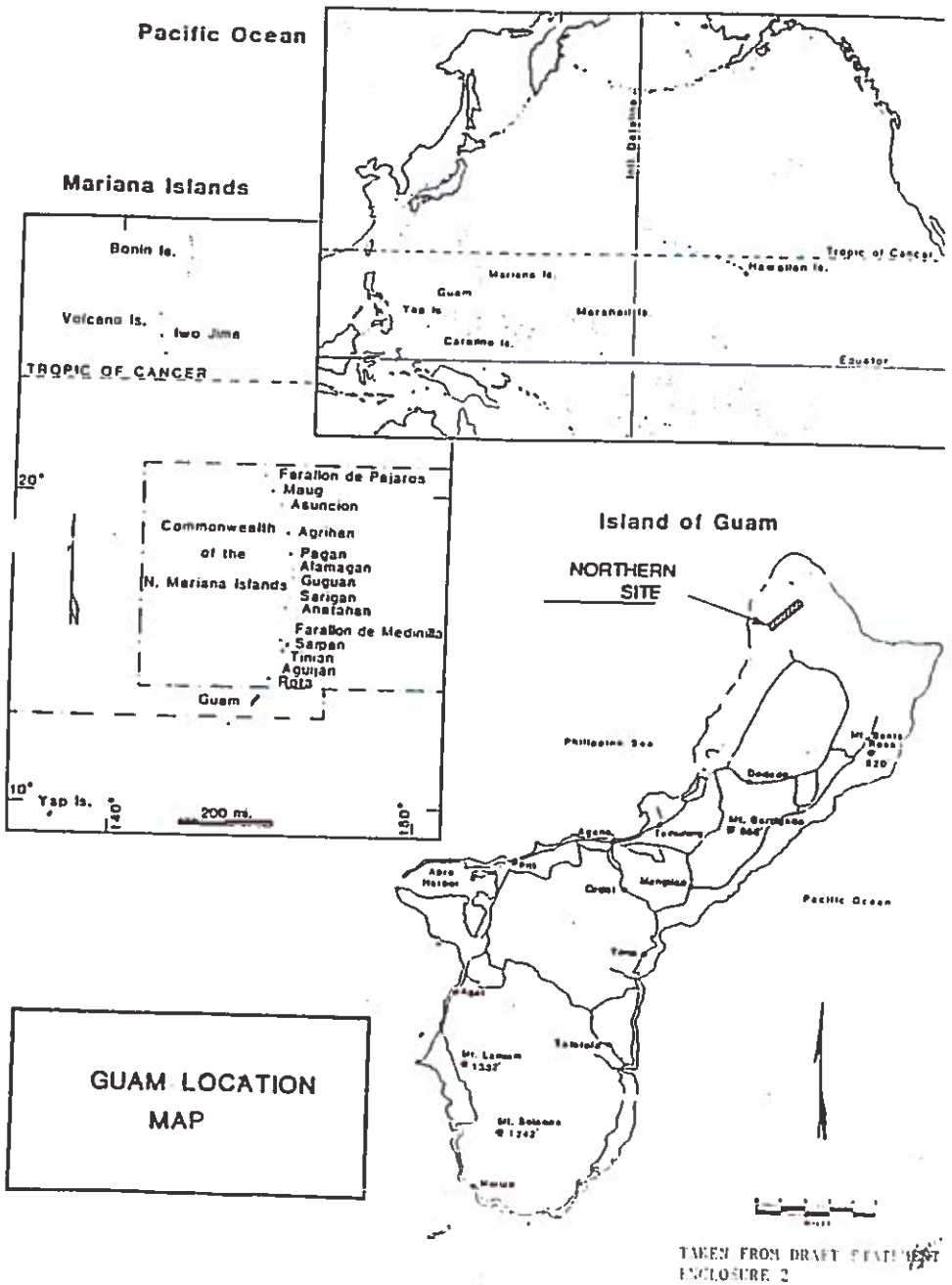
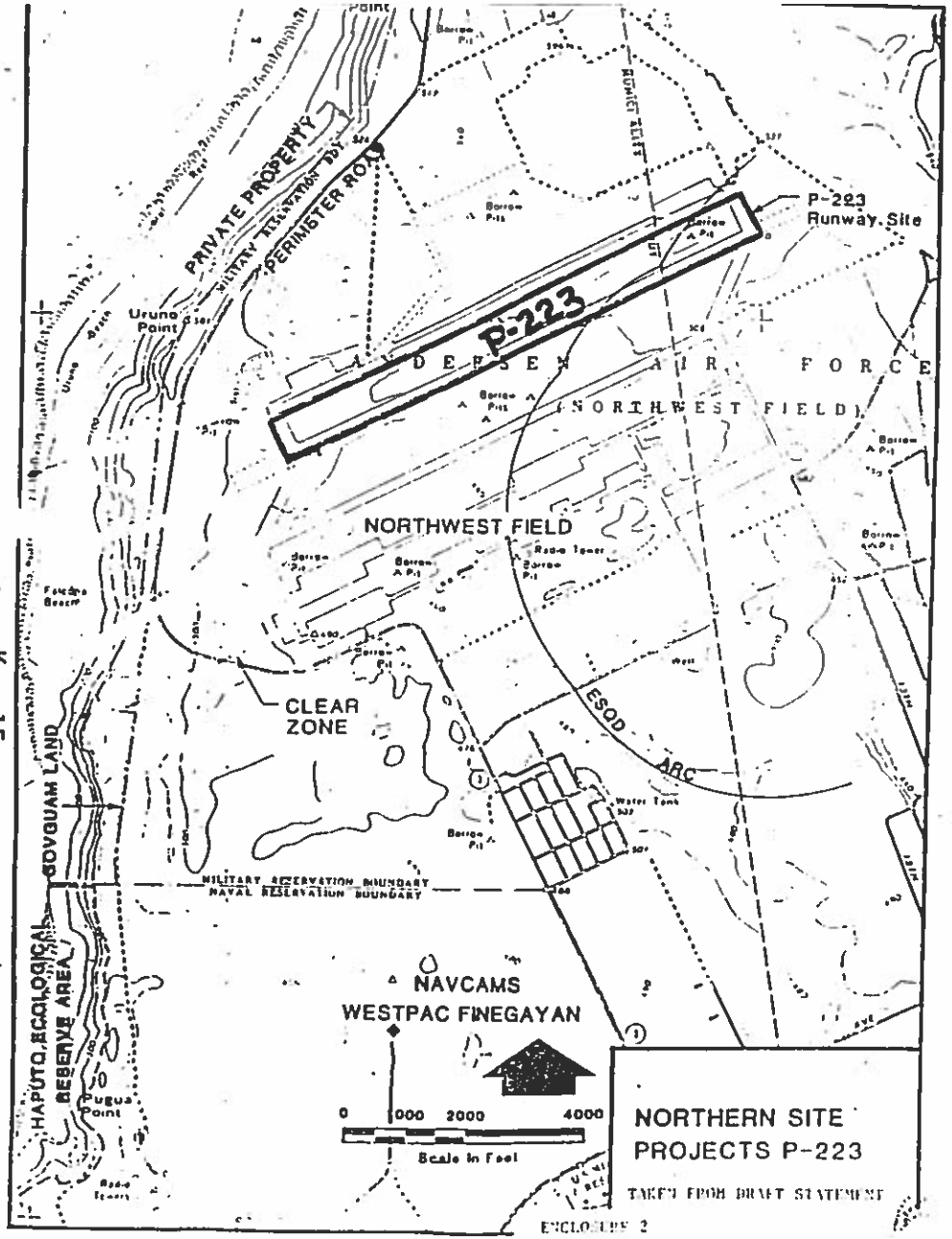


FIGURE 1





TAKEN FROM DRAFT STATEMENT
ENCLOSURE 2



ENCLOSURE 2

5.1.22 Means of Mitigating Potentially Adverse Effects

As previously discussed, the CNMI Division of Fish and Wildlife considers the Brown Tree Snake to be the single greatest threat to CNMI's wildlife resources. [Ref. 10] Measures to prevent the accidental introduction of the Brown Tree Snake to Tinian will have to involve the cooperation and diligence of a number of entities including the U.S. Navy, private contractors and government agencies on Guam, Saipan and Tinian. Cargo and equipment bound for Tinian originating in Guam or being transshipped through Guam presents the greatest hazard for the accidental introduction of the Brown Tree Snake to Tinian. Brown Tree Snakes could hide in the cargo as it leaves Guam and arrive in Tinian and eventually become established.

There are no biological controls known for the Brown Tree Snake. Although the snake mite has some potential as a biological control, the lack of information on potential secondary impacts makes it difficult to warrant its use at this time. [Ref. 58]

Since there is a high population density of snakes on Guam, mitigation or control measures should be used on Guam and Tinian. These measures were discussed and reviewed during workshops held in Saipan, Rota and Tinian in September 1986. [Ref. 10] Specific measures on Guam include:

- Control of snakes in and around warehouses, material and equipment storage areas;
- Stringent inspection of cargo and equipment prior to shipment from Guam;
- Special inspection attention to high risk cargo such as lumber, pipes, construction material, automobiles, heavy equipment/machinery and large unsealed crates; and
- Requirement that high risk cargo be certified as being snake-free prior to loading for shipment. [Ref. 10]

Mitigation or control measures applicable to North Field area and the commercial port on Tinian discussed during the September 1986 workshop include:

- Stringent inspection of cargo and equipment after arrival, especially those arriving from Guam;

TAKEN FROM DRAFT STATEMENT

- Construction of a fenced cargo and equipment area for holding material after unloading. (Snakes would have to climb the fence to leave the area and could be detected);

- Searches for snakes from 2000 to 2200 hours (8:00 to 10:00 P.M) the night following the unloading of high risk cargo;

- Conduct of full-scale control efforts immediately after any snake sighting to eliminate it before a colony can become established; and,

- Post instructions with immediate notification procedures in the event a snake sighting at cargo entry points. [Ref. 10]

The construction of the U.S. Air Force Pacific Barrier III (PACBAR III) Project on northern Saipan presented a similar situation as the ROTHR projects. The accidental introduction of the Brown Tree Snake to snake-free Saipan poses the same threat as introduction of the snake to Tinian. As a mitigation measure for the PACBAR III project, the Prime Contractor, Black Micro Corporation of Guam, a subsidiary of Black Construction Corporation, prepared a plan entitled, An Implementation Plan to Prevent Importation of Harmful Insects, Rodents and Especially Brown Tree Snakes. [Ref. 65] The plan identified "high risk equipment and materials" as equipment and materials originating from Guam, especially those not containerized or not in completely sealed containers. Cargo imported from elsewhere and unloaded, stocked and reloaded for transshipment from Guam was also identified as high risk cargo. This category includes those in breakbulk condition or not in completely sealed containers.

The Black Micro Corporation Plan also presented guidelines to prevent the accidental transport of the Brown Tree Snake. [Ref. 65] Specific guidelines included:

- Appointment of quarantine officer to visually inspect cargo in Guam prior to shipment;

- Thorough cleaning by high pressure water blaster to remove all foreign materials, such as dirt, grease, grass, weeds, insects, and snakes from all equipment being shipped from Guam whether by ship or air;

- Inspection of all incoming cargo at the destination by an appointed quarantine officer immediately upon arrival or within 12 hours of off-loading cargo; and

- In the event of a snake sighting, the quarantine officer shall take all efforts to capture and eradicate the snake, then contact the CNMI snake control team.

The specific guidelines for shipment of high risk material were similar and included:

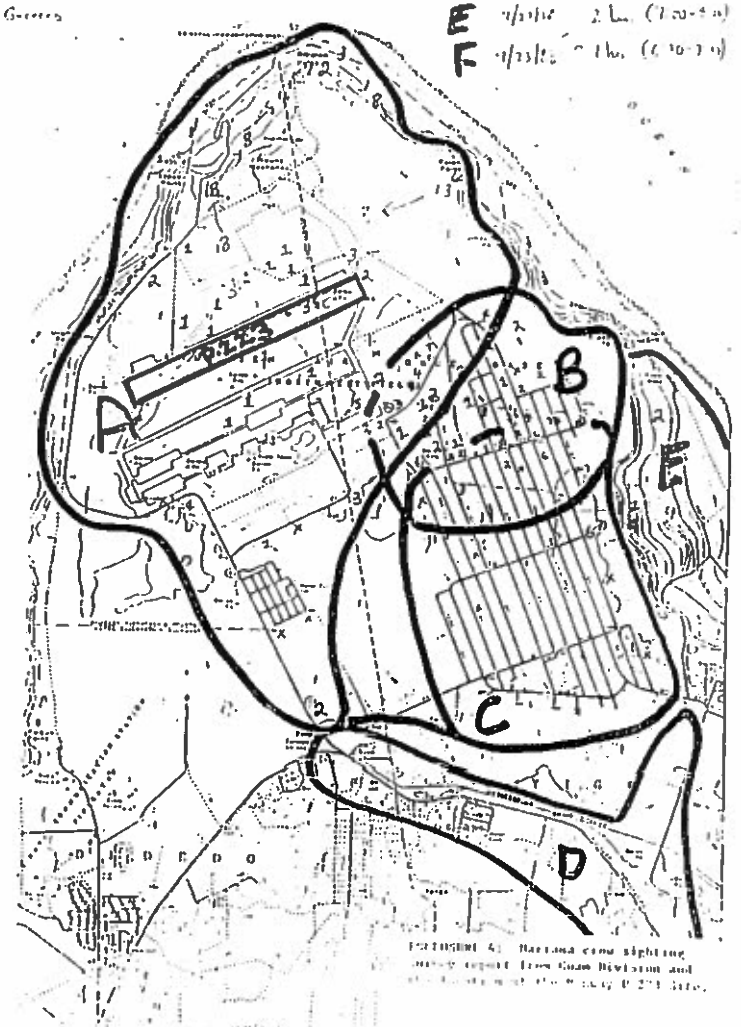
- Visual inspection by the quarantine officer in Guam prior to shipment of high risk cargo such as lumber, pipes (PVC, cast iron and ductline), hollow blocks, crates, and other material where snakes could hide; and

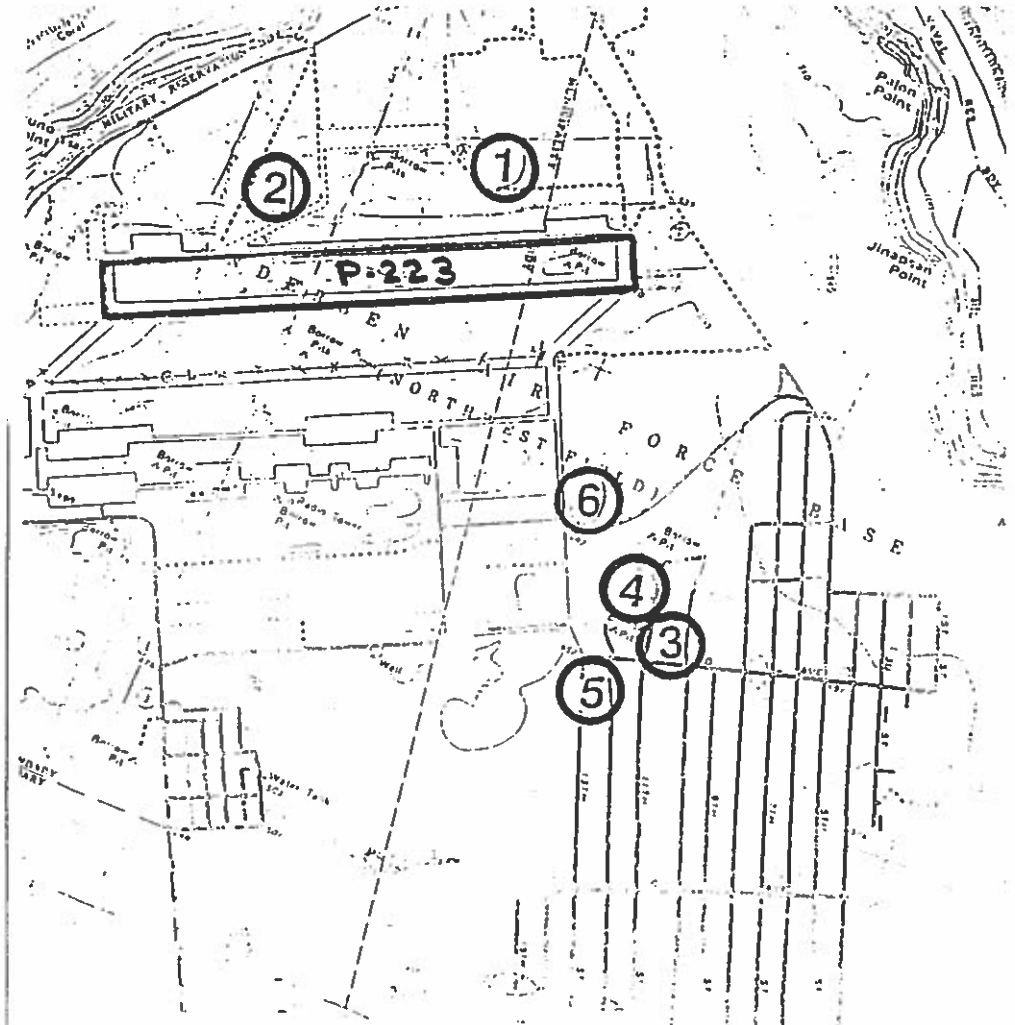
- Visual inspection by the quarantine officer at the destination (Tinian).

All cargo moving via surface ship or air either originating in Guam or transhipped through Guam was to be subjected to these procedures. This requirement extended to material shipped directly by the Contractor or via a freight forwarder. All types of high risk cargo were required to be treated in this manner.

An inspection check list covering 16 items and a signed verification by the quarantine officer was included in the Black Micro Construction Implementation Plan. [Ref. 65]

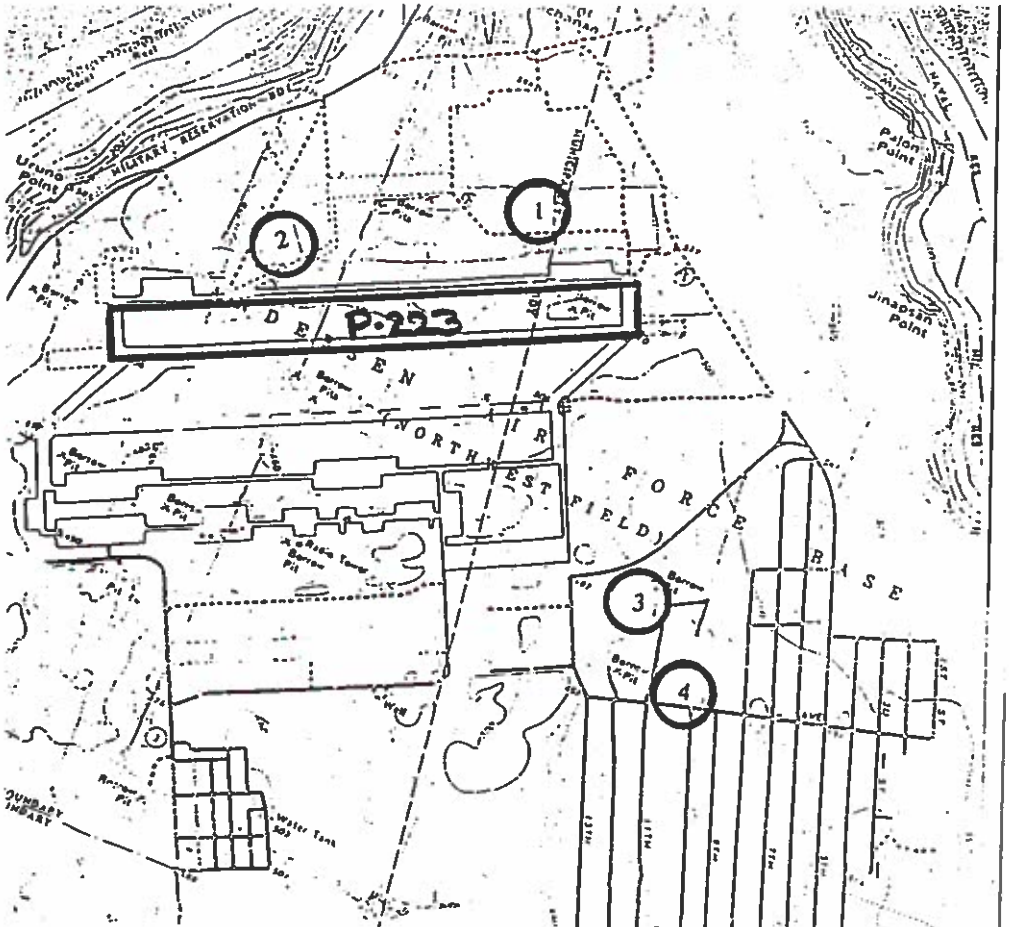
The U.S. Navy has not as yet selected a prime construction contractor for the ROTHR project. However, once selected, the prime construction contractor will be required to develop a snake protocol modeled after the one prepared by Black Micro Construction. Use of a protocol modeled after the Black Micro Construction will ensure that personnel handling high risk cargo in Guam and in CNMI will be familiar with the established inspection and notification procedures. The final protocol for the ROTHR will be established in conjunction with appropriate CNMI and Government of Guam agencies, the prime construction contractor and the U.S. Navy. The prime contractor for operation of the ROTHR systems will also be required to establish a similar snake protocol.





crow nesting activity on Andersen Air Force Base, Guam.

Date	Activity	Location
vember 01, 1988	Nest	Northwest Field (P-223 Site)
tober 26, 1988	Nest	Northwest Field (P-223 Site)
tober/1988	Nest	Conventional Weapon Storage Area
tober/1988	Nest	Conventional Weapon Storage Area
tober/1988	Nest	Conventional Weapon Storage Area
gust/1988	Possible crow fledgling	Northwest Field



Location of Mariana Crow nests on Northwest Field, AAFB, "snakeproofed" since October 1988 by DAWR staff.

From Guam Division Report

United States Department of the Interior

FISH AND WILDLIFE SERVICE
PACIFIC ISLANDS OFFICE
P O BOX 50167
HONOLULU, HAWAII 96850

May 8, 1990

Mr. J. L. Busekrus
Assistant Head, Facilities Planning Department
Pacific Division, Naval Facilities Engineering Command
Pearl Harbor, Hawaii 96860-7300

Dear Mr. Busekrus:

This replies to your May 4, 1990 request for our assistance in updating biological information on endangered species occurring at the proposed P-223 radar project site at Northwest Field, Andersen Air Force Base, Guam. Specifically, you asked if Mr. John Engbring or another biologist from our staff could participate in an upcoming survey of the project site.

Although we fully support your effort to gather the best and most current data available through continued field investigations, we regret that we do not have sufficient staff time to participate in the survey. Mr. Engbring is working almost exclusively in drafting our proposal to designate certain forested areas of Guam as critical habitat for forest birds and bats, and other staff members are equally charged with priority tasks through the remainder of this spring and into the summer.

Thank you for your confidence in our field personnel. Again, I regret that we cannot assist you at this time.

Sincerely yours,

William R. Kramer

for Ernest Kosaka
Field Office Supervisor
Fish and Wildlife Enhancement

K - 19

DEPARTMENT OF THE NAVY
PACIFIC DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
(MAKALAPA, HI)
PEARL HARBOR, HAWAII 96860-7300

11015.4G1
Ser 2432/ 38
17 MAY 1990

Mr. Allan Marmelstein
Pacific Islands Administrator
Pacific Islands Office
U.S. Fish and Wildlife Service
P.O. Box 50167
Honolulu, HI 96850

Dear Mr. Marmelstein:

INTERAGENCY ENDANGERED SPECIES CONSULTATIONS 1-2-88-F-51R AND 1-2-87-F-051, CONSTRUCTION AND OPERATION OF RELOCATABLE OVER-THE-HORIZON RADAR ON TINIAN, COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS, AND GUAM; MILCON P-223

From on-going informal discussions with your office, it is our understanding that the Service is proceeding with preparation of a proposed rule for designation of critical habitat for six endangered species on the Island of Guam. In view of this and in response to advice contained in the December 18, 1989 biological opinion issued under the referenced consultations, the Navy requests technical assistance from your agency in developing conservation recommendations. Specifically, the Navy requests mitigation recommendations for the potential clearing of forest lands which may be included in the area under consideration for designation. Such clearing may result from future Navy construction projects on Guam, including MILCON Project P-223.

The Navy is interested in considering those additional conservation recommendations which could be effective in minimizing the loss of habitat for endangered species. In order to minimize costly delays in project construction and implementation, the Navy would prefer measures which could be undertaken in advance of project commencement. One concept which may have merit is the setting aside and conversion of marginal habitat, such as existing grassland and scrub forest, into more favorable endangered species forest habitat. These restored habitats or habitat banks could be utilized as mitigation for future construction projects located in forest habitat that may be designated as critical habitat.

Your additional technical assistance and recommendations regarding MILCON P-223 are requested. The Navy anticipates continuing to work closely with your agency on this matter. Should any further information concerning this letter be required, please contact Mr. Timothy Sutterfield of our Natural Resources Management Branch at telephone 471-3217.

Sincerely,

P. W. Hiller

P. W. HILLER
Commander
Civil Engineer Corps
U. S. Navy
Head, Facilities Planning Department

APPENDIX L

Biological Opinion
Project P-225

United States Department of the Interior

FISH AND WILDLIFE SERVICE
PACIFIC ISLANDS OFFICE
P.O. BOX 50167
HONOLULU, HAWAII 96850

4 MAY 1990

Commander P. W. Miller
Head, Facilities Planning Department
Pacific Division, Naval Facilities Engineering Command
Pearl Harbor, Hawaii 96860-7300

Dear Commander Miller:

This responds to your October 13, 1989 request for consultation under Section 7 of the Endangered Species Act of 1973 (Section 7). At issue are the possible impacts of the Navy's proposed engineering field survey work relating to the construction and operation of Relocatable Over-the-Horizon Radar Project P-225 on endangered species on Guam and the island of Tinian, Commonwealth of the Northern Mariana Islands (Commonwealth).

Our log number for this consultation is 1-2-90-F-00).

Listed species considered in this opinion are:

On Guam: Mariana crow (Corvus kubaryi)
Mariana fruit bat (Pteropus mariannus mariannus)
Guam broadbill (Myiagra freycineti)
Guam Micronesian kingfisher (Halcyon cinnamomina cinnamomina)

On Tinian: Tinian monarch (Monarcha takatsukasae)

Copies of pertinent materials and documentation are maintained in an administrative record in the U. S. Fish and Wildlife Service (Service) office in Honolulu, Hawaii.

Biological Opinion

It is our biological opinion that your proposal to conduct topographic survey work on the islands of Guam and Tinian as described and referenced in your October 13, 1989 letter to us is not likely to jeopardize the continued existence of any endangered or threatened species. As there are no designated critical habitats for any listed species on either island, there will be no adverse impact on any such habitat.

Description of the Action

The P-225 project is proposed to consist of a radar transmitter on the island of Tinian which will be paired with a radar receiver on the island of Guam. One of the areas under consideration for the Tinian transmitter is called the "Northern Site" in your July 1989 Draft Environmental Impact Statement (Draft Statement); one of the proposed sites for the radar receiver on Guam is referred to as the "NAVCAMS WESTPAC Finegayan" site. Maps of the areas are enclosed. Descriptions of the proposed installations and details of their operation are contained in your October 13, 1989 letter initiating consultation and in the Draft Statement.

A thorough and highly accurate assessment of topography and soil characteristics is required prior to the selection of a final construction site and actual construction of the transmitter and receiver. As requested in your October 13, 1989 letter, this consultation assesses only the impact of those surveys at the P-225 Northern Site on Tinian and at the P-225 NAVCAMS WESTPAC Finegayan location on Guam and not the impacts associated with the construction and operation of the facilities themselves. We recognize that there may be other alternative sites on those islands which may ultimately be selected, and reinitiation of consultation may be required should survey work at other locations be found to affect listed species.

As described in your letter, topographic survey work will require taking systematic ground surface elevation measurements. A 25-foot transect grid is required for accurate visual alignment and subsequent determination of vertical and horizontal distances. Wider trails allowing access for soil testing equipment are also required.

On Guam, it is proposed that the vegetation along the transects be cut to a width of three feet. The cutting will be done with hand tools (including chain saws and possibly other hand-held power tools). In addition, a 15-foot by 50-foot trench will be dug with a bulldozer to expose the soil profile and determine its engineering characteristics. Bulldozer trails approximately 10 feet wide will also be cut to permit access to equipment conducting soil tests. Forty soil borings with a maximum depth of 35 feet will be drilled along the bulldozer trails. Information gained from the bulldozer-related clearing is needed to predict both the ease of leveling the terrain to meet project requirements and other engineering and physical properties of the soil and rock which may affect the efficiency of the antennas.

By your October 13, 1989 estimation, approximately 297,000 linear feet of hand-cut transects are required; these will be approximately 3 feet wide, yielding an area to be cleared by hand of approximately 20.5 acres. The 17,600 linear feet of 10-foot wide bulldozer trails will add approximately 4 acres to be cleared. The total area of transects and bulldozer cuts will equal approximately 24.5 acres. However, subsequent discussions among Mr. William Kramer of this office and Mr. James Chun and Mr. Thomas Egeland of your staff indicated that a considerable portion of the project site consists of very low, grassy vegetation, some of it cut regularly as part of the maintenance of the Naval Communications Station property. This is described in the botanical survey conducted for the P-225 site as "open grassland" and is characterized by vegetation of less than 30 centimeters in height. When

this low vegetation section is deleted from the total area to be surveyed, the amount of area where taller vegetation will have to be cut drops to about 18 acres.

On Tinian, much of the topographic information required is already available, obviating the need to cut the 3-foot transects. Bulldozer trails to allow access to boring sites will, however, be required and will result in a loss of about 0.8 acres of vegetation.

Effects of the Action on Listed Species

On Guam-

The Draft Statement reports that a bird survey was conducted during June 1988 on the northern site for P-225. Vocalizations of at least two individual Mariana crows were heard on two occasions within the site. In addition, vocalizations of one Micronesian kingfisher and one Guam broadbill were heard. The broadbill was last reported prior to this detection in Northwest Field at Andersen Air Force Base in March 1984 and in Barrigada, in central Guam, in September 1984. One Mariana fruit bat was observed near the P-225 site.

-Mariana crow: This bird is endemic to Guam and the island of Rota, Commonwealth of the Northern Mariana Islands. While the population of the bird on Rota appears to be stable and numbers about 1,000, their numbers on Guam have dropped drastically over the past decade. In the June 1989 report "Current Status of the Mariana Crow (Corvus kubaryi) on Guam" (Beck 1989), it states that there are less than 50 left on that island, and that their number appears to be decreasing. At present, crows on Guam are found only in extreme northern Guam. No successful nesting and fledging of young has been verified since 1985. This poor reproductive success is believed to be the result of predation of crow eggs and possibly young crows by the brown tree snake and monitor lizard.

As stated in the Draft Statement's Appendix E (Bird and Mammal Survey, Guam), hearing the calls of two crows in the P-225 area is "significant because it represents a slight range expansion, possibly caused by recent hurricane damage to some areas of Northwest Field where the crows have generally been found during the last few years." No crow nests or other evidence of nesting activity was observed during the 1988 survey.

-Guam Micronesian kingfisher: Although no systematic survey has been conducted on northern Guam for this species since 1981, both anecdotal and confirmed reports of kingfishers document the dramatic decline in the number of the birds during the past decade. The 1984 U.S. Fish and Wildlife report Distribution and Abundance of the Forest Birds of Guam: Results of a 1981 Survey estimated the island-wide population of kingfishers to be 3,022. The report states, "The kingfisher remains one of the most widely distributed of all native species, and presently occupies about 40% of its 1950's range."

The decline in its numbers is well documented. The last confirmed sighting of a kingfisher on Guam was made in August of 1987. An unconfirmed sighting of one kingfisher was made in May 1988, and the June 1988 survey detected the call of one kingfisher in the same general P-225 survey area. To the best of our knowledge, none have been seen or heard since that time anywhere on Guam. The decline is believed to be the result of predation of eggs, young, and possibly adults by the brown tree snake.

-Guam broadbill: The broadbill has suffered a decline in numbers on Guam similar to that of the kingfisher. None have been observed in the wild since 1984, and the hearing of a broadbill call in 1988 is the last reported evidence of their continued existence on the island. As with the crow and kingfisher, the brown tree snake is believed responsible for their decline. The bird is either extinct or exists in extremely low numbers on Guam.

-Marianas fruit bat: In northern Guam, this fruit bat forages and roosts mainly in native limestone forests. Roost sites are characterized by limestone forests within 100 meters of the large 80 to 100 meter tall cliffline that fringes northern Guam. Bats prefer to roost in mature fig trees, although other species of trees are used. No bat colonies or the vegetation normally associated with such a colony are located within or adjacent to the P-225 site. However, surveys conducted for part of the Draft Statement identified one bat feeding or roosting adjacent to the P-225 boundary, and a Guam Division biologist observed a bat in, or very near to, the site in February of this year.

Illegal hunting by poachers and predation by the brown tree snake appear to be the two major causes of the bat's depressed population; hunting bats was outlawed in 1966. In 1984, 500 bats were estimated to exist in northern Guam; all the bats recorded during the surveys were found on Andersen Air Force Base. Lack of habitat does not appear to be implicated in the decline of the bat's population; losses due to poaching by humans and predation by the brown tree snake are responsible for their endangered status. There are sufficient fruit trees and roosting sites available in northern Guam to support a recovered population if illegal taking and the snake are controlled.

Of special consideration in our analysis of the impact of the transect cutting and other survey requirements is that the hand cut transects will be only a few feet wide. We would expect the vegetation to grow back quickly, and any adverse impacts associated with the cutting would be temporary. Taller limestone forest portions of the site would take much longer to heal, as would bulldozer trails. However, the 4 acres to be cleared by bulldozers would represent only a fraction of 1% of the total habitat available to the crow, kingfisher, broadbill, and bat in northern Guam. Based on the information we have concerning the numbers and distributions of the crow, kingfisher, broadbill, and bat on Guam, the reasons for their endangered status, and the impact of the survey-related cutting, bulldozing, drilling, and digging, we have determined that the actions would not be likely to jeopardize the continued existence of any of the four species.

On Tinian-

The only listed species which may be affected by the topographic and soil testing work would be the Tinian monarch. Although tangantangan (Leucaena leucocephala) forest provides the primary habitat for the monarch, the clearing proposed (0.8 acres) will destroy only a small fraction of 1% of this type of vegetation island-wide. Surveys conducted by this Service in 1982 (Micronesian Forest Bird Survey, 1982: Saipan, Tinian, Agiguan, and Rota, 1986) estimated that there were 11,733 monarchs in approximately the northern third of the island, with an island-wide population of 40,000. The loss estimated due to the clearing for the survey work at P-225 would remove about 1/4 of the average habitat area required for one bird. In that the noise and other disturbance created by the bulldozer work in cutting trails will, however, adversely affect a much wider path than the 10 feet actually cut, we would anticipate that up to 24 birds may actually be directly disturbed (harassed) by the proposed activities. We would not expect any adult birds to be injured or killed as a result of the cutting.

While it is impossible to accurately determine the number of nests containing eggs and/or young which may be destroyed due to the transect and access road cutting, based on nesting density, the chances are that no nests will be found on the transect right-of-ways. However, even if several nests were to be destroyed (a loss of far less than 1% of monarch nests island-wide), the impact of this loss on the survival and recovery of the species on Tinian would be negligible . Such a loss would not constitute jeopardy to the continued existence of the species or significantly deter its recovery.

Cumulative Effects

Cumulative effects are those impacts of future local government and private actions which are reasonably certain to occur. A non-Federal action is reasonably certain to occur if the action requires the approval of a local resource or land use control agency, and such agencies have essentially approved the action. Activities that do not require local agency approval must be essentially ready to proceed. Future federal actions will be subject to the consultation requirements established in Section 7 of the Act and, therefore, are not considered cumulative to the proposed action.

A Japanese investment group (Marianas Agupa Enterprises, Inc.) is asking for land on Rota on which to construct a resort community with seven hotels, three golf courses, 1,500 to 2,000 condominium apartments, and a stadium (Guam Business News, July 1989). Although neither the topographic surveys required for P-225 are located on Rota, approximately 1,000 Mariana crows are estimated to be found there. The island of Rota has a total area of approximately 32.8 square miles, including 21.2 square miles of habitat suitable for the crow (Micronesian Forest Bird Survey, 1982: Saipan, Tinian, Agiguan, and Rota 1986). Preliminary descriptions of the project indicate the area required to be about 1,400 acres. If the site for the resort is located entirely within crow habitat on Rota, such a development would destroy approximately 9% of the crow habitat on the island. We cannot estimate the area of the 1,400-acre site which is used by crows, but the area may provide excellent crow habitat. Such a loss would represent a significant decrease in crow habitat on Rota, where the crow population is considered healthy. We do know that some coastal strand vegetation habitat will most likely be destroyed due to the development, and that this type of habitat is used by the crows.

We do not know if any federal authorization may be required which would "trigger" formal Section 7, Endangered Species Act consultation with this Service. To the best of our knowledge, no Commonwealth permit has been issued allowing construction.

In evaluating the significance of such a loss of habitat on Rota to our consultation regarding the topographic survey for P-225, we considered the following:

1. Loss of habitat on Rota will not affect the individual crows remaining on Guam. However, should Rota crows be required as stock for repopulating Guam, a significant decrease in the number of crows on Rota will make it more difficult to take birds from there, negatively affecting the recovery of the species.

2. The drastic decline of crows on Guam is directly attributable to predation by the brown tree snake, not to a loss of habitat. Sufficient habitat remains on Guam to support a fully recovered crow population there.

3. Rota could be invaded and colonized by snakes. Should this occur, it would have the potential for seriously depleting the crow population there. The Rota resort development will diminish crow habitat there by possibly as much as 9%. However, this decrease will not substantially decrease the chances for the recovery of the species on Guam, its recovery there being directly dependent on control of the brown tree snake. While the loss of up to 9% of the crow habitat on Rota may equate to a loss of up to 90 birds (9% of their population of 1,000), the remaining 910 would still be sufficient to support a small-scale reintroduction program on Guam without jeopardizing the Rota population. However, a serious threat to the specie's recovery would likely result should future significant losses of habitat on Rota be sustained.

Incidental Take

Section 9 of the Act prohibits any taking (harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct) of listed species without specific exemption. Under the terms of Section 7(b)(4) and 7(o)(2), taking that is incidental to and not intended as part of the agency action (in this case, take associated with topographic surveys required for P-225) is not considered prohibited within the bounds of the Act provided that such taking is in compliance with the incidental take statement.

On Tinian:

We anticipate that although no adult Tinian monarchs will be injured by the proposed activities, some may be harassed by bulldozer trail cutting and general human activity during the survey. Survey data indicate that there may be as many as 24 individual monarchs in the P-225 site. While the actual survey work will not require the removal of vegetation from this entire area, birds within the site may be harassed due to noise.

We would expect that up to 24 monarchs may be harassed due to noise and other project-related activities. Such harassment would be temporary and we would not expect there to be any associated injury. Additionally, monarch nests in the path of bulldozers would be destroyed. Based on our estimates of nest density, two nests may be destroyed as a result of the survey.

Accordingly, the incidental take allowance is set at 24 birds and 2 nests (including eggs and young they may contain).

The island-wide population of Tinian monarchs is estimated to be about 40,000. In that there may be harassment (not injury or death) of 24 monarchs and destruction of two nests, no jeopardy to the continued existence of the species exists if the maximum anticipated incidental take is reached.

While we would expect that the incidental take level for individual birds may be reached, we would not expect it to be exceeded. This expectation is based on the previously referenced surveys. However, we recognize that it is impossible to determine the exact number of birds which may be taken.

Reasonable and prudent measures are considered necessary or appropriate to minimize the amount or extent of the anticipated incidental take of the species. To minimize the taking of Tinian monarchs on Tinian, you must (1) insure that as little vegetation is removed as is required to complete the project and (2) you must reduce the chances of monarchs being adversely affected by the project.

Terms and conditions are specific actions which must be carried out by the action agency (the Navy) to implement the reasonable and prudent measures. Incidental taking of monarchs is subject to the following terms and conditions, which must be implemented:

a. Project contractors must be made aware of the sensitivity of the area to monarchs and the Navy's commitment to further their conservation. You must insure that the contractor clears or otherwise adversely modifies only the area described in the present project documentation. Additional clearing for such uses as equipment storage, access roads, or other activities which have not been listed in the present project description and have not been subsequently reviewed by this Service as part of our Section 7 consultation are not to be allowed.

b. The Navy, project contractors, or others involved with the project must notify the Chief of the Commonwealth Division immediately upon the discovery of any Tinian monarch injured or killed as a result of the clearing or construction activities. Their telephone number on Saipan is (670) 322-9729. The Commonwealth Division will advise on the handling and disposition of injured or killed birds (such as taking an injured bird to a veterinarian for treatment or how to preserve and forward any dead specimens).

c. This office is to be notified within three days of any project-related injury or death of any Tinian monarch. Our telephone number in Honolulu is (808) 541-2749. A written report of such an incident is to be sent to this office within five days of the incident and will contain such information as the time and date of the incident, how the injury or death occurred, the fate and present location of the bird, the name and telephone number of someone familiar with the incident, and measures implemented to prevent recurrence.

On Guam:

It is possible that during the clearing of the P-225 area crow, broadbill, or kingfisher nests or a roosting Mariana fruit bat may be found. Construction-related activities prior to or during the discovery and identification of these may constitute harassment of those birds, their nests, or the bats.

While we do not expect there to be any crow, broadbill, or kingfisher nests along the transects to be cut for the P-225 survey, it is possible that one may be found. Taking through harassment (not destruction) of one active crow nest (including birds tending or otherwise associated with the nest plus eggs or young) is allowable under this incidental take statement. Accordingly, an incidental take limit of one nest and associated birds and eggs is established.

Taking through harassment (not destruction) of one active kingfisher nest (including birds tending or otherwise associated with the nest plus eggs or young) is allowable under this incidental take statement. Accordingly, an incidental take limit of one nest and associated birds and eggs is established.

Taking through harassment (not destruction) of one active Guam broadbill nest (including birds tending or otherwise associated with the nest plus eggs or young) is allowable under this incidental take statement. Accordingly, an incidental take limit of one nest and associated birds and eggs is established.

Taking through harassment (not physical injury) of up to 3 Marianas fruit bats is anticipated. Accordingly, an incidental take limit of 3 Marianas fruit bats is established. It would be expected that the bat(s) would not remain in a tree for very long before leaving to forage or return to a colony. After the bats leave, clearing activities in the vicinity of the tree(s) can be resumed.

"Harass" in the definition of "take" in the Act is defined in 50 CFR 17.3 (1988) as an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding or sheltering. As applied to this consultation, harassment would include disturbance of listed birds or bats by the activities leading up to the discovery of the birds, their nests, or bats. This would include transect or access road clearing, survey work, soil boring, and related activities.

Whenever the level of allowable incidental take established in this consultation is exceeded, consultation with this Service is to be reinitiated immediately. Any nesting of any of the three bird species is very significant to their recovery.

These levels of allowable incidental take were reached based on the fact that this incidental take allowance does not allow the injury or killing of any bird or bat, but only their initial harassment by personnel or machinery in the vicinity of a nest or roosting bat. As soon as a crow, kingfisher, or broadbill nest or a roosting bat is detected, the human activity in the vicinity of the nest or roost (as specified below) is to cease. We do not anticipate the loss of any bats, birds or their eggs as a result of this incidental take. As such, the allowable incidental take will not jeopardize the continued existence of any of the species.

Reasonable and prudent measures are designed to minimize incidental take. For the P-225 survey work associated with this consultation, reasonable and prudent measures are those which will reduce the probability of the crows, kingfishers, broadbills or bats being harassed, injured or killed by project-related activities. You are to avoid harassment of crows, kingfishers, broadbills, and bats by implementing the following terms and conditions, which are required:

a. Within the month prior to the commencement of vegetation cutting, the area must be surveyed for crow, kingfisher, and broadbill nesting activity. A report of the results of such a survey will be forwarded to the Guam Division and this office.

b. Should crow, broadbill, or kingfisher nesting activity be discovered in the project area before or during transect clearing, all activities other than passive data recording (such as measuring, non-mechanical soil sampling, etc.) within 200 meters of the nest site is to be halted and the Chief of the Guam Division (671-734-3944) and this office (808-541-2749) are to be notified. A decision will be made at that time as to how to avoid harassment of the birds until the nesting activity ceases. Upon cessation of nesting activity, construction may be resumed. (For the purposes of this Incidental Take section, cessation of nesting activity means either the destruction of the nest by "natural" causes with no attempt to renest within two weeks or abandonment of the nest by the adults.)

c. Should roosting bats be found in the P-225 area, activities within 50 meters of the roost shall cease. Survey-related activities may begin again after the bat(s) has/have left.

d. Your proposal states that a total of 25 acres are required for the transects; much of this is in areas not used by the species under consideration, decreasing the amount of forested area required to, perhaps, 18 acres. This amount of cutting is not to be exceeded. Transects are not to be cut or otherwise cleared to widths greater than those indicated in the project documentation you have provided us. Should it be found that more than 18 acres of forest is cut or otherwise physically disturbed, all further clearing is to be halted pending reinitiation of consultation with this Service.

Conservation Recommendations

Section 402.02 (Definitions) of Section 7 of the Act states that discretionary measures which would serve to minimize or avoid adverse effects of a proposed action on listed species or critical habitat may be recommended.

1. Cut as little vegetation as is needed to reach project requirements. Past experience with contractors has shown that they must be closely monitored to insure that transects are kept to the minimum widths and lengths specified.

2. Whenever possible, avoid cutting larger trees unless absolutely necessary to achieve survey requirements. If trees lie in the transect or access roadway, attempts should be made to work around them.

This concludes formal consultation on this action. As cited in sub-section 402.16 of Section 7, reinitiation of formal consultation is required and shall be requested by the Federal agency (Navy) or by this Service, where discretionary Federal involvement or control over the action has been retained or is authorized by law and:

a. If the amount or extent of taking specified in the incidental take statement is exceeded;

b. If new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered;

c. If the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion; or

d. If a new species is listed or critical habitat designated that may be affected by the identified action.

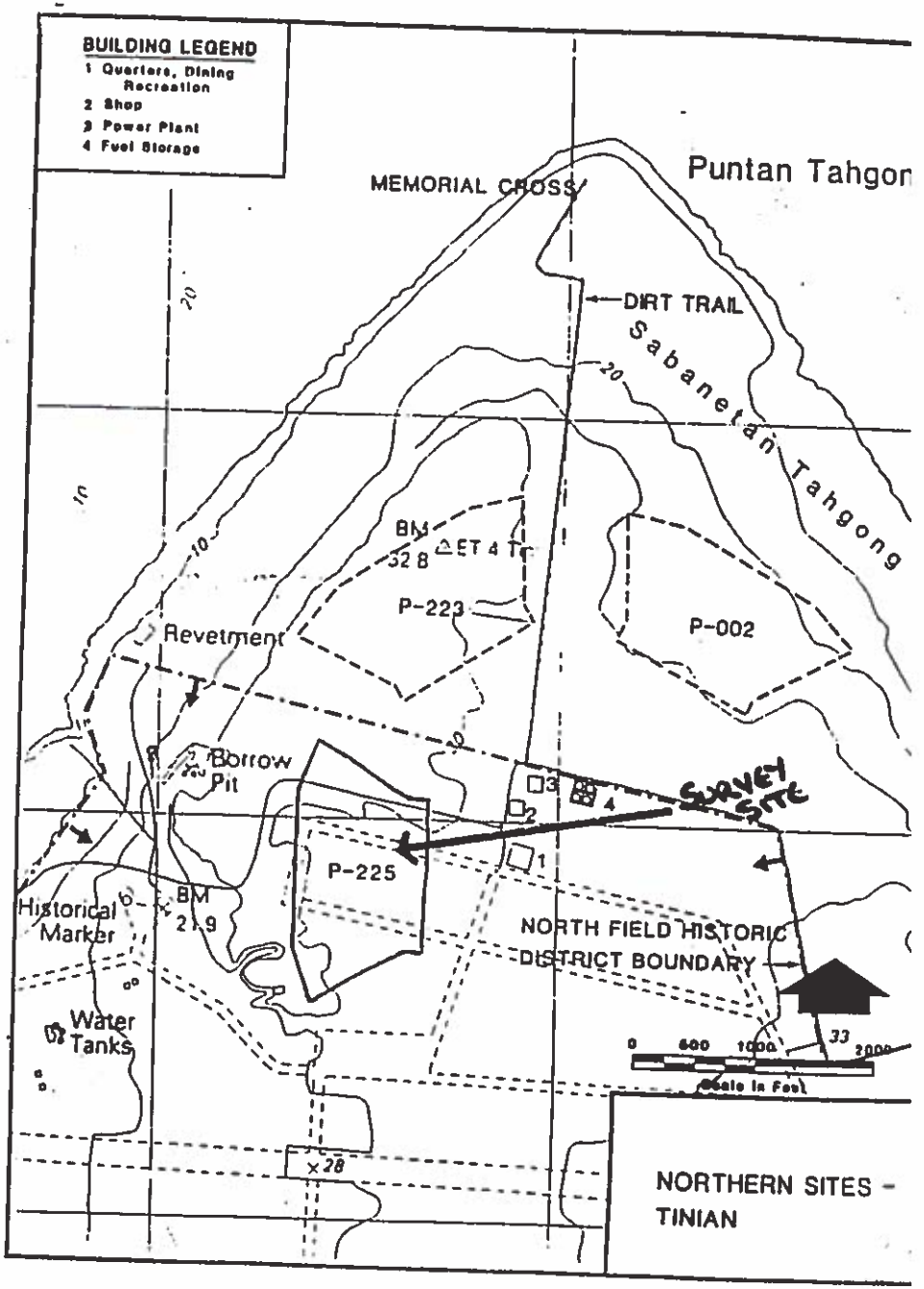
Portions of Guam including the project site are under consideration for designation as critical habitat. If and when a proposal for designation of critical habitat is published, and if you determine that the project may affect that proposed critical habitat, you are required to confer with this Service as directed by Section 7. We may then recommend measures which may be taken to reduce or eliminate the impact to the proposed critical habitat. Should a final designation be made, you must reinitiate consultation if the project may affect such designated critical habitat.

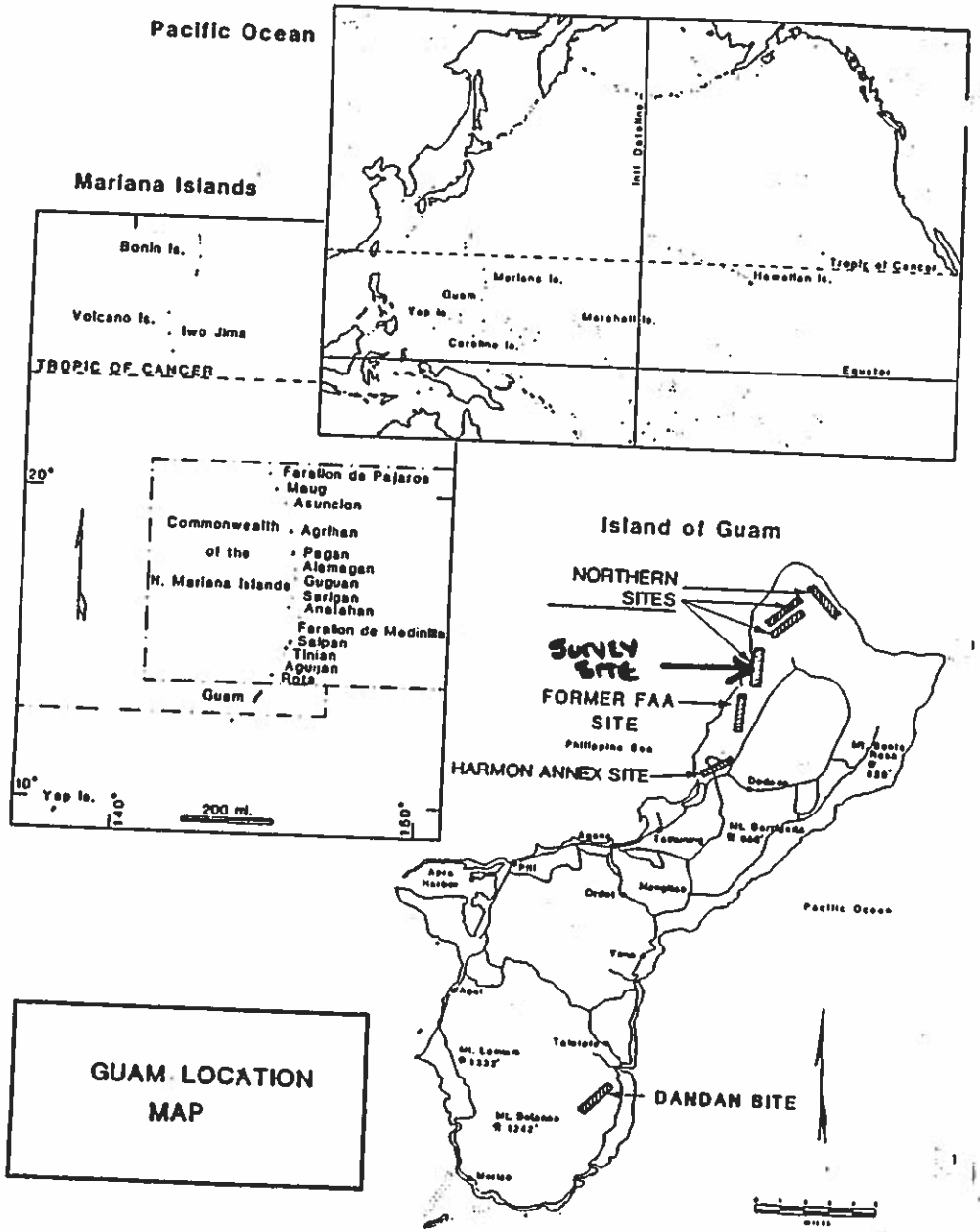
Sincerely yours,

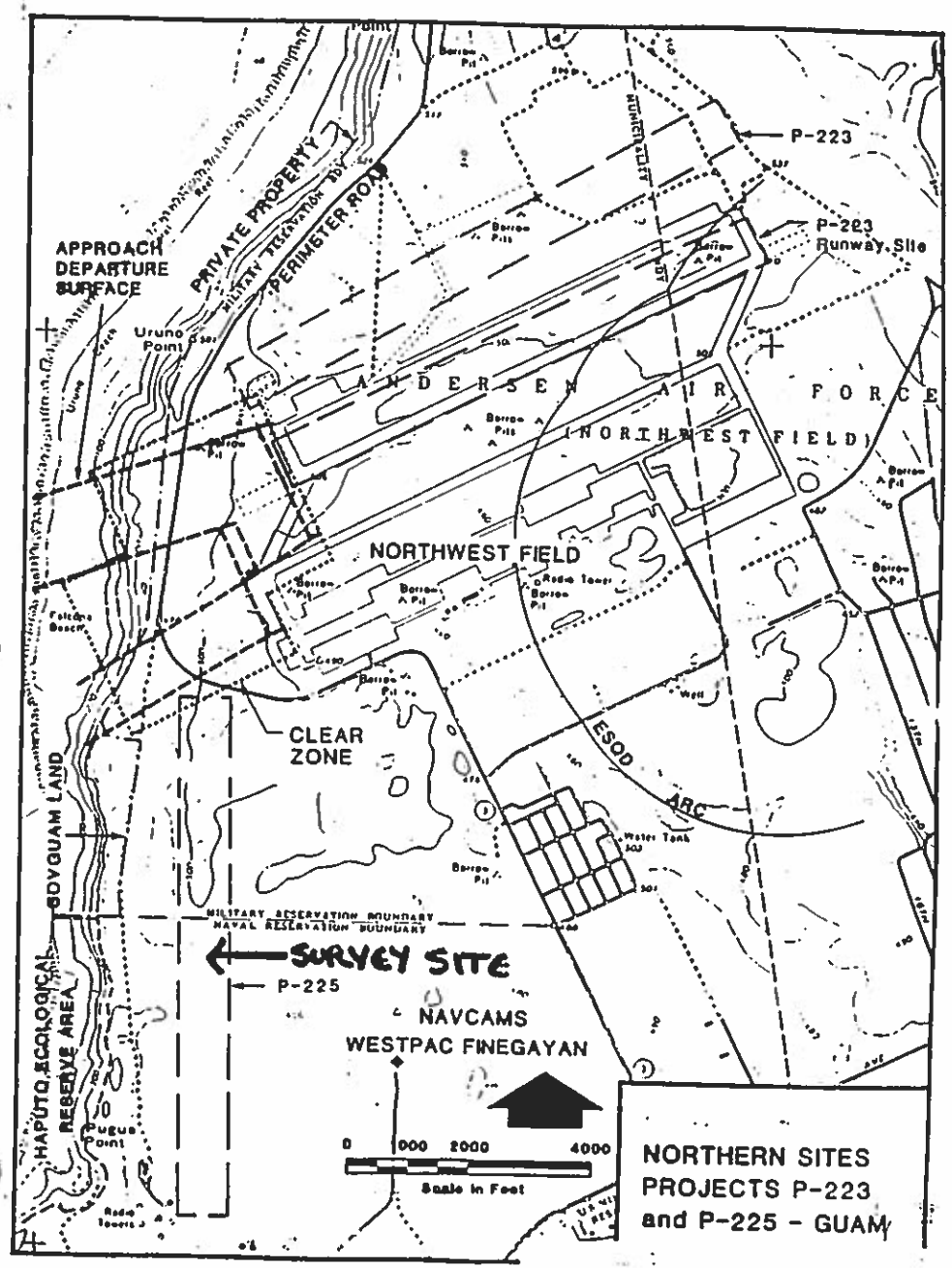
for Ernest Kosaka
Field Office Supervisor
Fish and Wildlife Enhancement

Enclosures (four site location maps)

cc: Assistant Regional Director - Fish and Wildlife Enhancement, Region 1, Portland, Oregon




Pacific Ocean
Mariana Islands
Bonin Is.
Volcano Is.
Iwo Jima
TROPIC OF CANCER
Marcus Is.
Guam
Yap Is.
Caroline Is.
Marshall Is.
Hawaiian Is.
Tropic of Cancer
Equator
Farallon de Pajaros
Maug
Asuncion
Commonwealth of the N. Mariana Islands
Agrihan
Pagan
Alamagan
Guguan
Sarigan
Anatahan
Farallon de Medinilla
Saipan
Tinian
Aguijan
Rota
Guam
20°
10°
140°
150°
200 mi.
Yap Is.
Island of Guam
NORTHERN SITES
SURVEY SITE
FORMER FAA SITE
HARMON ANNEX SITE
DANDAN SITE
Philippine Sea
Pacific Ocean
Apra Harbor
Agana
Tamuning
Dededo
Mt. Barrigada
Mt. Santa Rosa
Ordot
Mangilao
Yona
Inarajan
Talofofo
Mt. Lamlam
Mt. Bolanos
Merizo
GUAM LOCATION MAP


APPROACH DEPARTURE SURFACE
PRIVATE PROPERTY
MILITARY RESERVATION BOUNDARY
PERIMETER ROAD
P-223
P-223 Runway Site
Uruno Point
ANDERSEN AIR FORCE
(NORTHWEST FIELD)
NORTHWEST FIELD
CLEAR ZONE
ESOD ARC
GOVGUAM LAND
HAPUTO ECOLOGICAL RESERVE AREA
MILITARY RESERVATION BOUNDARY
NAVAL RESERVATION BOUNDARY
SURVEY SITE
P-225
NAVCAMS WESTPAC FINEGAYAN
Pugua Point
0 1000 2000 4000
Scale in Feet
NORTHERN SITES PROJECTS P-223 and P-225 - GUAM

APPENDIX B-1

Bird and Mammal Survey (Tinian)

A Bird and Mammal Survey of Proposed Support Facility Sites Tinian, CNMI

March 31, 1990

Maile A. Kjargaard
P.O. 476
Volcano, Hawaii 96785

Introduction

The following report provides the results of a two-day faunal survey of three sites on the island of Tinian, Commonwealth of the Northern Marianas Islands. The sites are located on the northwestern side of North Field and altogether total about 50 acres in area.

This study was performed to provide information for a supplement to the DEIS for the Electronic Installation projects proposed on Guam and Tinian. The three Tinian sites are to be used for the construction of support facilities for the nearby electronic installation.

Site Location and Land Use History

The study area lies on the upper part of Sabanetan Tagong at an elevation of approximately 30 m (see map, Figure 1). Two sites (1 and 2) are small (300' by 750') contiguous parcels whose long axes are parallel to the access road. Site 3 is located roughly one-third of a mile to the east and is the largest of the three sites (750' by 1300').

Although the area is presently vacant, it has been extensively used in the past. Much of the island's original forest was probably first modified by a sizeable pre-contact Chamorro population (Fosberg 1960). Soon after spanish contact, the island was depopulated, and remained sporadically and sparsely inhabited for almost the next three centuries. Peattie 1988, Farrell 1989). Pigs, goats, and cattle were introduced by the Spaniards, and large feral populations of these animals were established by the end of the eighteenth century; feral dogs were present in large numbers by 1886. Human activity on the island during this period was limited to exploitation of its feral animal stocks and an occasional short-lived commercial ranching venture (Farrell 1989).

Major land use changes took place after the Japanese mandate, when much of Tinian was converted to sugar production (Peattie, 1988). By 1939, 15,000 acres were under cultivation; the prewar population of Tinian peaked in 1940 when nearly 15,000 people resided on the island. North Field was constructed in 1939-40, supplanting part of the cultivated land on the north end of the island.

The American invasion of Tinian, accompanied by heavy naval bombardment and scorching napalm bombs, completely devastated the island's landscape. After the invasion, Tinian was transformed into a major airbase, with two airfields, 90 miles of roads, and a military population of 150,000.

With demobilization at the conclusion of the war, much of the island fell into disuse and rapidly reverted to a rural state. Because of concerns about the potential for heavy erosion and loss of watershed in areas denuded by wartime activity, Iangan-tangan (Leucaena leucocephala) was aerially dispersed into these areas shortly after the war. This rapidly growing shrub now forms a virtual monoculture in places where it was seeded, including the northern part of the island.

Profound habitat changes resulted from these human activities. By the end of World War II, at least 90 of the island's 100 square km had been deforested. Little forest bird habitat remained, thus greatly reducing population sizes of these species. With increased forest cover since the end of the war, many of these species have greatly increased in number.

Endangered and Threatened Species

Table 1 lists those bird and mammal species on Tinian that have or may require federal protection under the Endangered Species Act.

Five bird species on Tinian are listed by the U. S. Fish and Wildlife Service as endangered or threatened (Federal Register 1970, 1984, 1987. Although it was previously given endangered status, the Tinian Monarch (Monarcha takatsukasae) was reclassified as a threatened species in 1987 (Federal Register 1985, 1987).

No mammal species on Tinian are listed as endangered by the USFWS. Two Mariana species are classified as candidate endangered species, indicating that they may require future protected status. Until more information on abundance and distribution becomes available, however, no further action will be taken.

Previous surveys near the present study site (Jenkins and Aguon 1981, Hawaiian Agronomics 1985, Engbring et al. 1986, Freed 1986) have detected only the Tinian Monarch in the area. A number of the endangered species have specialized habitat requirements that make it unlikely that they would utilize the habitat in the study area (Table 1).

Survey Methods

Two observers spent a total of 12.5 hours at the study area (25 man-hours of survey time). Weather conditions during the survey were ideal: partly cloudy skies with northeast tradewinds from 5 to 15 mph and no precipitation. Temperatures ranged from about 75 F (at pre-dawn) to 90 F (at noon). Observations were suspended at midday when avian activity was reduced.

We performed transect counts both along roads and within each of the three sites (Figure 1). While trail-blazing, accurate lengths of the transects were measured using hip-chain along pre-determined compass headings. Birds were identified visually and from vocalizations. Nesting activities were noted as they were observed in the course of transect counts.

No specific trapping regime was performed to determine mammal densities at the study site. Mammals and indirect evidence of their presence (such as digging, tracks, or scat) were noted during bird transect counts.

Results

A. Faunal Habitats

A single faunal habitat was present throughout the three sites, consisting of a closed canopy Tangan-tangan scrub forest 12 to 15 feet in height with an understory of Tangan-tangan seedlings, grasses, and mixed herbs. Occasional emergent Casuarina trees were present in all three sites. Small open areas were common in sites 1 and 2; these were generally overrun with Mikania vines, but frequently they contained wild Papaya (Carrica papaya) as well. The uniform nature of the habitat in this portion of Tinian is easily seen in Photo 1.

B. Summary of Significant Findings

Table 2 lists the twelve bird and two mammal species detected during the survey. Only one of these (the Tinian Monarch) is a federally listed species. The Monarch was the second-commonest bird species in the area,

and was quite common throughout the study area. One active nest of this species was found 20 m from the access road in site 3 (see figure 1).

Avian species diversity and density estimates for the site are consistent with those reported for previous surveys of the general area (Owen 1974, Hawaiian Agronomics 1985, Engbring et al. 1986, Freed 1986). The absence of the White-throated Ground-dove during this survey is probably not significant as it reflects the limited resources available to this species in closed-cover Tangan-tangan habitats. Freed (1986) found only one individual in an adjacent area; certainly this species has not been abundant in the area in recent times.

Two mammal species were found during the survey: feral pig activity was present in site 1, and a single house mouse (Mus musculus) was seen in site 3. No bats were detected.

C. Annotated Bird Species List

The following list includes information on the status, distribution, and relative abundance of bird species found during the survey. Nomenclature and English common names follow Engbring and Pyle 1985 or Pratt et al. 1987; Chamorro common names are from Segal (1984).

Notes on distribution, habitat preferences, and behavior are from Mayr 1945, Baker 1951, Pratt et al. 1987, and my own field observations.

An asterix before an entry indicates endangered or threatened status. The status of each species is indicated by abbreviations as follows: R=resident breeding species, native; RA=resident breeding species, alien; and M=migratory species.

FAMILY ARDEIDAE (Herons, Bitterns, and Egrets)

Yellow Bittern, Kakag (Ixobrychus sinensis), R, Uncommon.

This small Bittern is native and fairly common from India to the eastern part of Micronesia. It is often found in densely vegetated areas were it feeds on insects and small vertebrates.

Bittern were found in all three sites, most often in the early hours of the morning when a number of small groups were seen in flight. Later in the day, individuals were occasionally seen foraging along roadsides or in small clearings.

FAMILY PHASIANIDAE (Francolins, Pheasants, Quail)

Red Junglefowl (Gallus gallus), RA, Uncommon

This species was dispersed throughout the Pacific by indigenous populations and is virtually indistinguishable from early varieties of the domestic chicken.

A number of Junglefowl were found during the survey. They were consistently detected in the northern portions of sites 2 and 3.

FAMILY CHARADRIIDAE (Plovers)

Lesser Golden Plover, Dulili (Pluvialis dominica), M, Uncommon

This is a common migratory species throughout the Pacific where it is found in coastal areas, in wetlands, and along roadsides and in grassy areas.

Few Plover were found during the survey. Several were seen in flight early in the morning, and some had feeding territories in roadsides bordering the study sites.

the frequency of territorial interactions suggested that the birds were breeding in the area. This impression was confirmed when we found an active nest in site 3.

Rufous Fantail (Riphidura rufifrons), R, Abundant

The Rufous Fantail occurs from Australia north to Yap and the Northern Marianas Islands. It is an active bird, foraging in the forest understory for insects, which it catches on the wing.

Although this species was less abundant than the Monarch, it was present in each of the three sites. It was much more abundant in site 3 than in the two smaller sites.

FAMILY STURNIDAE (Starlings and Mynas)

Micronesian Starling, Sali (Aplonis opaca), R, Common

A number of Starling species are native to the Pacific, and while they belong to a different genus than the familiar European Starling, they share many of its traits. The Micronesian Starling is generally arboreal, and feeds on insects and fruit. It is an adaptable bird and can be found in a wide range of habitats. Like most members of the group, it is highly social and is often seen in noisy flocks.

Although not as abundant as the White-eye or the two Musicapid species, the Starling was an obvious resident of all the sites. They were frequently observed vocalizing from exposed perches or chasing conspecifics. Small flocks of up to 8 individuals were seen overhead, particularly in the cooler part of the day.

B-1-3

FAMILY MELIPHAGIDAE (Honeyeaters)

Cardinal Honeyeater, Egigi (Myzomela cardinalis saffordi) R, Rare

The Cardinal Honeyeater in the Mariana Islands is one of several closely related subspecies that are found throughout much of the southern Pacific. The different species vary in plumage but share many behavioral traits. They are found in a variety of habitats including forest edges, plantations, and roadsides, where they feed on both nectar and insects.

Only three Honeyeaters were found during the survey, all during early morning hours. They were unusually quiet and inconspicuous; only one of the birds was detected on the basis of its vocalizations.

FAMILY ZOSTEROPIDAE (White-eyes)

Bridled White-eye, Hosa (Zosterops conspicillatus), R, Abundant

This species is one of a complex of White-eye species found throughout the South-west Pacific. The species in the Mariana Islands was probably derived from an asian ancestor, and shares a number of behavioral traits with continental species. Their flock calls and relatively complex songs bear a distinct resemblance to those of the Japanese White-eye (Z. japonicus).

The Bridled White-eye is found in both forests and shrubby areas. It is an opportunistic feeder, taking insects, fruit, and nectar.

The Bridled White-eye was by far the commonest bird species in the study area: it was at least three times more abundant than any other bird species found during the survey. White-eyes were active throughout the day, and were observed both singly and in small, vocal groups. Small

FAMILY LARIDAE (Gulls and Terns)

Common Fairy Tern (Gygis alba), R, Common.

This pantropical seabird nests and roosts in forested areas or in low vegetation when no trees are available.

Fairy Terns were seen in flight over all three sites, and were a common sight even during the hottest part of the day. Several pairs appeared to be site specific and their behavior suggested that they were breeding in the vicinity.

FAMILY COLUMBIDAE (Doves and Pigeons)

Philippine Turtle-Dove, Paluman Senesa (Streptopelia bitorquata), RA, Common.

This species is native to the Philippines and was introduced to the Marianas in the 1700's. It is a ground feeding dove found in a variety of habitats.

Turtle-doves were consistently seen on the dirt road that forms the western boundary of site 2, as well as in the vicinity of fruiting Papaya in all sites. They were least common in site 3.

Mariana Fruit Dove, Totot (Ptilinopus rosaecapilla), R, Rare.

The Mariana Fruit Dove is typically a bird of dense forests where it feeds in the canopy of Ficus and other fruiting trees. It was only detected twice in the study area, once each in sites 2 and 3. The habitat in the study area is generally unsuitable for Fruit Doves, so the low number of detections is to be expected. There may be some seasonal variation in the number of Fruit Doves in the area, depending on the phenology of the few Ficus at the site.

FAMILY ALCEDINIDAE (Kingfishers)

Collared Kingfisher, Sihig (Halcyon chloris albicilla), R, Common

The Collared Kingfisher is a widespread tropical species, occurring from the Red Sea east to the Pacific. H. c. albicilla is endemic subspecies to Tinian and Saipan. It is a forest-dwelling Kingfisher that preys on a wide variety of small animals such as insects, lizards, and small birds.

Small numbers of this species were found at all the sites; they were most vocal and frequently detected in the early part of the day.

FAMILY MUSICAPIDAE (Thrushes, Flycatchers, and Old World Warblers)

*Tinian Monarch (Monarcha takatsukasae), R, Abundant

This species is endemic to the islands of Tinian and Agiguan. It was recently removed from the endangered species list (Federal Register 1987) but still retains federal protection as a threatened species. Although the Monarch is abundant in the forested parts of the island, its status as a protected species was justified by its limited distribution and the potential threats of Leucaena defoliation by introduced insects and of the introduction of the predatory brown tree snake. At present, the estimated population size is 39,000 birds.

This species is insectivorous, capturing both sedentary and flying prey.

Monarchs were the second most common species in the study area, and were abundant in all areas we surveyed. High rates of vocalization and

groups of White-eyes were seen being chased by Tinian Monarchs on two occasions. No breeding activity was observed, although old nests were found in each of the sites.

Table 1. List of endangered or threatened species on the island of Tinian, CNMI.

Species	Status*
BIRDS	
Common Moorhen (*Gallinula chloropus guami*) Wetland species; no appropriate habitat at site.	E
Mariana Mallard (*Anas platyrhynchos*) Wetland species; no appropriate habitat at site. Not seen since 1979, believed extinct (Hawaiian Agronomics 1985, Engbring et al. 1986).	E
Micronesian Megapode (*Megapodius laperouse laperouse*) Single individual seen near Maga 1984 (Wiles et al. 1987); Natural interisland recolonization likely (Pratt and Bruner 1978, Wiles et al. 1987) Prefers limestone forest habitats on Tinian (Wiles et al. 1987).	E
Island Swiftlet (*Aerodramus vanikorensis bartschi*) Nests and roosts in caves (Jenkins 1983); no approriate habitat at site.	E
Tinian Monarch (*Monarcha takatsukasae*) Common at survey site.	T
MAMMALS	
Marianas Fruit Bat (*Pteropus mariannus mariannus*) Seen near cliffs on S. coast, 1979 (Wheeler 1980); Less than 25 on island, 1984 (Wiles et al 1989). No recent detections near site (Hawaiian Agronomics 1985, Engbring et al. 1986, Freed 1986).	CE
Sheath-tailed Bat (*Emballonura semicaudata*) Hypothetical for Tinian (Freed 1989)	CE

*E=Endangered
CE=Candidate Endangered
T=Threatened

Table 2. Numbers of bird and mammal species detected at support facility sites, Tinian, CNMI.

SPECIES	SITES 1	2	3
Birds			
Yellow Bittern (Ixobrychus sinensis)	2	3	3
Red Junglefowl (Gallus Gallus)	-	5	2
Lesser Golden Plover (Pluvialis dominica)	2	3	3
Common Fairy-tern (Gygis alba)	4	3	4
Philippine Turtle-dove (Streptopelia bitorquata)	9	11	2
Mariana Fruit Dove (Ptilinopus roseicapilla)	-	1	1
Collared Kingfisher (Halcyon chloris albicilla)	2	3	10
Tinian Monarch (Monarcha takatsukasae)	7	22	39
Rufous Fantail (Rhipidura rufifrons)	3	9	21
Micronesian Starling (Aplonis opaca)	3	7	11
Cardinal Honeyeater (Myzomela cardinalis saffordi)	-	2	1
Bridled White-eye (Zosterops conspicillatus saypani)	32	74	101
Mammals			
House Mouse (Mus musculus)	-	-	1
Feral Pig (Sus scrofa)	1	-	-

Figure 1. Oblique aerial view of the Tinian Airfield site. Note the continuity of the Tinian Forest habitat through all the field sites.



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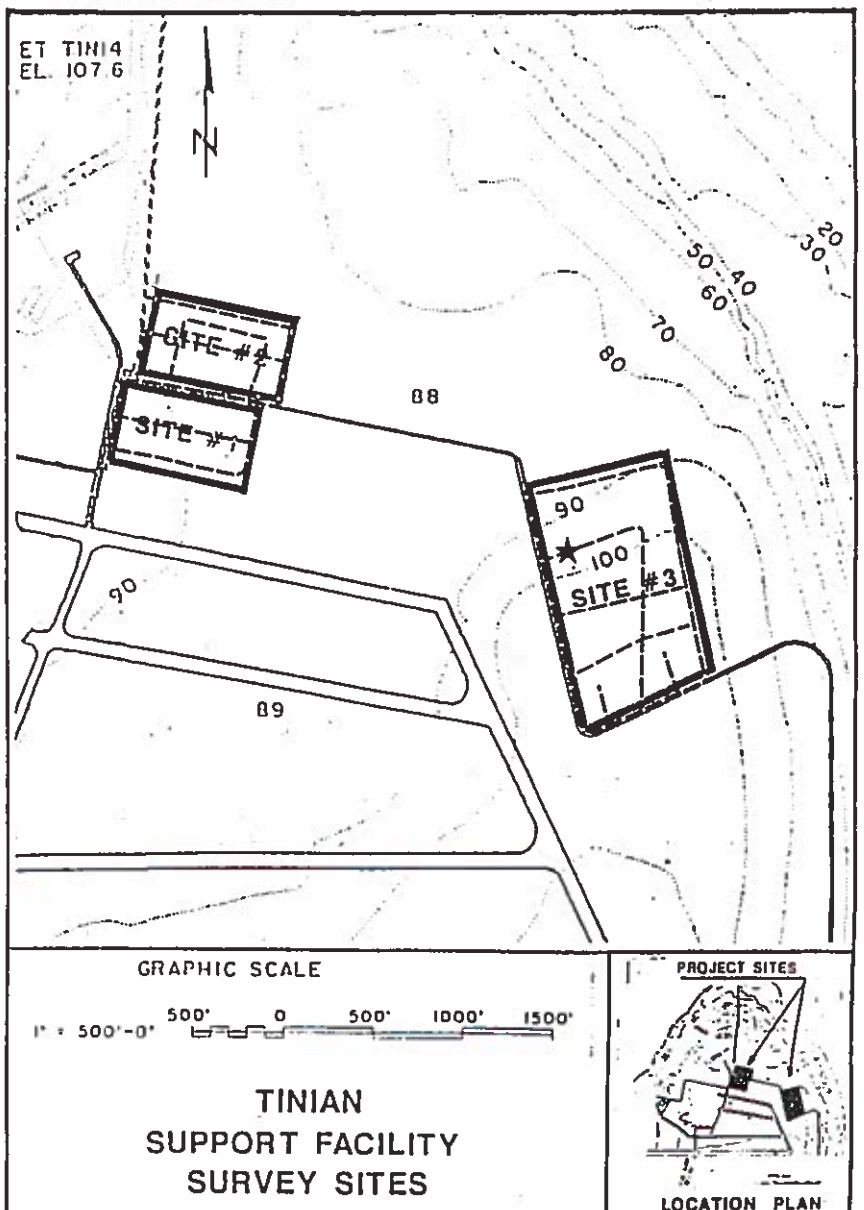
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Figure 1. Map of Tinian Study Area, Survey Areas (Dashed Lines), ★= Tinian Monarch Best Site



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APPENDIX C-1

Botanical Survey (Tinian)

BOTANICAL SURVEY REPORT OF TINIAN ANCILLARY SERVICES SITE

Prepared for Wilson Okamoto and Associates
Honolulu, Hawaii

by
Evangeline J. Funk Ph.D.
March 1990

C-1-1

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INTRODUCTION

During March 6th and 7th, 1990, a botanical survey was conducted on 50 acres of land located in the Sabanetan Tohgong section of Tinian, an island which is essentally a terraced platform of elevated reef limestone. The study area is composed of three small parcels, the largest (Site 1, Figure 1) consists of 25 acres and the two smaller parcels (Sites 2 and 3, Figure 1) are 12 acres each. Because of the homogeniety of the vegetation in the area, the three parcels will be referred to as "the study site".

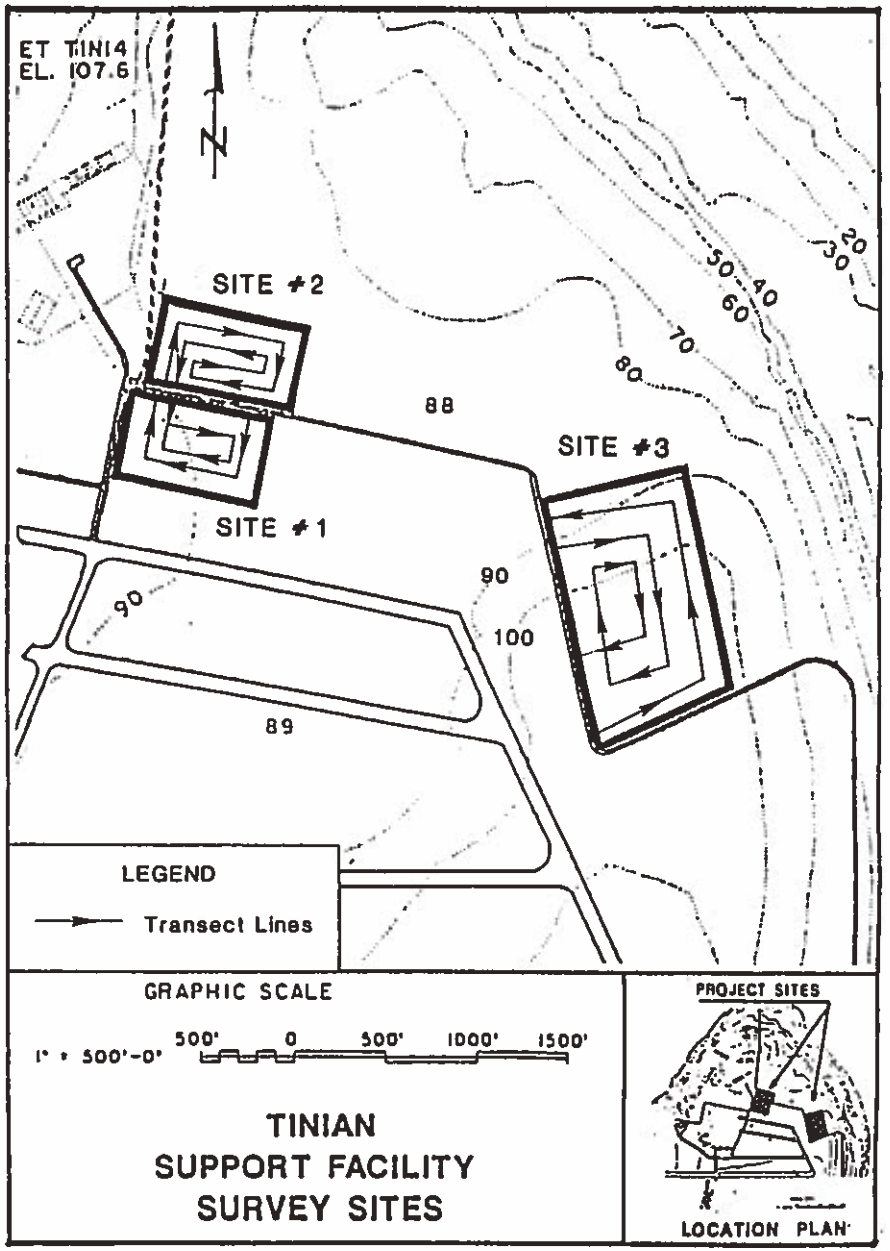
The purpose of the botanical survey was to determine if any US Government candidate, proposed or listed, threatened or endangered species are found on the site (USFWS 1989), to describe and map the vegetation and to prepare a species list of all taxa found on the site at the time of the survey.

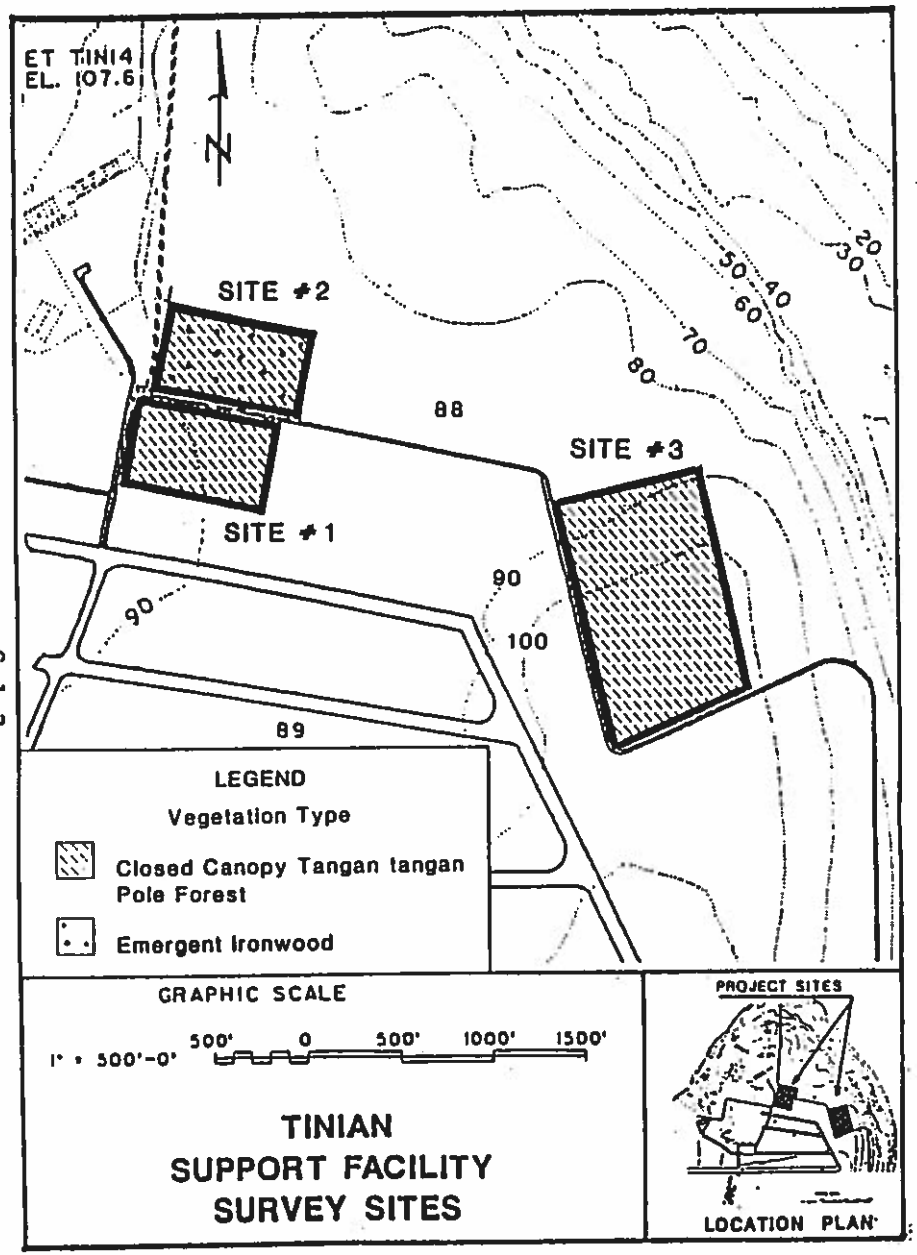
BOTANICAL HISTORY

Both Fosberg (Fosberg 1960) and Stone (Stone 1970-71) have published lengthy reviews on the early botanical history of the island of Tinian. A more recent overview of the flora and fauna of the island is contained in the US Navy commissioned inventory report completed in 1985 (Hawaiian Agronomics 1985). Ecological information (Owens 1974) and soil classifications (Sahara and Yamada 1973) have been collected and are available either at Hamilton Graduate Library of the University of Hawaii or at the Pacific Division, US Navy Library, Pearl Harbor, Hawaii.

METHODS

Data for the survey were collected by way of peripheral as well as cross site transects (Figure 1). All parts of the parcels were surveyed and all taxa encountered were recorded. Notable floristic and topographic features were noted. Twentyfour manhours were devoted to data collection on the site.





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VEGETATION TYPE

A single vegetation type, Closed Canopy, tangan-tangan (*Leucaena leucocephala* (Lam.) de Wit), pole forest i.e. closely spaced, small diameter tangan-tangan trees, 12 to 20 feet in height, was found on all parts of the study site (Figure 3). Some minor varations were noted (Figure 2.)

The shortest stature tangan-tangan was found on parcel 1. The plants averaged one to four feet apart and in some places the canopy was down (Figure 4). In these open areas, dense stands of vines and undergrowth have become established. Mile-a-minute vine (*Mikania scandens* (L.) Willd.), passion flower vines (*Passiflora foetida* L. and *P. suberosa* L.), Alalag (*Operculina ventricosa* (Bert.) Peter) and bitter melon or almogosa (*Mormodica charantia* L.) are the most common. In the understory, large numbers of chili pepper (*Capsicum frutescens* L.), lantana (*Lantana camara* L.), and other weedy plants have become established.

A few native plants such as banago (*Jasminium marianum* DC) and lada (*Morinda citrifolia* L.) are also found in the understory.

On Site 2, the tangan-tangan trees were a little more widely separated and averaged 15 to 18 feet in height. The general aspect of the vegetation was open with the ground layer made up of tangan-tangan seedlings and scattered forbs (non-woody plants) (Figure 5). Here again, doni-sali or chili pepper (*Capsicum frutescens* L.) was an important part of the ground layer. The open aspect of Site 2 was probably due to the presence of widely scattered, emergent, gagu or ironwood trees (*Casuarina equisetifolia* L.), forty to fifty feet in height.

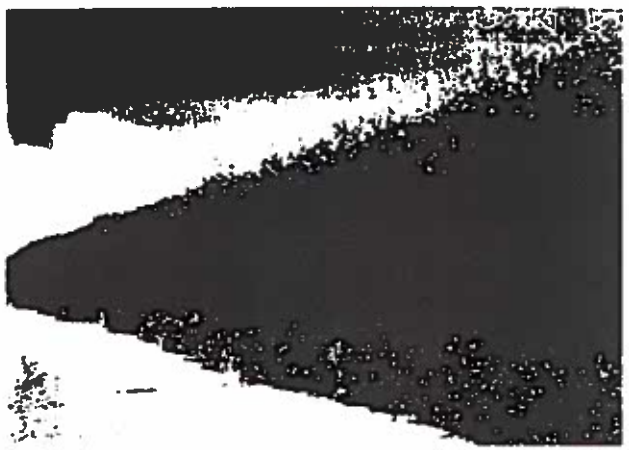


Figure 3. This type of Closed Canopy Tangan-tangan Pole Forest was found in all parts of the study site.

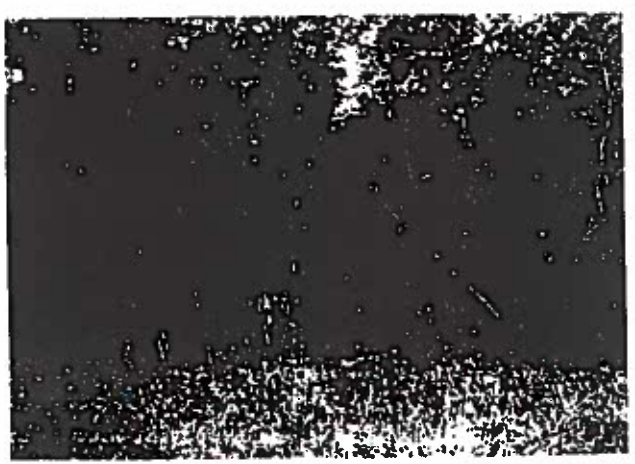


Figure 4. Weeds flourish where the canopy is thin.

The same closed canopy, tangan-tangan pole forest, with individual trees twelve to fifteen feet in height was found on site 3. Stems varied from seedlings to 5 inches in diameter at the base. One large Nunu or banyan tree (*Ficus prolixa* Forst.), several Formosan koa (*Acacia confusa* Merr.) and Trongkon-mames or Siris trees (*Albizia lebbeck* (L.) Bentham) were also found on this parcel (Figure 6).

In addition to the large banyan, several other native species were found. They include Qualitay or Callicarpa (*Callicarpa candicans* (Burm. f.) Hochr.), Aplokating (*Psychotria mariana* Bartl. ex DC), Agatelang (*Eugenia palumbis* Herr.), and Alom (*Melanolepis multiglandulosa* var. *glabrata* (Muell.-Arg.) Fosb.

ENDANGERED SPECIES

No proposed, listed or candidate threatened or endangered plant species were found on this site (USFWS 1989).

CONCLUSIONS

The vegetation cover of this site is composed of ninty-two plant species from twenty plant families. By far the greatest number (80%) of these species have been introduced to Tinian. Seventeen percent are in the grass family. The remaining thirty-three percent, those native to the Marianas Islands, are commonly found on the island.



Robust Tangan-tangan shades out understory plants, Site 3.



Larger Siris trees shade out Tangan-tangan, Site 3.

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SPECIES LIST

The plant families in the following species list have been alphabetically arranged within four groups, Ferns, Gymnosperms, Monocotyledons, and Dicotyledons. The genera and species are arranged alphabetically within families. The taxonomy and nomenclature follow that of Fosberg, Sachet & Oliver (1979, 1982, 1987) and Stone (1970-71). For each taxon the following information is provided:

1. An asterisk before the plant name indicates a plant introduced to Tinian since Magellan or by the aborigines.
2. The scientific name.
3. The Chamorro name and or the most widely used common name.
4. Abundance ratings are for this site only and they have the following meanings:

   Uncommon - a plant that was found less than five times.

   Occasional - a plant that was found between five to ten times.

   Common - a plant considered an important part of the vegetation

   Locally abundant - plants found in large numbers over a limited area. For example the plants found in grassy patches.

This species list is the result of an extensive survey of this site at the beginning of the rainy season (March 1990) and it reflects the vegetative composition of the flora during a single season. Minor changes in the vegetation will occur due to introductions and losses and a slightly different species list would result from a survey conducted during a different growing season.

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CHECKLIST OF PLANTS FOUND IN NORTHERN TINIAN - MARCH, 1990

SCIENTIFIC NAME	COMMON NAME	ABUNDANCE
FERNS		
POLYPODIACEAE		
Polypodium scolopendria Brum f	Laua'i	Occasional
ANGIOSPERMS		
MONOCOTYLEDONES		
GRAMINEAE - Grass Family		
**Cenchrus echinatus* L.	Laso cato	Occasional
**Chloris inflata* Link	Finger grass	Occasional
**Cynodon dactylon* (L.) Pers.	Grama	Locally abundant
**Dactyloctenium aegyptium* (L.) Beauv.	Crowfoot grass	Locally abundant
**Digitaria violascens* Link		Uncommon
**Eleusine indica* (L.) Gaertn.	Ragi	Locally abundant
**Eragrostis ciliaris* (L.) R. Br.		Locally abundant
**Eragrostis tenella* (L.) R. & S.	Lovegrass	Locally abundant
**Panicum maximum* Jacq.	Guinea grass	Locally abundant
**Paspalum orbiculare* Forst. f.		Occasional
**Paspalum paniculatum*		Common
**Pennisetum polystachyum* (L.) Schultes		Common
**Pennisetum purpureum* Schum.	Elephant grass	Occasional
**Rhynchelytrum repens* L.	Natal Redtop	Uncommon
**Sporobolus diander* (Retz.) Beauv.	Rat tail grass	Occasional
**Trichachne insularis* (L.) Nees	Cotton grass	Uncommon
LILIACEAE - Lily Family		
**Sansevieria trifasciata* Prain	Mother-in-law's tongue	Locally abundant
**Sansevieria trifasciata* var. *laurentii* HEBr.		Locally abundant
ANGIOSPERMS		
DICOTYLEDONES		
ACANTHACEAE - Acanthus Family		
**Blechum brownei* Juss.	Yerbas Babui	Locally abundant
AMARANTHACEAE - Amaranth Family		
**Achyranthes aspera* L.	Chichitun	Uncommon
**Amaranthus spinosus* L.	Kuletes	Uncommon
**Amaranthus viridis* L.	Kuletes apaca	Uncommon
**Deeringia amaranthoides* (Lam.) Merr.		Occasional

SCIENTIFIC NAME	COMMON NAME	ABUNDANCE
BORAGINACEAE - Heliotrope Family		
Heliotropium indicum L.	Bungi-tasi	Uncommon
CARICACEAE - Papaya Family		
Carica papaya L.	Papaya	Common
CASUARINACEAE - Ironwood Family		
Casuarina equisetifolia L. = *Casuarina litorea* L. (Fosberg)	Gagu	Occasional
COMPOSITAE - Sunflower Family		
Bidens pilosa L. = *Bidens alba* of Fosb.	Beggar's tick	Common
Conyza canadensis (L.) Cronq.	Horse-weed	Common
Chromolaena odorata (L.) King & Rob. = *Eupatorium odoratum* L.		Common
Emilia sonchifolia (L.) DC. ex Wight	Flora's paintbrush	Occasional
Mikania scandens (L.) Willd.	Mile-a-minute vine	Common
Synedrella odiflora(L.) Gaertn.	Salgon	Locally abundant
Tridax procumbens L.	Coat buttons	Locally abundant
CONVOLVULACEAE - Morningglory Family		
Ipomoea alba L.	Moon-flower	Ocassional
Ipomoea indica (Burm. f.) Merr.	Fofgu	Ocassional
Ipomoea quamoclet L.	Red morningglory	Locally abundant
Ipomoea triloba L.	Fofgu	Occasional
Operculina ventricosa (Bert.) Peter		Locally abundant
CUCURBITACEAE - Gourd Family		
Momordica charantia L.	Almagoso	Occasional
EUPHORBIACEAE - Spurge Family		
Acalypha indica L.	Hieber del cancer	Occasional
Euphorbia cyathophora Murray	Dwarf poinsettia	Locally abundant
Euphorbia hirta L.	Golondrina	Locally abundant
Euphorbia heterophylla L.		Locally abundant
Euphorbia prostrata Ait.		Occasional
Glochidion marianum Muell.-Arg.	Chosgo	Occasional
Melanolepis multiglandulosa (Reinw.) Reichb. f.		Occasional
Phyllanthus marianus Muell.-Arg.	Gaogao-uchan	Uncommon

SCIENTIFIC NAME	COMMON NAME	ABUNDANCE
LEGUMINOSAE - Pea Family		
Abrus precatorius L.	Kolales halumtano	Occasional
Albizia lebbeck (L.) Benth	Siris Tree	Uncommon
Cassia mimosoides L.	Amot-tumaga	Uncommon
Cassia occidentalis L.	Amo tomaga	Occasional
Crotalaria pallida Ait. = *Crotalaria mucronata* Desv.	Rattlebox	Occasional
Desmodium gangeticum (L.) DC.	Tomates aniti	Occasional
Desmodium triflorum (L.) DC.	Agsom	Occasional
Indigofera spicata Frosk.	Anills	Occasional
Leucaena leucocephala (Lam.) DeWit	Tangan-tangan	Common
Mimosa pudica L.	Sensitive plant	Occasional
Pithecellobium dulce (Roxb.) Bentham	Kamachile	Occasional
MALVACEAE - Hibiscus Family		
Hibiscus rosa-sinensis L.	Gumamela	Uncommon
Hibiscus tiliaceus L.	Pago	Common
Malvastrum coromandelianum Garcke	False marrow	Occasional
Sida acuta Burm. f.	Escobilla papagu	Ocassional
Sida rhombifolia L.	Escobilla dalili	Occasional
MORACAEAE - Fig Family		
Ficus prolixa Forst. f.	Nunu	Uncommon
MYRTACEAE - Myrtle Family		
Eugenia palumbis Merr.	Agatelang	Uncommon
Eugenia reinwardtiana (Bl.) DC.	Aabang	Uncommon
NYCTAGINACEAE - Four o'clock Family		
Boerhavia repens L.	Dafao	Common
OLEACEAE - Olive Family		
Jasminum marianum DC.	Banago	Common
Oxalidaceae - Wood Sorral Family		
Oxalis corniculata L.	Agsom	Occasional
PASSIFLORACEAE		
Passiflora foetida L.	Love-in-a-mist	Occasional
Passiflora suberosa L.		Occasional

SCIENTIFIC NAME	COMMON NAME	ABUNDANCE
PIPERACEAE - Pepper Family		
Piper guahamense DC	Pupulo aniti	Common
POLYGALACEAE - Polygala Family		
Polygala paniculata L.		Common
POLYGONACEAE - Buckwheat Family		
**Antigonon leptopus* H. & A.	Cadena de Amor	Locally abundant
PORTULACACEAE - Purslane Family		
**Portulaca oleracea* L.	Beddu lagas	Occasional
RUBIACEAE - Coffee Family		
Morinda citrifolia L.	Lada	Common
Psychotria mariana Bartl. ex DC.	Ajago	Uncommon
**Spermacoce assurgens* R. & P.		Common
SOLANACEAE - Nightshade Family		
Capsicum frutescens L.	Doni sali	Common
Physalis angulata L.	Tomates chaka	Occasional
Solanum nigrum (L.) Senu lato	Nightshade	Occasional
STERCULIACEAE - Coca Family		
Waltheria indica L.	Escobilla sabana	Uncommon
URTICACAE - Nettle Family		
Pilea microphylla (L.) Liebmann	Artillary plant	Locally abundant
Piprurus argenteus (Forst. f.) Wedd.	Amajayab	Uncommon
VERBENACEAE - Verbena Family		
Callicarpa candicans (Burm. f.) Hochr.	Qualitay	Occasional
Lantana camara L.	Lantana	Common
Premna obtusifolia R. Br.	Ahgao	Occasional
Stachytarpheta dichotoma Vahl	False verbena	Occasional
Stachytarpheta jamaicensis (L.) Vahl	False verbena	Common
Stachytarpheta urticifolia Sims		Occasional
Vitex parviflora Juss.		Occasional

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APPENDIX D-1

Archaeological/Historic Survey (Tinian)

Archaeological Inventory Survey Relocatable Over-The-Horizon Radar Support Facilities Sites

Island of Tinian, Mariana Islands, Micronesia

by

Alan E. Haun, Ph.D.
Senior Archaeologist

Roderick S. Brown, M.A.
Supervisory Archaeologist

and

Bradley J. Dill, B.A.
Supervisory Archaeologist

Prepared for

Wilson Okamoto & Associates, Inc.
1150 South King Street
Honolulu, Hawaii 96814

May 1990

PHRI
Paul H. Rosendahl, Ph.D., Inc.
Archaeological • Historical • Cultural Resource Management Studies & Services
505 Makawili Street • Hilo, Hawaii 96720 • (808) 969-1763 • FAX (808) 961-6998
P.O. Box 12836 • Tamuning, Guam 96911 • (671) 649-3046 • FAX (671) 649-2611

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INTRODUCTION

BACKGROUND

Under a contractual agreement with Wilson Okamoto & Associates, in conjunction with an amendment to their open-end contract with the Department of the Navy, Pacific Division, Naval Facilities Engineering Command (PACNAVFACENGCOM) to prepare environmental impact documents (Contract No. N62742-86-0-001), Paul H. Rosendahl, Ph.D., Inc. (PHRI) conducted archaeological inventory surveys at three proposed support facility sites for United States Naval electronics facilities on the island of Tinian, Commonwealth of the Northern Mariana Islands (Figure 1). The surveys were conducted in conjunction with an inventory survey for a proposed site for U.S. Navy electronics facility conducted on the Island of Guam (Haun, Brown, and Dilli, in prep). The overall objectives of the present surveys were (a) to determine the nature and locations of archaeological and historic resources that might be affected by the proposed projects, (b) to assess the significance of all identified resources, and (c) to recommend treatments for any significant historic resources. The surveys were conducted in compliance with the amended National Historic Preservation Act of 1966, the National Environmental Policy Act, Executive Order 11593, the Archaeological and Historic Conservation Act of 1974, and related U.S. Navy regulations.

The present project was supplementary to earlier surveys conducted on Tinian by PHRI (Donham 1986, Haun 1988). The Donham survey was conducted during the initial phase of environmental studies for the electronics facilities. The report on this earlier survey, because the earlier survey was conducted mostly within the immediate vicinity of the present project areas, contains detailed information (general environmental setting, previous archaeological work, and historical documentary research) relevant to the present project area. The report on the earlier survey is included in the EIS this report is in; therefore, the information is not repeated here.

The present surveys on Tinian were conducted at three sites situated on the northern half of the island; the northern half is in passive use as a training area and is under the cognizance of the United States Navy (Figure 2). Field work for the survey was conducted March 14-22, 1990 by a crew of five persons under the direction of Senior Archaeologist Dr. Alan E. Haun. Crew members included Supervisory Archaeologist Bradley J. Dilli and Field Archaeologists David Highness, Houki Schaafsma, and Mark Donham.

SCOPE OF WORK

The basic purpose of an inventory survey is to identify—to discover and locate on available maps—sites and features of potential archaeological/historical significance present within a specified project area. An *inventory survey* usually comprises the initial level of archaeological investigation. It is conducted to identify and inventory all archaeological/historical resources within a specified project area. An inventory survey determines both the nature and location of the identified archaeological/historical resources. It gathers information from the resources sufficient for evaluating their significance as defined by the appropriate laws, regulations, and guidelines. Finally, it facilitates formulation of realistic recommendations and estimates for such further work as might be necessary or appropriate. Such work could include *further data collection*—work involving detailed recording of sites and features, and limited excavations; and possibly subsequent *mitigation*—data recovery research excavations, construction monitoring, interpretive planning and development, and/or preservation of sites and features with significant scientific research, interpretive, and/or cultural values.

The significance of any archaeological remains identified within the project area were to be assessed in terms of (a) the National Register criteria contained in the Code of Federal Regulations (36 CFR Part 60), and (b) the criteria for evaluation of traditional cultural values prepared by the National Advisory Council on Historic Preservation (ACHP 1985). In order to facilitate future client management decisions regarding site treatments, sites were to be further evaluated in terms of three PHRI CRM (Cultural Resource Management) value modes, which are discussed further in the Conclusion section of this report.

PROJECT AREA DESCRIPTIONS

Three separate parcels (Project Sites 1-3), totaling approximately 37 acres were surveyed on Tinian. All three project areas were relatively flat topographically. Vegetation throughout all project areas was dominated by an overstory of secondary growth, primarily tangan-tangan (*Leucaena glauca* [L.] Benth.), and a ground cover of various unidentified vines, ferns, and grasses.

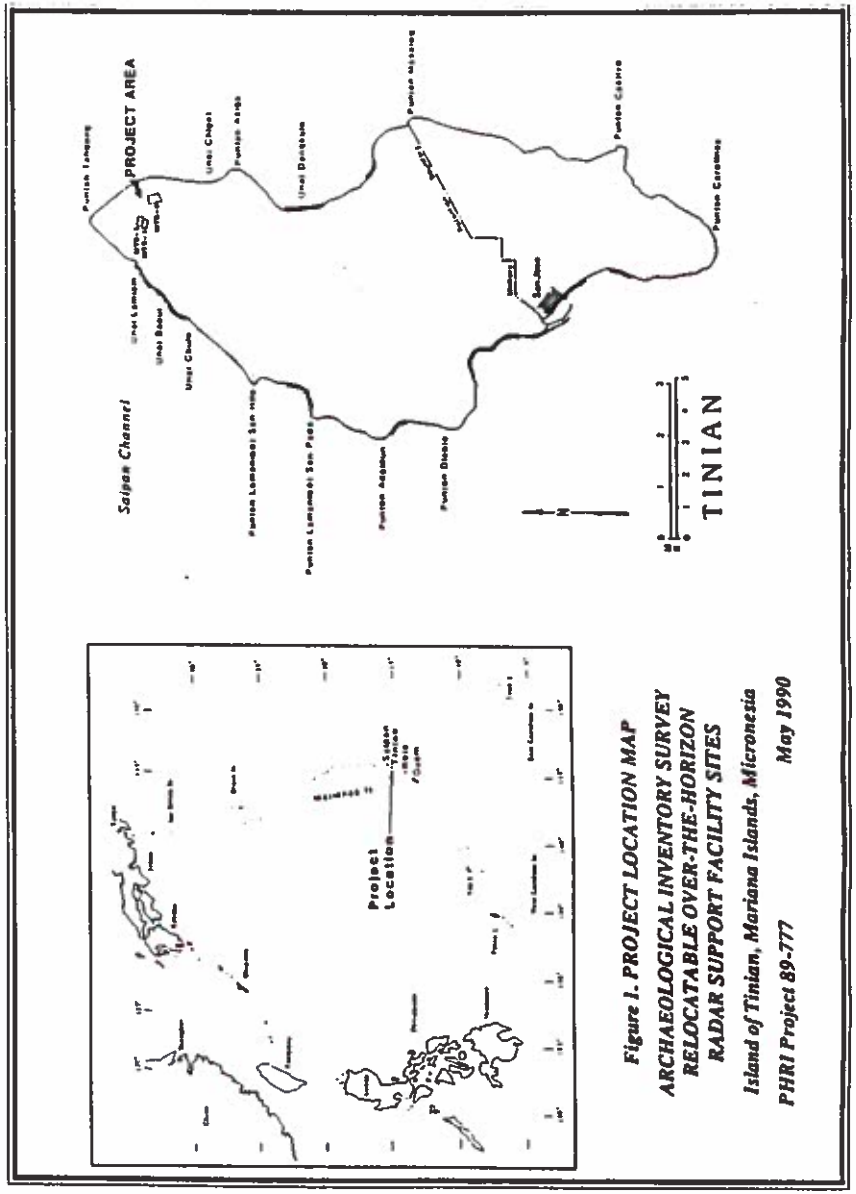


Figure 1. PROJECT LOCATION MAP
ARCHAEOLOGICAL INVENTORY SURVEY
RELOCATABLE OVER-THE-HORIZON
RADAR SUPPORT FACILITY SITES
Island of Tinian, Mariana Islands, Micronesia
PHRI Project 89-777 *May 1990*

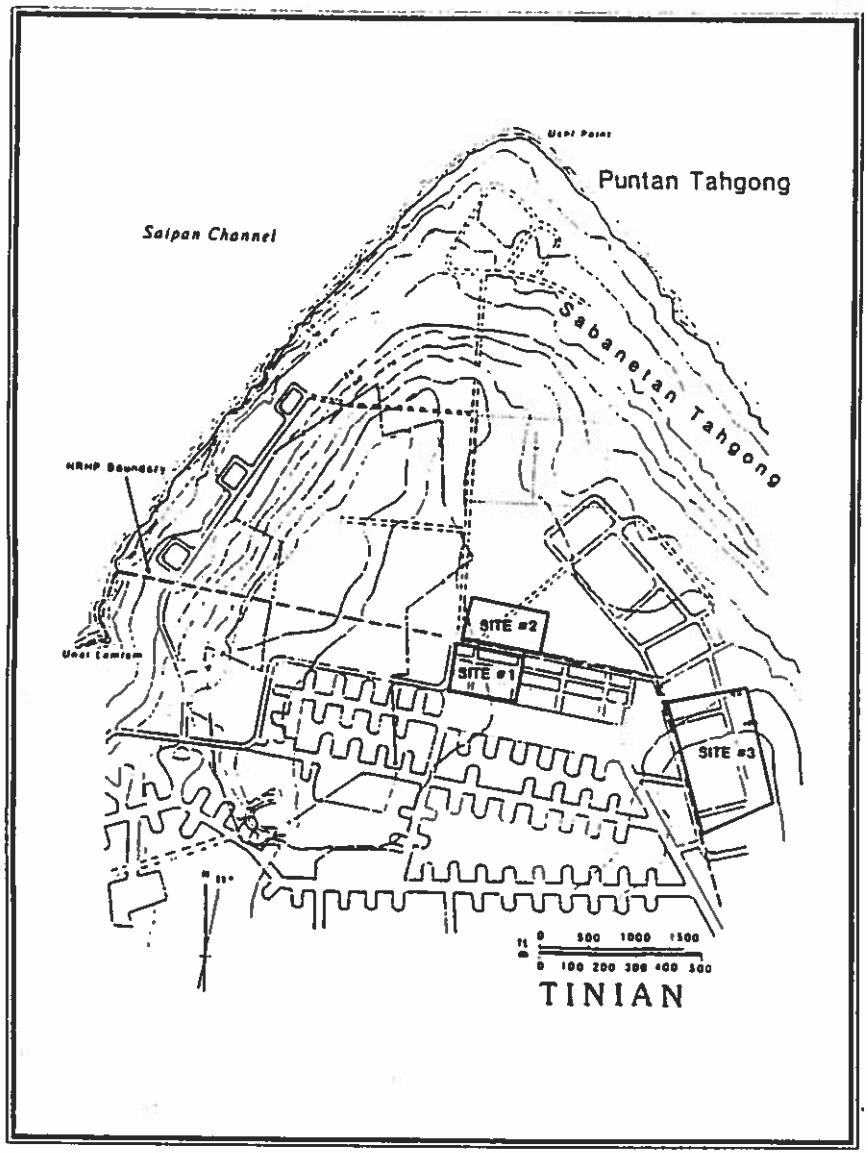


Figure 2. PROJECT AREA LOCATION MAP

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Project Site 1

Project Site 1 is rectangular and consists of c. 6.5 acres (Figure 2). The long axis of the site is oriented 77° west of north. Site 1 measures approximately 700 feet (213 m) long and 400 feet (122 m) wide. It is bounded on the north and west by existing paved roads which T-intersect at the northwestern corner of the parcel. The western road, Saw Mill River Parkway, continues, unpaved, on to the north, to Puntan Tahgong.

Project Site 2

This parcel is also rectangular and is immediately across the road from Project Site 1 (Figure 2). The road forming the northern boundary of Site 1 corresponds with the southern boundary of Project Site 2. An unpaved portion of Saw Mill River Parkway forms the western boundary of Project Site 2. Site 2 consists of approximately eight acres, and is approximately 700 feet (213 m) long and 500 feet (152 m) wide. The long axis of the parcel is oriented 77° west of north.

Project Site 3

Project Site 3 is a rectangular 22.5 acre parcel 1,400 feet long (427 m) and 700 feet (213 m) wide (Figure 2). The long axis of the parcel is oriented approximately 7° west of north. The parcel is bounded on both the southern and western sides by existing paved roads.

FIELD METHODS AND PROCEDURES

Prior to the field work, the project area boundaries had been flagged along the various paved roads that bound the project areas. In some cases a flag line had been set along the project area boundaries that were hard to locate. The parcels were examined by pedestrian survey by a crew of five. Transect intervals between crew members was approximately 25-30 m. In densely forested areas, or areas where dense ground cover hindered surface visibility, crew members periodically had to clear the surface free of debris in an effort to locate cultural materials.

When an archaeological feature was found, the survey crew was notified and the transect was halted. The crew intensified surface clearing and examination in the area of the feature in an attempt to locate additional features or artifacts which might be associated with the original find. Finds were flagged with day-glo pink-and-blue flagging tape, a temporary PHRI feature letter designation was written on the flagging, the approximate location of the find was recorded on a field map, the find was briefly described in a field notebook, and the transect was continued.

After the initial transect survey, all features were revisited and were recorded in detail on standard PHRI Site Survey Record forms. Recording included approximate dimensions, scaled mapping, written descriptions, and black-and-white photography. Multiple occurrences of the same type or style of feature, were designated as "feature types." Rather than record in detail numerous nearly identical features, a single example of a type was selected for detailed recording, and the numbers and locations of additional similar feature types were recorded.

FINDINGS

During the survey, two historic sites were identified (PHRI Temporary Sites T-1 and T-2). Site T-1 includes features in all three parcels which relate to U.S. military occupation during and immediately following WWII. No Japanese era features were found within the parcels; however, one Japanese Period site (T-2) was identified just outside Project Site 3.

Concrete pads and/or foundations were the most common feature found during the survey. Other features included debris scatters, crushed coral roads, metal boxes, rock alignments, walls, and fire hydrants. Concrete pads were all made of formed crushed coral concrete and some included pre-set iron bolts. Scatters of decayed building materials and other debris were found in the vicinity of most concrete features.

The exotic plant mother-in-law's tongue (bowstring hemp [*Sansevieria trifasciata* Prain.]) was found throughout all three project areas and was especially abundant in Project Site 3. The plant sometimes grew in rectangular patterns adjacent to recorded features, suggesting plantings once surrounded buildings which have since deteriorated. Individual, isolated plants were also found. Scattered tar paper and sheet metal at the sites suggest that many structures were formerly present but were either razed or have deteriorated beyond recognition.

Project Site 1

Two basic types of poured concrete features were found (Feature Types HH and II) in Project Site 1 (Figure 3, Table 1). Feature Type HH identifies concrete pads 14.7 m long and 6.3 m wide. Feature Type II identifies concrete pads with raised borders, each 39.5 m long and 9.2 m wide. Ten pads of each type form two parallel east-west rows paralleling two roads which divide the parcel into thirds. The middle third of the parcel is devoid of features except for one Type II pad at the extreme western end of the third, and two large metal boxes of unknown function. In the eastern and western quarters of the parcel are two north-south roads. Located in the northern third of the project area, between two Feature Type II pads, is a circular, coursed wall with an exterior diameter of approximately 2.0 m (Feature JJ). A sparse scatter of building materials was noted within the feature. In addition, two fire hydrants (Feature Type MM) were located in the northern and southern thirds of the parcel adjacent to concrete pads, between the pads and the overgrown eastern, north-south road.

Feature Type HH - Ten concrete pads of Feature Type HH and an eleventh pad, a variant of Feature Type HH measuring 19.2 by 6.3 m, are aligned in an east-west row, with their short axes parallel to the more southerly of the two roads which divide the project area into thirds. The orientation of Type HH pads is approximately 15° east of north. The Type HH pads are 8 m south of the more southerly road and are 13.4 m apart. The larger pad is four meters from the road. Corrugated scrap metal was located along the sides of most of the pads, suggesting that the pads, at one time, supported a corrugated metal superstructure. Square rock alignments were found at the ends of several of the pads. These probably are landscaping features. The function of Feature Type HH is uncertain. Access to the former structures, however, was apparently pedestrian; thus, they may have served as offices or residences.

Feature Type II - Ten concrete pads of Feature Type II were identified. Nine of the pads are aligned with the short axis parallel to the existing paved road which forms the northern boundary of the parcel. With the exception of two pads in the northwestern portion of the project area, an approximate distance of 18.5 m separates one pad from the next. The other two pads are approximately 34 m apart. Type II pads are oriented approximately 15° east of north. A beveled border, 0.15 m higher than the surface of the pad and 0.35 m above the present ground surface, runs the length of the long axis of each pad. The borders do not extend completely across the smaller ends of the pads. Limestone rubble platforms extend north and south from the small ends of the pads. The platforms abut roads which form the northern project area boundary and the more northerly of the two east-west roads which divide the parcel into thirds. The tenth Feature Type II pad is located in the middle third of the parcel, 9.5 m east of the road which forms the western boundary of the parcel.

The limestone rubble platforms associated with Feature Type II apparently provided vehicular access to, or through, the structures constructed on the pads. Such access suggests the structures served a storage or maintenance function.

Feature JJ - This is a circular coursed wall feature approximately 3 m in diameter. The southern end of the feature is only 0.2 m high, while the northern portion of the feature is 0.9 m high. The interior of the feature is filled with gravel and cobble-sized crushed limestone fill. The fill slopes from north to south. The feature is interpreted as a possible flagpole base.

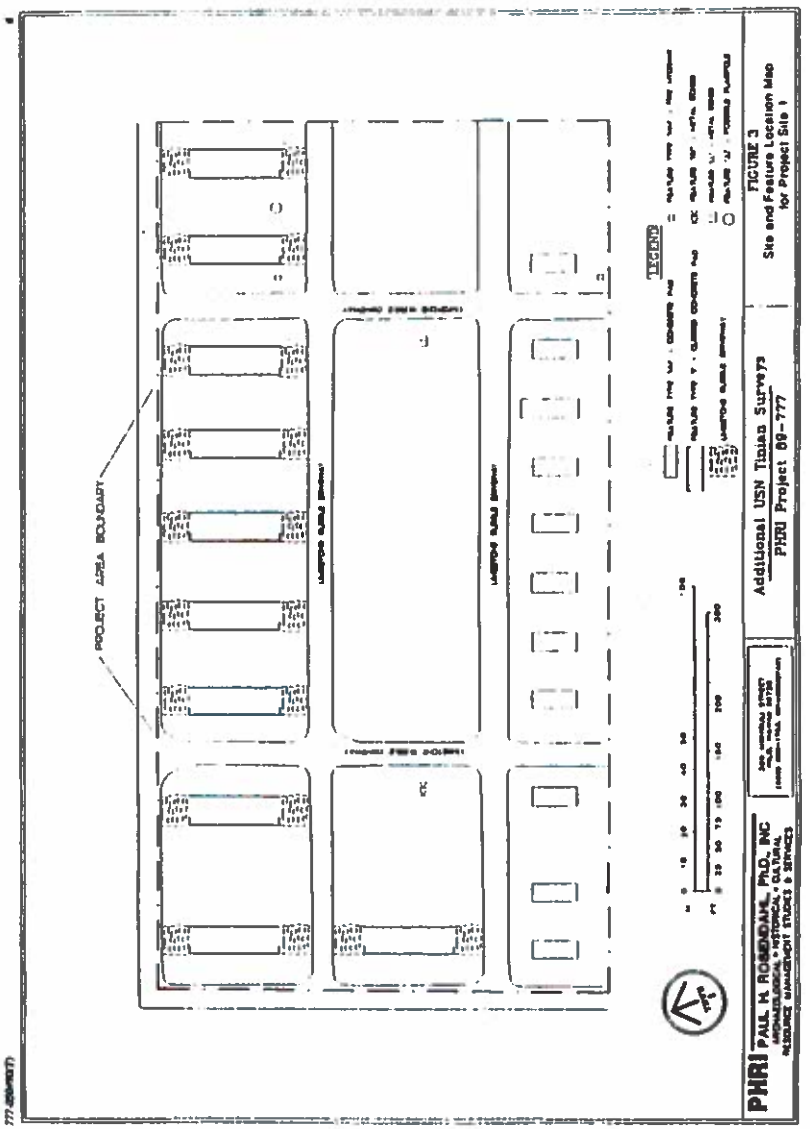


Table 1.

MAP LEGENDS FOR FIGURES 3-5

Feature Type	Description
PROJECT SITE 1, TINIAN	
(T-1, WWII Military)	
HH	11 concrete pads
II	10 concrete pads
JJ	Circular dry-laid limestone wall (possible flagpole foundation)
KK	Large metal boxes
LL	Large metal boxes
MM	Type-2 fire hydrants
PROJECT SITE 2, TINIAN	
(T-1, WWII Military)	
J	Metal boxes
BB	Concrete pad
CC	Large earth/rubble mound
DD	Concrete pad
EE	Well/cistern
FF	Concrete pylons. Foundation base for structure
GG	Concrete pad with raised supports
PROJECT SITE 3, TINIAN	
(T-1, WWII Military)	
A	Concrete pad
B	Two concrete pads and well/cistern
C	Metal boilers
D	T-shaped metal T-bar upright with crossbeam
F	Limestone rubble platform and small concrete platforms
G	Limestone rubble platforms, L-shaped concrete pads
H	Two small depressions in limestone
I	Small concrete pad

Table 1. (cont.)

Feature Type	Description
PROJECT SITE 3, TINIAN (cont.)	
(T-1, WWII Military)	
J	Double row of metal boxes
L	Small limestone pads
M	Two large concrete platforms with small concrete footings. Probable administration building
MM	Type-2 fire hydrant
N	Rubble (limestone)-filled pit
NN	Large concrete pad
O	Small, rectangular, straight sided, brick-lined pit. Possibly a latrine
OO	Well/cistern
P	Well/cistern
Q	Small concrete pad with concrete support for metal tank
R	Curbed concrete pad; possibly showers
S	Large irregularly shaped concrete pad
T	Concrete rubble wall
U	Limestone pad
V	Limestone rubble platform with earth-covered metal boiler
X	Concrete rubble wall
Y	Concrete wall rubble mound with well/cistern
Z	Small limestone rubble mound
(T-2, Japanese era)	
	Two concrete pillars with associated low, limestone rubble walls. Possible Japanese Shinto Shrine

Features KK and LL - These are three metal boxes 2.15 m long, 1.55 m wide, and 1.47 m high. Two of the boxes are badly deteriorated. The function of these boxes is unknown.

Feature MM - These are two fire hydrants which are almost certainly elements of a single water system. A square metal frame 1.8 m on a side and 1.0 m high surrounds each hydrant. The features are between concrete pads and the overgrown eastern, north-south road.

Project Site 2

Eight features were found in Project Site 2 (Figure 4). The features include three concrete pads of various sizes, one possible water cistern, two large limestone rubble mounds, one arrangement of small concrete footings, and a large V-shaped alignment of metal boxes. In addition, a possible road, 8 m wide, oriented 128° east of north, bisects the western half of the parcel. The road is not elevated, is very overgrown, and appears to consist of a bulldozed path.

Feature J - This feature type, consisting of linearly aligned metal boxes, was also located in Project Site 3. Feature J is a V-shaped alignment of metal boxes laid out end-to-end. Three evenly spaced handles are on each side of each box. Most of the boxes are filled with either dirt or concrete. The boxes measure 1.6 m by 0.46 m by 0.43 m. Both legs of the V-shape extend outside the project area. One leg, 24 m of which is within the project area, is oriented 105°west of north. The other leg is 21 m long and is oriented 7° west of south. There is an 11 m wide gap in the alignment 5 m from its apex. Two rectangular concrete pylons, 0.93 m tall and 0.31m by 0.2 m, are positioned on either side of the gap. The feature evidently served partly as a border/fence enclosing an area of undetermined function. A gate was probably attached to the pylons. Use of the boxes as a border apparently was secondary to their primary function as containers for some undetermined item(s) or substance.

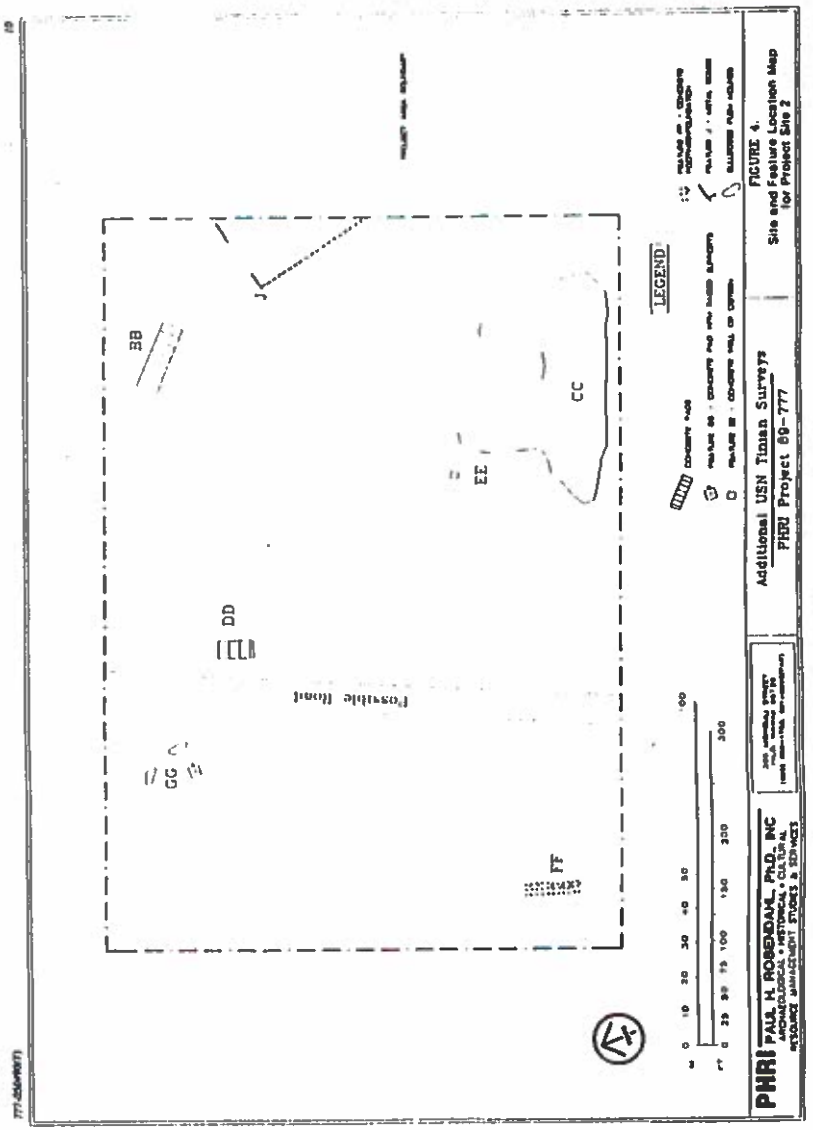
Feature BB - Feature BB is a concrete pad 20 m long and 6.2m wide, located approximately 28 m west of Feature Type J. The long axis of the pad is oriented 43° west of north. Two curbs, 0.08 m high and 0.15 m wide, run along the long axis of the pad. Each curb terminates 3 m from the northwest end of the pad. Plumbing fixtures and pipes are in place on the pad and scattered around the area. A small apron of soil, flush with the top of the pad, extends 3 m to the southeast of the pad. The plumbing fixtures suggest the feature may have been a latrine and/or shower facility.

Feature CC - Feature CC is a large earth mound. The feature is located 5 m north of the road which forms the southern boundary of the project area and is approximately 25 m from the eastern boundary of the parcel. The long axis of the mound parallels the road. The mound is approximately 75 m long, with two elongated areas stretching to the north of the long axis of the mound. The first elongated portion of the mound is the eastern end. It measures approximately 32 m north-south and 20 m east-west. The second elongated portion is west of the first, and measures 42 m north-south and 12 m east-west. Twenty-five meters separate the northern tips of each of the mounds. The mound extends another 20 m to the west. A trash deposit was noted between the two elongated portions of the mound. Remains noted include beds springs, machinery parts, spools of wire, and various other pieces of scrap metal. The feature's function is undetermined, however, it may simply be a bulldozed pile of debris.

Feature DD - This is a concrete pad located approximately 78 m west of Feature BB. Feature DD is 10.5 m long and 5 m wide. The pad is not elevated above the present ground surface. The long axis of the pad is oriented 55° east of north. A small, 1 by 1 m area of of mother-in-law's tongue is located 3 m west of the pad. The pad's function is undetermined.

Feature EE - Feature EE is a roofed, square concrete feature. The feature is located approximately 20 m west of Feature CC. Two sides of the feature are 2.15 m long; the remaining two sides are 2.1 m long. The top of the feature is closed with the exception of one 0.45 by 0.45 m hole. Hinges at the hole indicate that at one time the hole was covered with a small door. Two smaller deliberately made circular holes are also located in the top of the feature. The top of the feature is 0.55 m above ground surface. The interior depth of the feature is 1.65 m. The feature is currently filled with water and may have served as a cistern.

Feature FF - Feature FF consists of a rectangular pattern of 0.5 m by 0.5 m by 0.12 m concrete footings. The long axis of the pattern is oriented approximately 23° east of north. The southwest corner of the footings is 21 m northeast of the southwest corner of the project area. The footings paralleling the short axis are 1.94 m apart, and those forming the long axis are 1.7 8m apart. A total of 33 footings are included within Feature FF. Five more footings with grooved tops are located between the eastern two rows of footings. The orientation of these five footings is the same as the rest of those included in Feature FF. Four meters



separate each of the five footings. Rusted pieces of pipe are scattered adjacent to and along the length of the five footings with grooved tops. Five pieces of 0.1 m diameter pipe were noted protruding from the ground at four meter intervals between the western two rows of footings. Two of the concrete footings have been displaced. The footings probably supported a large wooden building.

Feature GG - Two small connected concrete pads and two mounds of dirt were designated as Feature GG. The larger of the two pads is oriented 60° west of north and measures 3 by 3 m. A small 0.54 by 0.58 by 0.23 m concrete block with a 0.20 m pipe protruding from the block rests on the surface of the larger pad. The smaller pad, adjacent to the first, is rectilinear in shape. The orientation of the short axis of the smaller pad is the same as that of the first pad. The smaller pad measures 1.37 m by 0.91 m. Two concrete beams, 0.31 m by 0.31 m, rest on the surface of the smaller pad. They are placed at the east and west ends of the smaller pad and are as long as the pad is wide. Two dirt mounds measuring approximately 4 by 11 by 2 m each are located approximately 7 m north and east of the two pads. Remains in the vicinity of Feature GG include several glass bottles, an oil filter, and various other automobile parts. The feature's function is undetermined.

Project Site 3

Twenty-six features of Site T-1 were located within the parcel (Figure 5). Features include concrete pads of various sizes, large holes excavated into bedrock, limestone rubble building foundations, roads, latrines (one brick-lined), a large V-shaped alignment of metal boxes (similar to the one noted in Project Site 2), several large metal boilers or ovens, and concrete rubble mounds which originally were two thin-walled structures interpreted as kitchen or mess hall areas.

At the site are four overgrown roads, two of which divide the parcel into thirds. The third road divides the northern third of the parcel into about half. The roads are approximately 8 m wide and are elevated approximately 0.6 m. A fourth overgrown road forms the eastern project area boundary. The overgrown roads will be referred to, north to south, as Roads 1, 2, 3, and the east road.

A 1951 Army Map Service map (scale 1:25,000) shows many features in the central and northern portions of the project area which were not encountered during the present survey (Figure 6). The missing features are oriented in a series of parallel rows and are probably barracks. The features either have deteriorated beyond recognition, or have been razed. Tar paper, wood, and corrugated metal roofing are scattered throughout the parcel; these materials are probably remnants of these former structures.

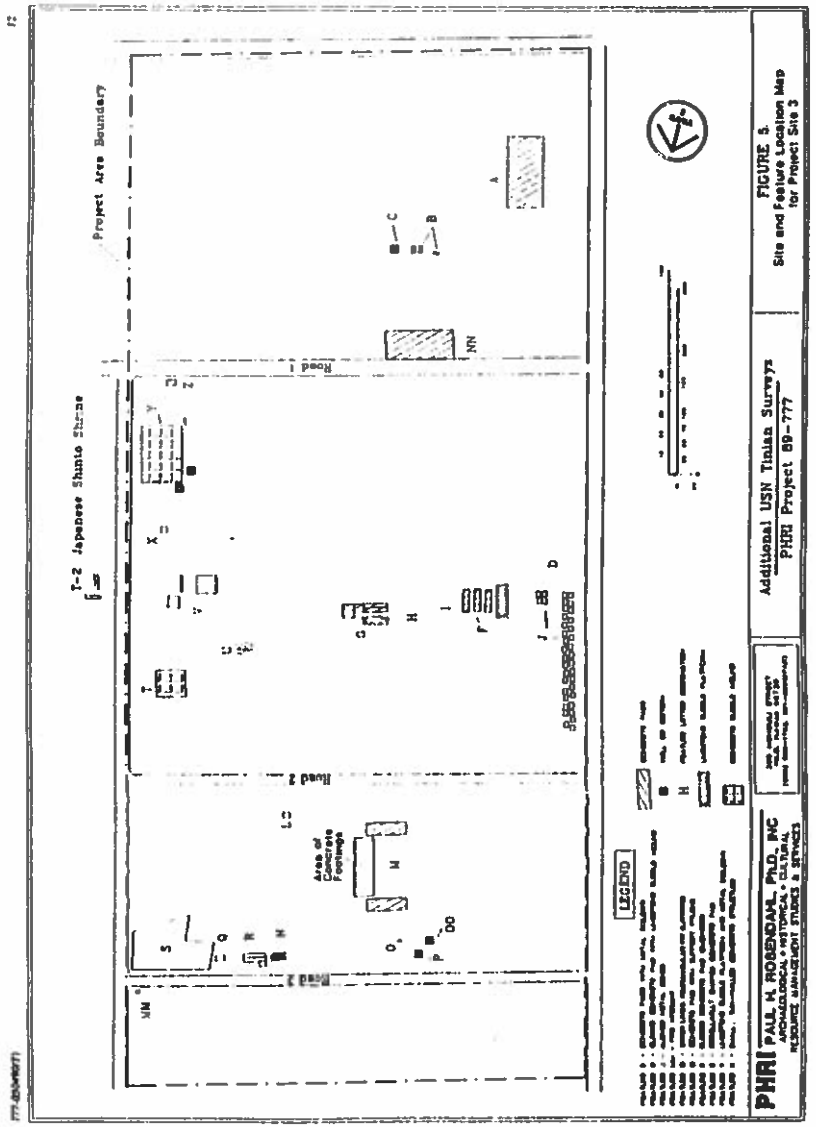
Feature A - Feature A is a concrete pad oriented 20° west of north; the pad's long axis measures 35 m. The pad is 18 m wide and 0.15 m high. The feature is located approximately 90 m northeast of the southwest corner of the project area. The pad's function is undetermined.

Feature B - Feature B consists of two small concrete pads and a metal boiler or oven. Both pads are 4 m long and 1.5 m wide. The pads are 1.5 m apart and are raised 0.1 m above ground surface. The long axes of the pads are oriented approximately 20° west of north. Six meters southwest of the pads is a round metal boiler or oven. The boiler is 2.5 m long, 1.57 m wide, and 1.3 m high and is located approximately 65 m west of Feature A. The feature's function is undetermined.

Feature C - Feature C is a 4 by 4 m hole excavated into bedrock to a depth of approximately 3 m. The feature is located 7 m northeast of Feature B. The feature may have functioned as a cistern.

Feature D - Two iron T-beams forming an upright T-shape and a smaller T-shaped feature were designated as Feature D. The first, larger T-shaped feature is 2.6 m high and the cross beam is 4 m long. The orientation of the cross beam is 105° west of north. The smaller feature is 5 m east of the first and is constructed on a small 1.5 by 1.5 m concrete pad. This feature is 2.8 m high, and the cross beam is 0.70 m long. The orientation of the cross beam is the same as on the larger feature. This feature is located approximately 75 m north of Road 1 and 19 m east of the western boundary of the project area. The function of these structural remains is undetermined.

Feature F - Feature F is a large limestone rubble platform with three small associated concrete pads. The limestone rubble mound is 18 m long, 7 m wide, and 0.6 m high. The smaller pads are aligned in a row with their long axes parallel to the long axis of the rubble mound. Each of the smaller pads is 11.5 m long, 3 m wide and is separated from one another by 0.5 m. The pad closest to the rubble mound is 0.5 m from the mound. The orientation of the long axes of all components is 20° west of north. Feature F is located approximately 28 m from the western project boundary and 103 m north of Road 1. The feature's function is undetermined; however, its location, central to a probable barracks complex, may indicate it served as a shower or latrine facility.



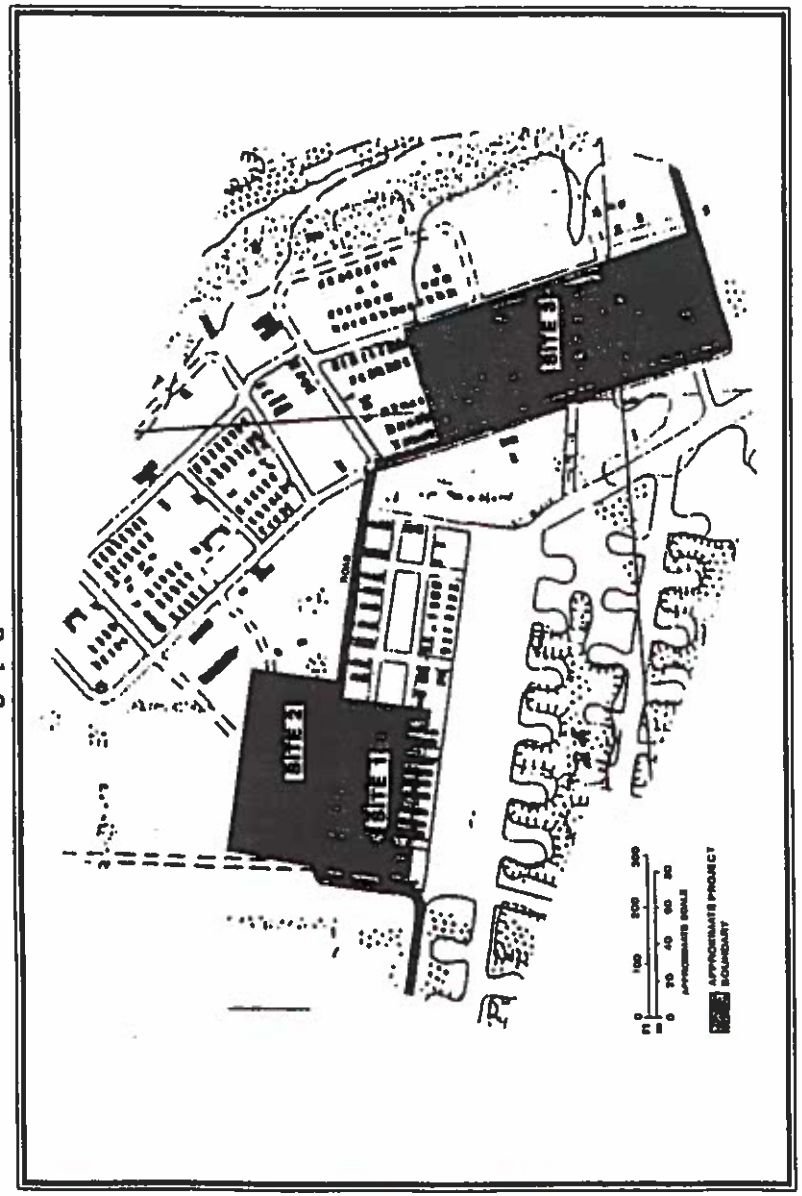


Figure 6. PORTION OF 1951 ARMY MAP SERVICE MAP OF TINIAN

D-1-8

Feature G - Feature G is an L-shaped concrete pad and an associated limestone rubble platform located approximately 113 m north of Road 1 and 108 m east of the western project area boundary. The concrete pad is 22.5 m long and 4 m wide. The long axis of the pad is oriented 105° west of north. All four sides of this pad are surrounded by a 0.10 m by 0.15 m curb. The feature is divided in half by a similar curb. A second pad, adjacent to the first, forms a 3.5 by 4.0 m extension to the north. Both pads are 0.1 m high. The longer pad is divided in half down the long axis by a limestone rubble mound 5 m north of the long axis of the first pad. The mound is 14 m long, 5 m wide, and shares the same orientation as the first pad. A round metal boiler or oven, similar to the one recorded at Feature B, is located at Feature G as well. Remains noted in the vicinity include pieces of pipe, pipe fittings, and various other plumbing items. Feature G is interpreted as a probable shower or latrine facility.

Feature H - Feature H consists of two small depressions, one stone-lined. Both of the depressions are approximately 3 m in diameter and 0.5 m deep. The depressions are 9 m apart. The eastern depression is stone-lined. Three courses of stone form the eastern wall of this depression. Feature H is located 10 m west of Feature G.

Feature I - Feature I is a 1.5 by 0.5 m concrete pad. The pad is 0.1 m high, and the long axis of the pad is oriented 20° west of north. A localized area of mother-in-law's tongue, 7 by 5 m, is located 4 m west of the pad. Feature I is located 5 m southwest of Feature H. The feature's function is undetermined.

Feature J - Feature J consists of two double rows of metal boxes at right angles to one another. One of the legs of the feature is approximately 90 m long; the other leg is 5 m long. A 2 m wide gap separates the legs. The long axis of the feature is oriented 20° west of north and parallels the western boundary of Project Site 3. Feature J is located 20 m south of Road 2 and 5 m east of the western project area boundary. The feature evidently served as a boundary/fence enclosing an area of undetermined function.

Feature L - Feature L is a 3 meter square limestone rubble platform. The feature is averages 0.15 m in height and is oriented 20° west of north. Feature L is located 13 m north of Road 2 and 70 m west of the eastern boundary. The feature's function is undetermined.

Feature M - Feature M consists of two large concrete platforms and a series of small concrete footings. The concrete pads are 20 m long, 6 m wide, and 0.7 m high. The long axes of the pads parallel one another and are 31 m apart. Two curbs, beginning at the western ends of the pads, extend 11.5 m along the sides of each pad. Three steps are situated at the western ends of each pad. The concrete footings are situated in six parallel rows of 19 footings each arranged in a rectangular pattern perpendicular to and between the eastern half of two concrete pads. The concrete footings measure 0.2 m by 0.14 m by 0.27 m, and are 1.3 m apart north-south and 1.15 m apart east-west. The long axis of the pattern of footings is oriented 20° west of north, and is 31 m long. The long axis of the pads is oriented 105° west of north. Two rusted metal sinks and a hot water tank were found on the surface of the southern pad. Feature M is located 25 m north of Road 2 and 90 m east of the western project area boundary. This large centrally located feature supported a large U-shaped wooden building. Its location, size, and indoor plumbing indicate it probably served as an administration building.

Feature MM - Feature MM consists of a fire hydrant surrounded by a metal frame; the feature consists of the same feature type (Type MM) in the discussion of Project Site 1. Within Project Site 3, Feature MM is located 6 m west of the eastern boundary and 6 m north of Road 3.

Feature N - Feature N is a 9 by 5 m rubble-filled pit. The depth of the pit is unknown. A bulldozed mound measuring 5.0 m north-south and 3 m east-west is located at the western end of the pit. The long axis of the pit is oriented 105° west of north. Feature N is located 75 m west of the eastern boundary of the project and 5 m south of Road 3. The function of the pit is undetermined.

Feature NN - Feature NN is a large concrete pad located adjacent to Road 1, 70 m east of the western project area boundary. The pad is 35 m long, 13 m wide, and 0.2 m high. The long axis of Feature NN is oriented 105° west of north. The feature's function is undetermined.

Feature O - This feature is a 2.00 m by 1.25 m red brick-lined latrine. It is divided into thirds by two brick walls that are perpendicular to the long axis of the pit. A 0.15 m diameter pipe protrudes from the south wall in the easternmost division of the pit. A 1 by 1.5 m limestone rubble mound is located immediately adjacent to the west side of the pit. The long axis of the pit is oriented 105° west of north. Feature O is located 15 m north of Feature M.

Feature OO - Feature OO is a circular pit. The pit is 5.0 m in diameter and 1.6 m deep. A 0.1 m pipe protrudes from the northwestern side of the pit. A 4.5 m diameter backdirt pile is located immediately adjacent to the pit on the southeast side. Feature OO is located 19 m northwest of Feature M. The pit may be a cistern.

Feature P - Feature P is a large 4.0 by 4.5 m pit excavated approximately 5 m into bedrock. Feature P is located 27 m northwest of Feature M. The pit is a probable cistern.

Feature Q - A small concrete pad with two concrete beams on the surface were designated as Feature Q. The pad is 4.5 m long, 3 m wide, and is 0.13 m high. The long axis of the pad is oriented 105° west of north. A small 3 m by 1.5 m rubble pile is located just off the southeast corner of the pad. The two concrete beams are parallel to one another, with their long axes perpendicular to the long axis of the pad. The beams are one meter apart, 0.78 m long, and 0.25 m wide. The western beam is 0.25 m from the west end of the pad. Bolts are inset approximately 0.2 m from each of the four corners of both beams. Feature Q is located 40 m west of the eastern boundary of the project area and 5 m south of Road 3. The feature's function is undetermined.

Feature R - Feature R is an L-shaped concrete pad located 11 m west of Feature Q. The long leg of the pad measures 12.0 m by 4.2 m by 0.3 m. Curbs, 0.2 m high and 0.15 m wide, enclose the surface of the pad and divide the pad in half down the long axis. Two 1.5 m wide openings are present in the southern portion of the curbs; these openings are inset one meter from each end of the pad. A trough, 0.20 m wide and 0.13 m deep, is located inside the curb along the northern edge of the pad. The shorter portion of the pad is located immediately adjacent to the northwest corner of the larger pad. The smaller pad measures 3.5 m by 2.5 m, with the long axis parallel to the long axis of the larger pad. Curbs also enclose the smaller pad. The long axis of Feature R is oriented 105° west of north. The feature may be a latrine or shower facility.

Feature S - Feature S is an irregularly shaped concrete pad located 6 m west of the eastern boundary and 13 m south of Road 3. The northern edge of the pad is oriented 105° west of north and forms the longest edge of the pad. The pads function is undetermined.

Feature T - This feature is a rubble mound consisting of thin pieces of concrete that once constituted a thin-walled concrete structure. The feature is located 38 m south of Road 2 and 15 m west of the eastern boundary of the site. The pieces of concrete have a uniform thickness of 0.1 m. The rubble mound is approximately 14 by 14 m. Two rectangular metal sinks, 1.5 by 1.0 m were noted within the rubble. Limestone rubble is scattered extensively throughout the area. This rubble may constitute the remains of the foundation of the structure that was once located here. The rubble looks to have been bulldozed. The feature is interpreted as a possible kitchen/mess hall.

Feature U - Feature H consists of a pad of crushed coral covered with mother-in-law's tongue. The pad is located 60 m south of Road 2 and 50 m west of the eastern project area boundary. The coral pad is 7 m long and 6 m wide an is elevated approximately 0.1 m above ground surface. The long axis of the pad is oriented 105° west of north. The pad's function is undetermined.

Feature V - This feature consists of a small, narrow limestone rubble platform with an associated buried metal container. The feature is located 25 m west of the eastern boundary and 90 m south of Road 2. The rubble platform is 7 m long, 2.5 m wide, and 0.2 m high. The long axis of the platform is oriented 20° west of north. Two meters north of the pad is a partially buried, 3/4 round metal container. Including the mounded earth on the sides of the container, maximum measurements are 5.5 m long, 6.0 m wide, and 1.5 m high. The long axis of the container is oriented approximately due west. The eastern end of the container is open. The feature's function is undetermined.

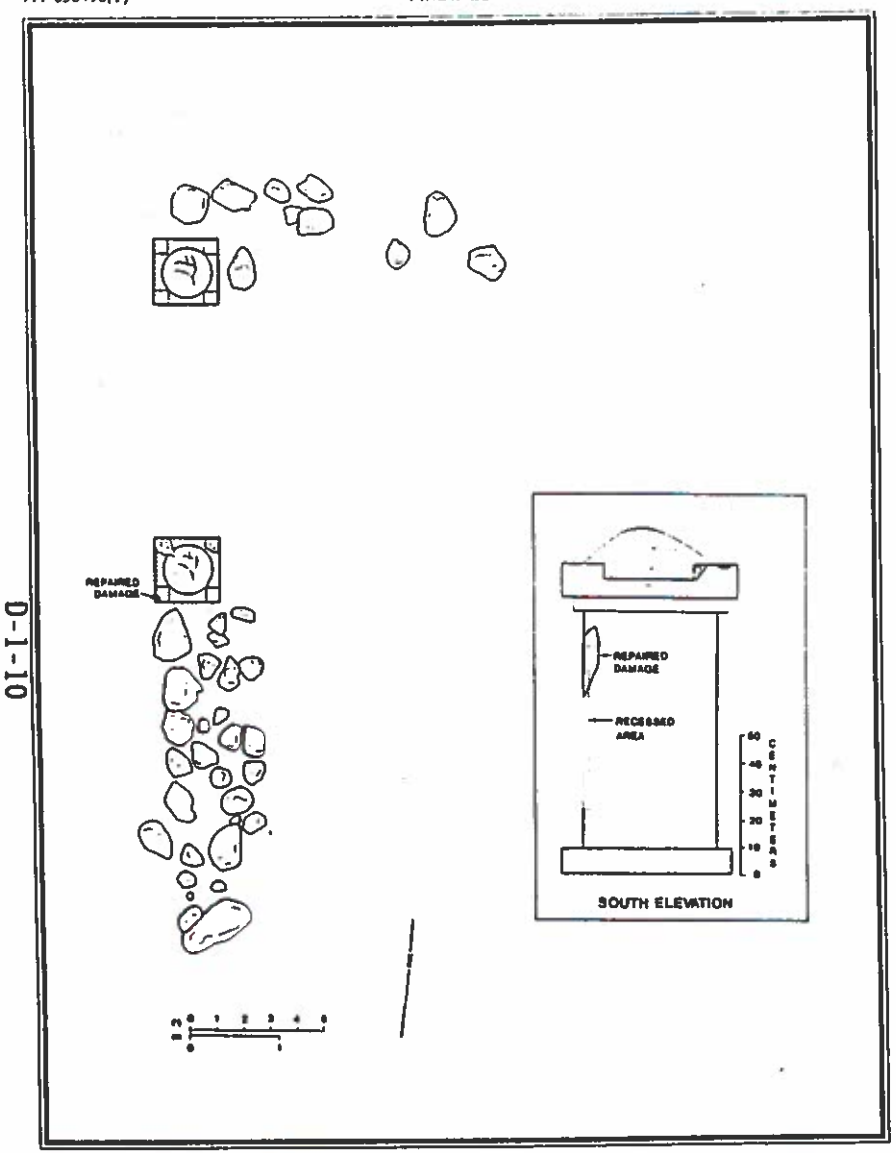
Feature X - Feature X is a small rubble mound that was once a thin-walled concrete structure. The mound measures 3 by 3 m and is approximately 0.3 m high. Abundant tar paper and corrugated metal were noted scattered in the vicinity. Feature X is located 75 m north of Road 1 and 19 m west of the eastern project area boundary.

Feature Y - Feature Y is located 50 m north of Road 1 and 20 m west of the eastern boundary of the project area. Four components comprise Feature Y. The largest component is a large rubble mound of 10 cm thick concrete slabs. The mound is approximately 28 m long and 20 m wide. The long axis of the mound is oriented 20° west of north. Two rectangular metal sinks, 1.5 by 1 m, were noted within the rubble. Two meters north of the northwest corner of the mound is another component, a 3.5 by 3.5 m pit excavated approximately 4 m into bedrock. An I-beam framework covers the pit. Another pit, approximately 4 m in diameter, is located 3 m west of the rubble mound. This pit is approximately 3 m deep. The final component consists of a small concrete pad, 4 by 1 m, located adjacent to the southeast corner of the rubble mound. Feature Y is interpreted as a possible kitchen/mess hall.

Feature Z - Feature Z is a small concrete pad located 35 m west of the eastern boundary of the project area and 2 m north of Road 1. The pad is 4.5 m long, 3 m wide, and 0.15 m high. The long axis of the pad is oriented 105° west of north. The pad's function is undetermined.

One Japanese site, designated PHRI Temporary Site No. T-2, was located approximately 10.0 m east of Project

Site 3 (Figure 7). The site includes two domed, concrete pillars standing approximately 2.5 m apart and 1.2 m high. The pillars each rest on square concrete platforms. A rectangular collar surrounds the base of the doomed tops of the pillars. Each corner of the collar has a small square pad which presumably served as a support for the upper, wooden portion of a gate/entryway. A limestone rubble wall extends south from the southern pillar, and another wall extends from the northern pillar eastward 3.0 m. The pillars have been damaged, possibly by shelling or bombing during WWII. They have since been repaired with concrete patches. Based on strucural form, the site is interpreted as a possible Shinto shrine.



D-1-10

Figure 7. SITE T-2

CONCLUSION

DISCUSSION

The features of Site T-1, all remnants of former U.S. military installations, are portions North Field. The remains encountered within Project Site 3 are part of the 77th and 72nd Service Groups situated north and south of Road 2, respectively. These conclusions have been reached after reviewing maps that show the project areas. A review of a map provided by Tinian Historic Preservation Coordinator Mr. Stanley Hocog—a visitor oriented map distributed on Tinian—depicts the island during U.S. military occupation. On the map, major features of North Field and the Service Groups (i.e., building foundations and roadways) are shown. The distribution of these major features corresponds well with distributions of these features shown on a 1951 Army Map Service (AMS) map of Tinian (scale 1:25,000). When the AMS map is compared with Figures 3-5, which are derived from PHRI field maps, the correspondence is nearly exact for Project Site 1 (compare Figures 3-5 with Figure 6). The only correspondence between the AMS map and the features identified in Project Site 2 is the location of Feature FF. For Project Site 3, identified Features, A, M, NN, T, and probably P, G, V, and Y can be correlated with buildings depicted on the AMS map.

The AMS map shows numerous structures between Roads 1 and 2 which were not found during the survey. As mentioned previously, these are thought to be barracks which have either been destroyed or have deteriorated to such a degree that they are no longer recognizable. Other elements identified during the survey, not depicted on the AMS map, primarily consist of minor landscaping features (i.e., alignments surrounding building foundations), fire hydrants, and various portable remains such as trash dumps, machinery, and so forth.

Site T-2, interpreted as the remains of a Japanese Shinto shrine, is located outside the present project area. The structure dates to the period of Japanese occupation, either during WWII, or before.

GENERAL SIGNIFICANCE ASSESSMENTS AND RECOMMENDED GENERAL TREATMENTS

General significance assessments and recommended general treatments for identified sites were formulated upon completion of the field work. Significance categories used in the site evaluation process are based on the National Register criteria for evaluation, as outlined in the Code of Federal Regulations (36 CFR Part 60). The purpose of the National Register is to list properties that are "...significant in American history, architecture, archaeology and culture..." (NHPA Sec 101 [a][1]). A property has significance if it satisfies each of two categories comprising the National Register criteria for evaluation (36 CFR Part 60.4): (1) the site must possess integrity of location, design, setting, materials, workmanship, feeling, and association; and (2) it must be characterized by at least one of the following:

(a) It must be associated with events that made significant contributions to broad patterns of history;

(b) It must be associated with the lives of persons significant in the past;

(c) It must embody distinctive characteristics of a type, period, or method of construction, or represent the work of a master, or possess high artistic value or represent a significant and distinguishable entity whose components may lack individual distinction (representative examples of site types); or

(d) It must have yielded, or may be likely to yield, information important in prehistory or history (information content) (36 CFR Part 60.6)

Sites were assessed for potential cultural significance using guidelines prepared by the Advisory Council on Historic Preservation (ACHP) entitled "Guidelines for Consideration of Traditional Cultural Values in Historic Preservation Review" (ACHP 1985). The guidelines define cultural value as "...the contribution made by an historic property to an ongoing society or cultural system. A traditional cultural value is a cultural value that has historical depth" (1985:1). The guidelines further specify that "[a] property need not have been in consistent use since antiquity by a cultural system in order to have traditional cultural value" (1985:7).

In order to facilitate future client management decisions regarding site treatments, sites were further evaluated in terms of three PHRI CRM (cultural resource management) value modes which are derived from the previously mentioned evaluation criteria. The archaeological sites were evaluated in terms of potential scientific research, interpretive, and/or cultural values. *Research value* refers to the potential of archaeological resources for producing information useful

in the understanding of culture history, past lifeways, and cultural processes at the local, regional, and interregional levels of organization. *Interpretive value* refers to the potential of archaeological resources for public education and recreation. *Cultural value* refers to the potential of archaeological resources to preserve and promote cultural and ethnic identity and values. Based on the above value modes, Site T-1 is assessed as moderately significant for research value, moderately to highly significant for interpretive value, and of low significance in terms of cultural value. Site T-2 is assessed as moderately significant for research value, and potentially highly significant for interpretive and cultural values.

Based on the above federal/state criteria, all sites identified during the present inventory survey are tentatively assessed as significant for information content (Criterion D) because they have yielded, and/or are likely to yield, information important for historical studies of Japanese occupation of Tinian (Site T-2) and information important for historical studies of American wartime technology and strategy (Site T-1). The U.S. military installations on Tinian represented by Site T-1 are assessed as also significant under Criteria A and C because they are part of North Field. Criterion A applies because of North Field's association with the advent of atomic weaponry, and Criterion C applies because North Field represents an excellent example of military aviation technology. North Field has been previously determined to be eligible for the National Register of Historic Places and has been subsequently elevated to National Landmark status. Site T-2, because of its probable religious significance, is potentially culturally significant, and may be significant under Criterion C, as well.

Further data collection and preservation with interpretive development are recommended for Sites T-1 and T-2. If the remains of the U.S. military installations on Tinian are to be destroyed, they first should be adequately documented. Interpretation of the specific functions of the various remains within these sites require in-depth documentary research and, if the documentary research fails to provide a reasonably complete record of the sites, may require additional field data collection. Adequate documentation might also require oral historical research involving island residents and military members who occupied the sites. Further data collection at the possible Shinto shrine would consist primarily of documentary research.

It should be noted that the evaluations and recommendations presented within this final report have been based on surface inventory surveys of the project areas. There is always the possibility, however remote, that potentially significant, unidentified surface and subsurface cultural remains will be encountered in the course of future archaeological investigations or subsequent development activities. In such situations, archaeological consultation should be sought immediately.

D-1-111

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APPENDIX E-1

Bird and Mammal Survey (Guam)

Bird and Mammal Survey

Harmon Annex Site, Guam

March 31, 1990

Maile A. Kjargaard
P.O. 476
Volcano, Hawaii 96785

E-1-1

Introduction

The following report provides the results of a five-day faunal survey of the Harmon Annex site on the island of Guam. The site is about 300 acres in area.

This study was performed to provide information for a supplement to the DEIS for the Electronic Installation projects proposed on Guam and Tinian. The Guam site is to be used for the construction of electronic facilities.

Site Location and Land Use History

The study area is situated approximately one kilometer north-northwest of Wettengel Junction in north-central Guam at an elevation of about 100 m (see map, Figure 1). It is an elongated rectangle measuring 2.75 km by .5 km with its long axis oriented in a northeasterly direction. Three paved roads (North Rd., Middle Rd., and Beach Rd.) cross the site dividing it roughly into thirds. Access was also possible via a number of little-used paved roads in the abandoned Harmon Annex housing area, and two dirt roads in the middle and upper portions of the site.

Much of the original forest in the area was probably first modified by a sizeable pre-contact Chamorro population of about 80,000 people (Fosberg 1960). Soon after Spanish contact, populations from other Northern Mariana Islands were forceably relocated to Guam, initially increasing the agricultural conversion of the island's forests. However, the Chamorro population declined steadily during Spanish period; by 1783, only 1500 Chamorros remained (Carano and Sanchez 1964).

Military use of Guam began after it was annexed by the United States at the close of the Spanish-American War. However, in spite of the fact that Guam was largely governed by naval officials for the next four decades, little military construction took place.

The administration encouraged the lease of government-owned land in rural areas, but copra production and other agricultural enterprises remained a small segment of the island's economy. In 1938, only 1660 tons of copra were exported from Guam, as compared with 13,100 tons from the Japanese Mandated Islands (Oliver, 1989).

World War II brought major increases in military land use. The Japanese deployed 18,500 troops on Guam and constructed several military installations. After the American invasion, 200,000 military personel were stationed on the island.

Harmon Field, 1.5 km south of the present study site, became the center of operations for B29 Bombers towards the end of the war. Air Force housing was constructed in the area now included in the southern part of the study site, but it fell into disuse after Harmon Field operations were discontinued; the development was abandoned by the early 1970's. All that remains are the access roads and rusting debris of previous house sites. At the present time, the area is vacant with the exception of two dwellings in the southwestern end of the site.

Endangered and Threatened Species

Table 1 lists those bird and mammal species on Guam that have or may require federal protection under the Endangered Species Act.

A precipitous decline of Guam forest bird populations has occured over the last 10 to 20 years, the result of predation by the introduced

brown tree snake (Boiga irregularis) (Savidge, 1987). The range contraction of the forest avifauna has proceeded northwards from the presumed point of introduction of the snake in south-central Guam. Records of the snake in the Barrigada/Harmon area date from 1965; the decline in bird populations near the site had begun by the mid 1960's and was complete by 1980 (Savidge 1987). Since that time, the wave of avian decline and extinction has moved northwards into the Northwest Field/Ritidian Point area where small populations of some forest bird species still remain.

Ten bird species on Guam are listed by the U. S. Fish and Wildlife Service as endangered (Federal Register 1984). An additional five species are listed as endangered or threatened by the Government of Guam (GOVGUAM) (Government Code 1979, 1981). Three bird species (the Mariana Mallard, the Micronesian Megapode, and the Nightingale Reed-warbler) are still included on the endangered species list but are now considered extict on Guam.

Two mammal species on Guam are listed as endangered by both the USFWS and GOVGUAM, and one is considered endangered by GOVGUAM only.

Four recovery plans are presently being drafted by the USFWS for the endangered species in the Mariana Islands. At this time, these documents are in the final stages of preparation: the public comment period closed at the end of March 1990, and final drafts are nearing completion. Neither the Island Swiftlet Recovery Plan nor the Common Moorhen Recovery Plan are relevant to the Harmon Annex site since the specialized habitats required by these birds for nesting oand/or feeding do not occur in the area. However, the Guam Forest Bird Recovery Plan and the Marianas Fruit Bats Recovery Plan pertain to species that may potentially utilize the site. These plans designate areas as essential habitat if they contain habitat components necessary for the species' eventual recovery. None of the forested areas in the Harmon Annex site are considered essential habitat for either the Fruit Bats or the Forest Birds.

Guam Division of Aquatic and Wildlife Resources (DAWR) surveys last recorded forest bird species in the Amantes Point area (near the southern end of the site) in 1979 (Savidge, 1979, DAWR, pers. comm.). A recent survey (Freed 1989) north of the site near the FAA Headquarters recorded no endangered species, although DAWR personel had observed the Marianas Fruit Bat in the vicinity in late 1988.

Survey Methods

Two observers spent a total of 30.5 hours at the study area (61 man-hours of survey time). Weather conditions during most of the survey were ideal: partly cloudy skies with northeast tradewinds from 5 to 15 mph. Occasional heavy showers occured during one of the survey days, but otherwise there was no precipitation. Temperatures ranged from about 75 F (at pre-dawn) to 90 F (at noon). Observations began at dawn and were suspended at midday when avian activity was reduced.

We performed transect counts both along roads and in the interior of the site (Figure 1). Birds were identified visually and from vocalizations as we moved slowly through the site along the transects, frequently pausing for five minute periods to listen for songs or calls. Nesting activities were noted as they were observed in the course of transect counts.

No specific trapping regime was performed to determine mammal densities at the study site. Mammals and indirect evidence of their presence (such as digging, tracks, or scat) were noted during bird transect counts.

Results

A. Faunal Habitats

Three faunal habitats were present at the site (Figure 2, Photo 1). Two of these include more than one distict vegetation type, since faunal use patterns of the vegetaion units in question were similar. Detailed descriptions of the vegetation types included here may be found in the botanical survey of the site.

1. Forest. (Photos 2 and 3)

This habitat type includes both the second growth limestone forest at the northern and southern ends of the site, and the abandoned coconut grove in the southern third of the area.

2. Scrub. (Photos 4 and 5)

Scrub habitat is present in a number of areas throughout the site and includes the feral scrub (in the abandoned Harmon Annex housing area), Pago bramble (in the northeastern third of the site), and Tangan-tangan thickets (such as those adjacent to North Road).

3. Grassland. (Photo 6)

An extensive grassland covers much of the middle portion of the study site. It consists a mosaic of areas characterized by different species composition and vegetation densities. Most of the grassland habitat consists of dense thickets of Pennesetum six to eight feet in height. A number of areas in the vicinity of North Road are more sparsely vegetated with a cover of ferns, grasses, and herbs that rarely exceeded three or four feet in height.

B. Summary of Findings

Table 2 lists the six bird and five mammal species detected during the survey. None of these were federally listed species. All of the mammal species and four of the bird species are alien to Guam.

Avian densities were exceedingly low in the study area: fewer than ten individuals were detected of all species except the Lesser Golden Plover (Pluvialis dominica).

Evidence of feral mammal activity was common in forest and scrub habitats throughout the site. Sign of pigs (rooting and scat) and Sambar deer (scat and characteristic tree damage) were most common in the northern portion of the site; feral dogs were seen on three occasions in the abandoned coconut grove and in nearby feral scrub habitat.

C. Annotated Bird Species List

The following list includes information on the status, distribution, and relative abundance of bird species found during the survey. Nomenclature and English common names follow Engbring and Pyle 1985 or Pratt et al. 1987; Chamorro common names are from Segal (1984).

Notes on distribution, habitat preferences, and behavior are from Mayr 1945, Baker 1951, Pratt et al. 1987, and my own field observations.

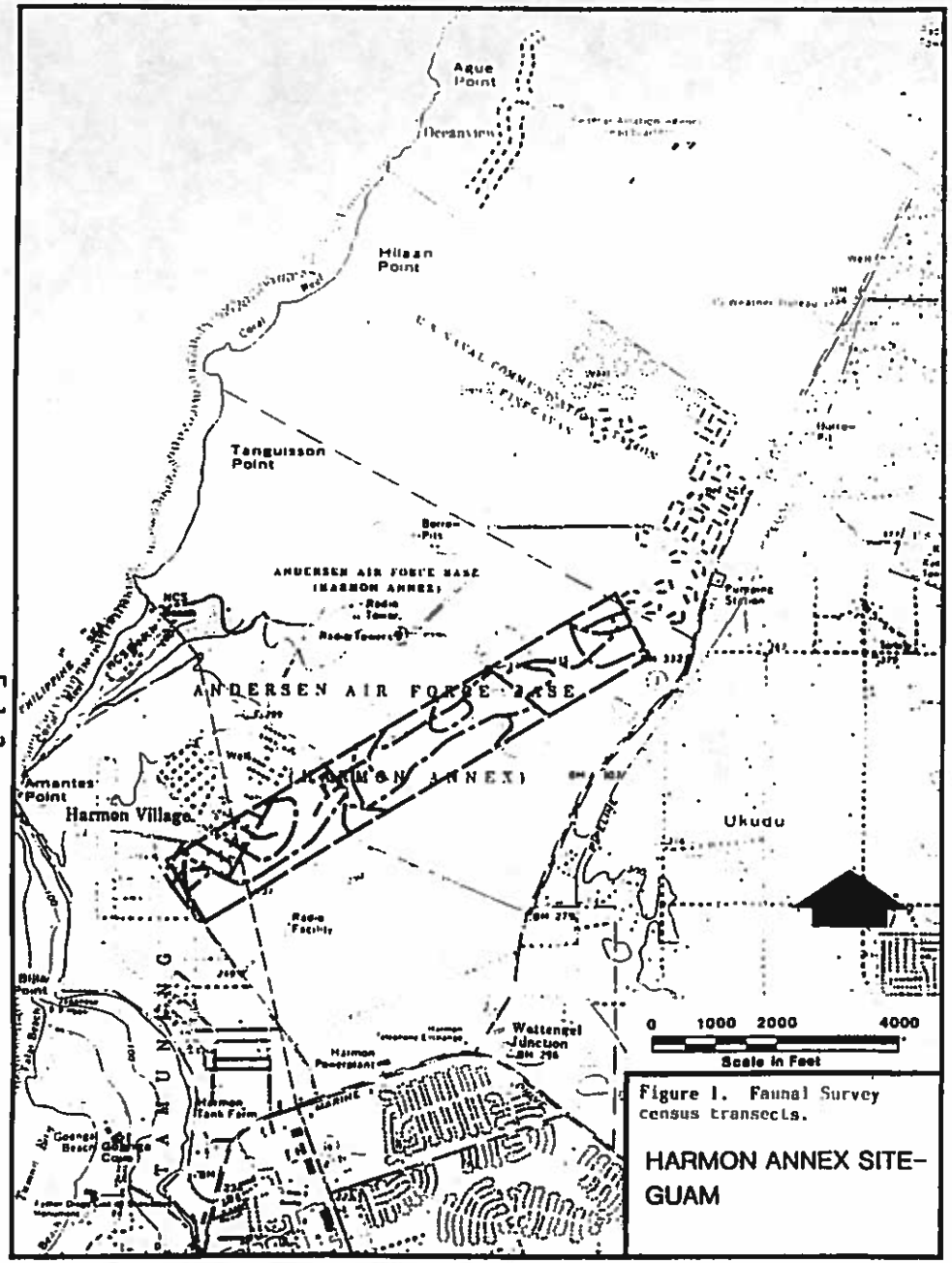


Figure 1. Faunal Survey census transects.

HARMON ANNEX SITE-GUAM

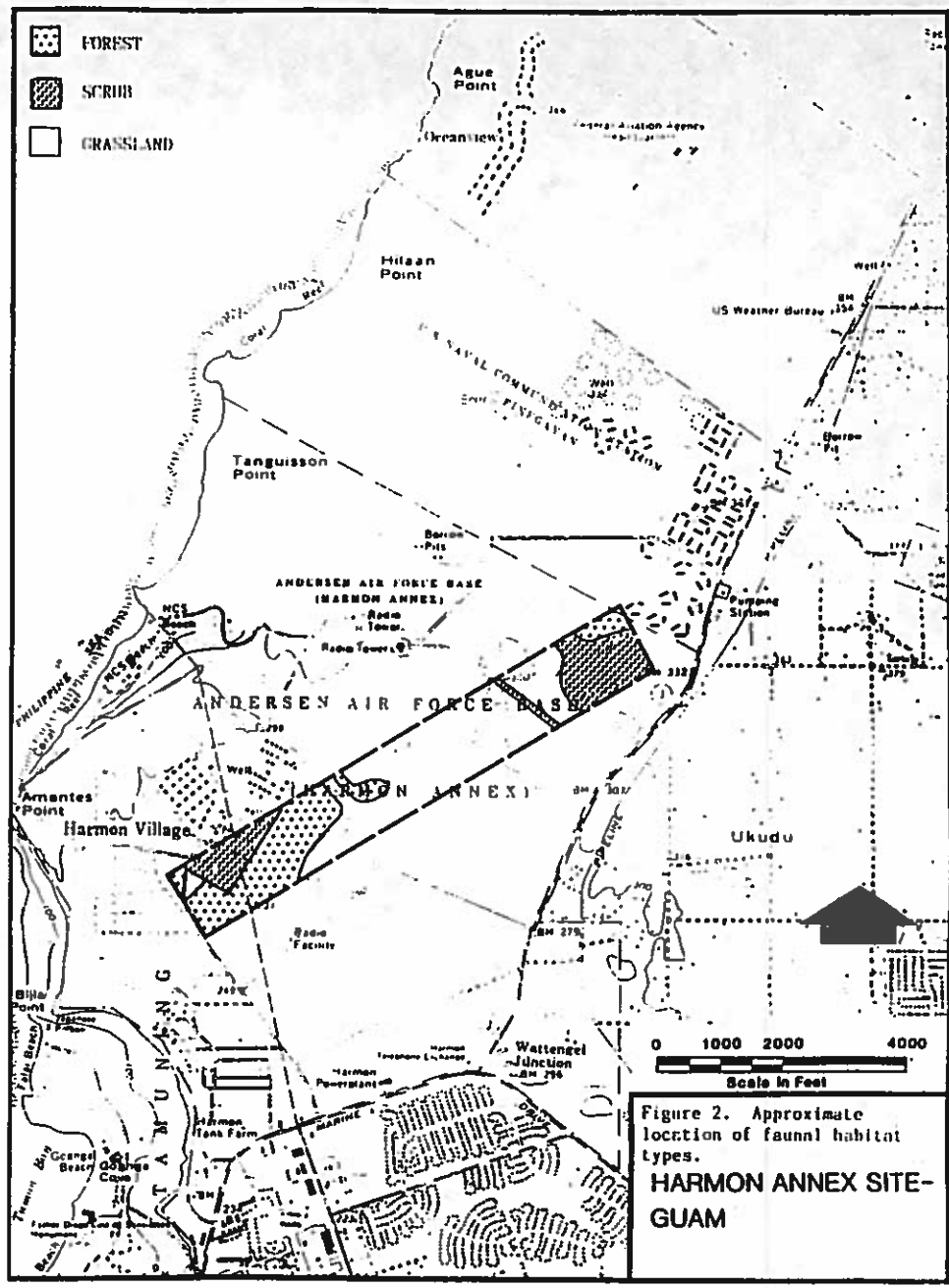


Figure 2. Approximate location of faunal habitat types.

HARMON ANNEX SITE-GUAM

The status of each species is indicated by abbreviations as follows: R=resident breeding species, native; RA=resident breeding species, alien; and M=migratory species.

FAMILY ARDEIDAE (Herons, Bitterns, and Egrets)
Yellow Bittern, Kakag (Ixobrychus sinensis), R, Uncommon.

This small Bittern is native and fairly common from India to the eastern part of Micronesia. It is often found in densely vegetated areas were it feeds on insects and small vertebrates.

A single Bittern was observed in the Pennesetum grassland south of North Road. A second observation, perhaps of the same individual, occurred southeast of the sewage treatment plant during the botanical survey. In spite of the fact that much of this part of the site is good potential habitat for this species, extensive surveys of the remainder of the area failed to turn up any other individuals.

FAMILY PHASIANIDAE (Francolins, Pheasants, Quail)
Black Francolin (Francolinus francolinus), RA, Uncommon

This gamebird species was introduced to Guam in 1961, in Mangilao and near the U.S. Naval Magazine. By 1977, the range of this species was about 26 square km in extent (Drahos 1977); they have since spread into central and northen Guam. Freed (1988) detected Black Francolins on the P-225 site, indicating that this species has become established well north of the present site.

Three Francolin were found in grassland habitats in the central and middle portions of the site. The individuals were sparsely distributed and no evidence of breeding activity was discovered. Grassland species such as this one are somewhat less vulnerable to tree snake predation than forest bird species; the northward spread of Black Francolin during the last ten years suggests that successful reproduction is occuring in this area.

FAMILY CHARADRIIDAE (Plovers)
Lesser Golden Plover, Dulili (Pluvialis dominica), M, Abundant

This is a common migratory species throughout the Pacific where it is found in coastal areas, in wetlands, and along roadsides and in grassland habitats.

Plover were found on roadsides throughout the area, but were most common in the upper part of the site. A group of between 36 and 63 birds regularly roosted on an old antenna foundation near North Road. This part of the site was vegetated with a sparse cover of ferns and herbaceous species which allowed unrestricted visibility.

FAMILY COLUMBIDAE (Doves and Pigeons)
Philippine Turtle-Dove, Paluman Senesa (Streptopelia bitorquata), RA, Uncommon.

This species is native to the Philippines and was introduced to the Marianas in the 1700's. It is a ground feeding dove found in a variety of habitats.

Turtle-doves were consistently found in forested parts of the site and in lower numbers in scrub habitats. In spite of being the second-most abundant species at the site, they were never common. The largest

population of Turtle-doves in the site occurred in the coconut grove south of the middle road.

FAMILY DICRURIDAE (Drongos)
Black Drongo (Dicrurus macrocerus), RA, Uncommon.

Drongos are native to most of southern Asia. The species was introduced to Rota in the 1930's, and had spread to Guam by the 1960's.

The Drongo occurs in a wide variety of habitats, and is particularly common in towns and along roadways. It is often observed perching on wires and in other exposed locations, from which it preys on insects and other small animals.

This species was regularly seen in the northeastern end of the study site, particularly in the early morning and late afternoon. Occasionally, groups of two or three individuals were observed in this area. Two Drongos were in flight over the dirt road in the upper portion of the study area; they were also seen on fences and powerlines near the northern boundary of the site at the USN printshop and the sewage treatment plant.

FAMILY PASSERIDAE (Old World Sparrows)
Eurasian Tree Sparrow (Passer montanus), RA, Uncommon.

This species was introduced to the Mariana Islands from temperate Eurasia, and is most common in urban environments.
It is closely related to the familiar House Sparrow (Passer domesticus), which it vaguely resembles.

Eurasian Tree Sparrows were sparsely distributed in the study site; they were found in both forest and scrub habitats in very low numbers. One active nest of this species was observed in the second growth limestone forest south of the beach road.

Photo 1. Oblique aerial view of the Ramon Annex Site looking ESE. The site is outlined in black; its southwestern end is outside the right hand edge of the photo. Forest and grassland habitats in the southwestern end of the site are clearly visible.

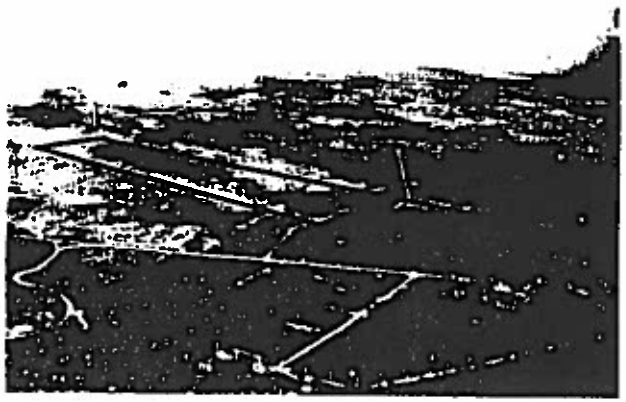


Photo 2. Forest habitat in the central part of the study area; view of the coconut plantation from Middle Road.

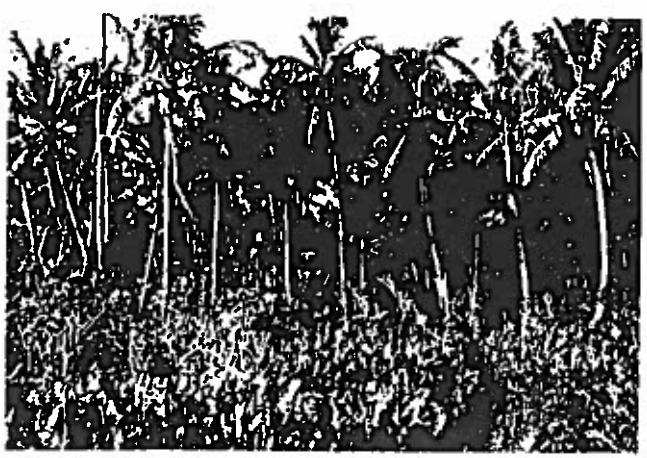


Photo 3. Secondary limestone forest in the southwestern end of the site.



Photo 4. Scrub habitat in the abandoned Ramon Annex housing area.





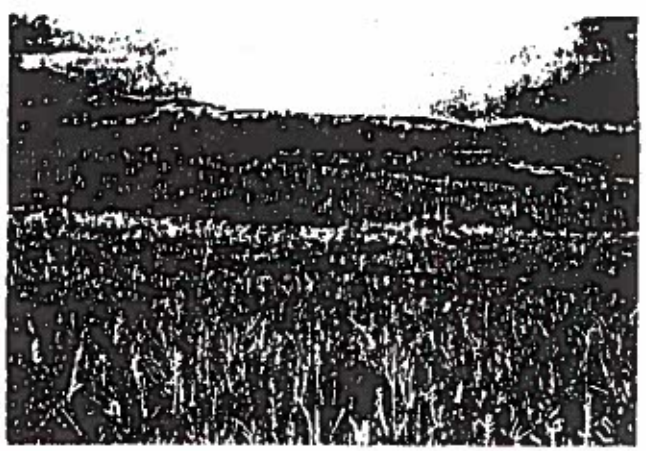


Table 1. List of endangered or threatened species on Guam.

Species	Status*
BIRDS	
Common Moorhen (Gallinula chloropus guami) Wetland species; no appropriate habitat at site.	E
Mariana Mallard (Anas platyrhynchos) Wetland species; no appropriate habitat at site. Believed extinct on Guam.	E
Micronesian Megapode (Megapodius laperouse laperouse) Believed extinct on Guam.	E
Guam Rail (Rallus owstaleti) Not recently detected, DAWR Perimeter Rd surveys, 1987, 1988 (Robert Beck, Pers. Comm.). Forest, Grassland habitats.	E
Island Swiftlet (Aerodramus vanikorensis bartschi) Nests and roosts in caves (Jenkins 1983); no appropriate habitat at site.	E
Micronesian Kingfisher (Halcyon cinnamomina cinnamomina) Heard in Northwest Field area (P-225 site), 1988 (Freed, 1988), and on Perimeter Rd., 1988 (Robert Beck, pers. comm.).	E
Mariana Fruit Dove (Ptilinopus roseicapillus)	EG
White-throated Ground Dove (Gallicolumba xanthonura xanthonura	EG
Guam Broadbill (Myiagra freycineti) Heard in P-225 site, 1988 (Freed, 1988)	E
Rufous Fantail (Rhipidura rufifrons uraniae)	EG, CE
Not recently detected, DAWR Perimeter Rd. surveys, 1987, 1988. (Robert Beck, Pers. Comm.)	
Bridled White-eye (Zosterops conspicillata conspicillata) Not recently detected, DAWR Perimeter Rd. surveys, 1987, 1988. (Robert Beck, Pers. Comm.)	E
Micronesian Honeyeater (Myzomela rubrata saffordi) Not recently detected, DAWR Perimeter Rd. surveys, 1987, 1988. (Robert Beck, Pers. Comm.)	EG
Micronesian Starling (Aplonis opaca guami)	TG
Mariana Crow (Corvus kubaryi) Present in small numbers, Northwest Field area	E
Nightingale Reed-warbler (Acrocephalus luscinia) Believed extinct on Guam)	E
MAMMALS	
Marianas Fruit Bat (Pteropus mariannus mariannus) Seen in P-225 site 1988 (Freed, 1988), Few observations in NW Field area since late 1970's (Wheeler and Aguon 1978, Wiles 1987)	E
Little Marianas Fruit Bat (Pteropus tokudae)	E
Sheath-tailed Bat (Emballonura semicaudata)	CE

*E=Endangered (USFWS, GOVGUAM), CE=Candidate Endangered (USFWS), EG=Endangered (GOVGUAM only), TG=Threatened (GOVGUAM only).

Table 2. Numbers of bird and mammal species detected at Harmon Annex site, Guam.

SPECIES	HABITATS* 1	2	3
Birds			
Yellow Bittern (Ixobrychus sinensis)	-	-	2
Black Francolin (Francolinus francolinus)	-	-	3
Lesser Golden Plover (Pluvialis dominica)	-	1	73
Philippine Turtle-dove (Streptopelia bitorquata)	9	2	-
Black Drongo (Dicrurus macrocercus)	5	2**	-
Eurasian Tree Sparrow	4	1	-
Mammals***			
House Mouse (Mus musculus)		1	-
Rallus, sp.	1	1	-
Feral Dog (Canis familiaris)	2	1	-
Sambar Deer (Cervus unicolor)	-	3	-
Feral Pig (Sus scrofa)	1	1	-

* 1=forest, 2=scrub, 3=grassland.
** Two individuals seen in flight over upper road.
*** Mammal detections included here are both direct sightings or observations of mammal tracks, scat, or damage.

E-1-7

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APPENDIX F-1

Botanical Survey (Guam)

HAWEO ACCESS PROJECT SITE: A BOTANICAL SURVEY REPORT

F-1-1

Prepared for Wilson Okamoto and Associates
Honolulu, Hawaii

by
Evangeline J. Funk Ph.D
March 1990

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INTRODUCTION

A botanical survey of a 275 acre area known as Harmon Annex - Project Site 223 was conducted in March 1990. The purposes of the survey were as follows: to determine if US Government (USFWS 1989) or Government of Guam (GEPA 1987) candidate, proposed or listed, threatened or endangered species exist on the site; to collect technical data to describe and map the existing vegetation; and to compile an inventory of the existing flora.

METHODS

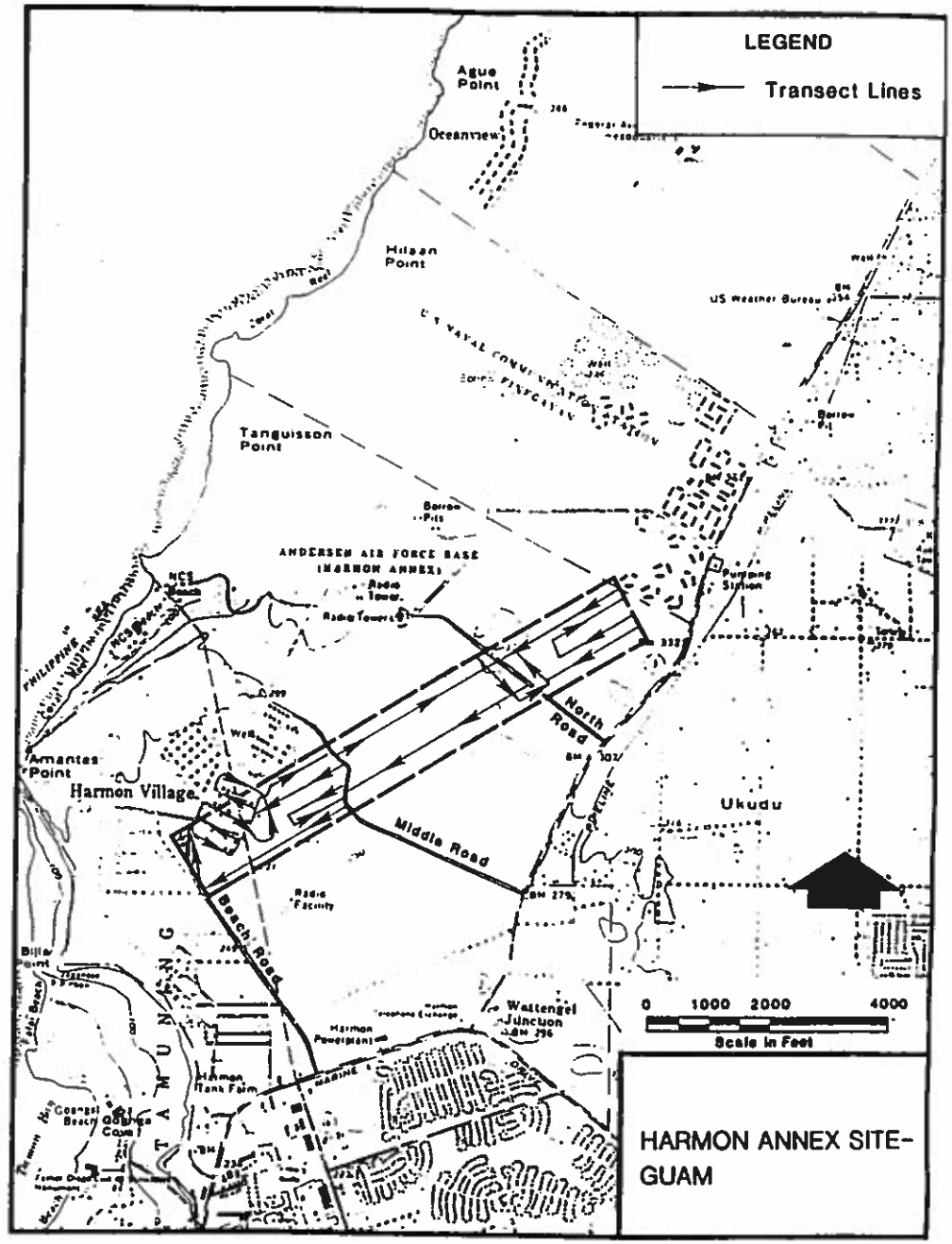
Before the field survey was undertaken, interviews were held with knowledgeable botanists from U. S. Fish and Wildlife Service in Honolulu, Hawaii and at the University of Guam to familarize investigators with the area and to delineate access routes and boundaries.

Access was gained by way of existing roads and trails and by way of peripheral and cross site transsects (Figure 1). All parts of the site were surveyed and all taxa encountered were recorded and are contained in the species list.

F-1-2

BOTANICAL HISTORY

A most thorough review of the botanical literature pertaining to the Marianas Islands was written by Ray Fosberg in 1960 (Fosberg 1960). Much of the same material was reviewed and enlarged upon by Ben Stone in 1970-71 (Stone 1970-71). Since that time, several floristic treatments of the archipelego have appeared (Fosberg, Sachet and Oliver 1979, 1982, 1987), but research on the vegetation has been lacking. Except for Fosberg and Stone, modern day botanists have overlooked Guam. It may be that Fosberg's early assessment, i.e. "the vegetation of Guam, even more than that of the other islands of the Marianas Group, is vastly altered from its primative state and



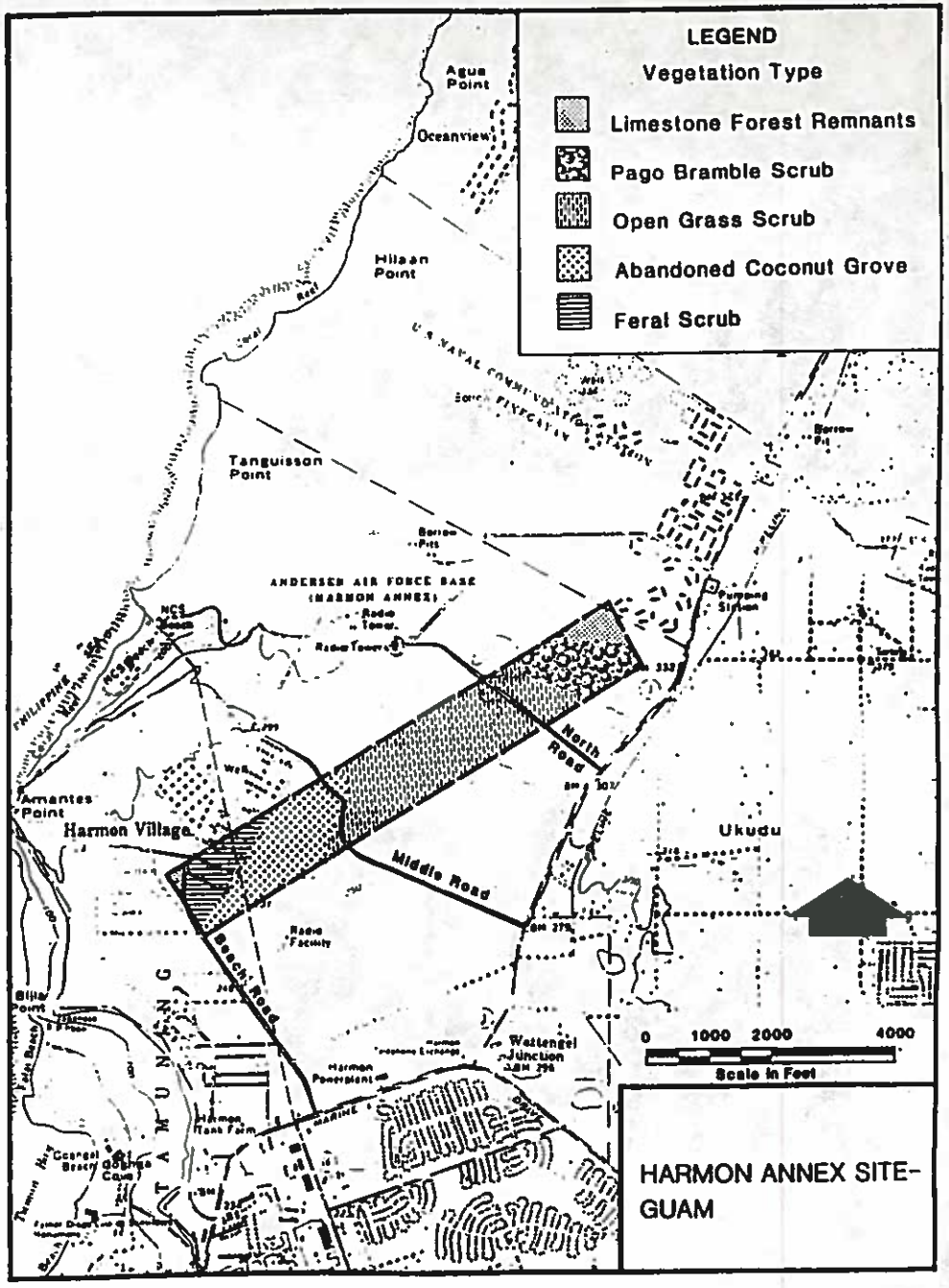
it seems best to regard the present day forests on the plateaus and terraces as modified. Most of the vegetation types of Guam have been disturbed rather profoundly and now contain a greater or smaller proportion of weedy species which were not part of the original plant communities. Where the disturbance has been so great as to destroy completely the original vegetation, this is often replaced entirely by communities of aggressive, mostly exotic, pioneer species commonly called 'weeds'", may have dampened interest in the botany of the island. In this statement, Fosberg, seems to be describing the plant community of the study site.

VEGETATION TYPES

The five vegetation types found on the Harmon Annex Site are, for the most part, made up of introduced grasses, herbs, shrubs, and trees (Figure 2). Only in the Limestone Forest Remnants were native species, in any significant numbers, found. The remaining vegetation types, Open Grass Scrub, Pago Bramble Scrub, Feral Scrub, and Abandoned Coconut Groove are basically weed communities.

Limestone Forest Remnant

Remnants of limestone forest (Figure 2) are found at both the northeast and northwest corners of the Harmon Annex study site. Together these areas comprise about 50 acres. Scattered, emergent dok-dok or breadfruit trees (*Artocarpus mariannensis* Trecul) and *Neisosperma oppositifolia* (Lam.) Fosb. & Sachet, 40 to 45 feet in height were found in both areas. These big trees often support large epiphytic colonies of ferns and occasionaly orchids. Two medium sized yoga (*Elaeocarpus sphaericus* (Gaertn.) K. Schumann) trees are growing in the northeast remnant near the Navy housing.



Some scattered native plants such as fadang (*Cycas circinalis* L.) (Figure 3), galak or bird-nest fern (*Asplenium nidus* L.), hejueo or false cattail (*Flagellaria indica* L.), pahong and kafu (*Pandanus dubius* Sprengel and *P. fragrans* Gaud.), ifil (*Inocia bijuga* (Colebr.) O. Kuntze), otot (*Discocalyx megacarpa* Merr.), were found in the comparatively undisturbed areas. In addition, a great many weedy plants such as tangan-tangan (*Leucaena leucocephala* deWit), lantana (Lantana camera L.), tinta'n-china (*Cestrum diurnum* L.), limon-chino or limberry (*Triphasia trifolia* (Burm. f.), Eupatorium (*Eupatorium odoratump* L.), *mile-a-minute vine (Mikania scandens* L.), stay-awhile (*Caesalpinia major* (Medic.) Dandy & Exell.), and mixed grasses were also present.

These forest remnants are surrounded by dense tangles of spiny plants. But, inside the canopy, the forest is fairly open and the ground layer is slightly surpressed, making it somewhat easier to move about.

F-1-4

Open Grass Scrub

Open Grass Scrub (Figure 4) is the most common and widespread vegetation type found on the Harmon Annex Project Site. It extends from east of North Road, westward to Middle Road and part way to Beach Road (Figure 2). For most of this distance, it covers the site from its northern to its southern boundaries. This is a well developed weed community with the large forage grass, *Pennisetum purpureum* Schumach or napier grass as its most dominant feature. Near North Road, the napier grass is less than three feet in height, but in the ravines and near the sewage disposal plant it is six to eight feet tall. At the time of the survey, many of the large clums (stems) had fallen or bore only large tufts of dead leaves. Scattered about in this broad, open area were small patches of short, bushy lada trees (*Morinda*



Limestone forest remnants contained many Cycads and [illegible]



Figure 4. Open Grass Scrub was the most common vegetation type

citrifolia L.) and tangan-tangan shrubs, none of which over topped the grass.

Within the Open Grass Scrub can be found randomly spaced, dense patches of sword and laua'e fern (*Nephrolepis* spp. and *Polypodium scolopendria* Burm. f.). These mostly circular patches vary in size from twenty to fifty feet in diameter. Some patches contain only sword fern or laua'e fern, while others contain several species of ferns and weeds. Also found in this vegetation type was a wide ranging, scant colony of the pantropical, diminutive fern *Ophioglossum nudicaule* L.

Hidden in the weeds and grasses were scattered patchs of pakoo or wait-a-bit vines (*Caesalpinia major* (Medic) Dandy & Excell), and several old house sites. In the vicinity of the house sites there were often cultivars from abandoned gardens such as papaya (*Carica papaya* L.), bullock's heart (*Annona reticulata* L.), sugar apple (*Annona squmosa* L.), spider lillies (*Hymenocallis littoralis* (Jacquin) Salisb. and *Lippia nodiflora* (L.) Rich.

Pago Bramble Scrub

Eastward from the Open Grass Scrub to the Limestone Forest Remnant and beyond to the eastern boundary, is a large patch of Pago Bramble Scrub (Figure 2). Pago or *Hibiscus tiliaceus* has been described as "a small intricately branched tree with many low, spreading branches without a central trunk" and the bramble, pakao or *Caesalpinia major* has been described as a "woody climber with spiny stems and racheses - with hook-like, recurved prickles". In some places the pago trees have become dense enough to form a continuous canopy, but for the most part the little trees are widely separated.

Where the bramble has become established it forms dense, impenetrable



Pago forms dense impenetrable thickets.



Figure 6. The abandoned coconut grove contains trees of all sizes.

colonies. Both pago and pakao are vigorous invader species and are spreading to all parts of the study site.

Fern patches such as those described earlier in the Open Grass Scrub were also found in the Pago Bramble Scrub (Figure 5). In this part of the site, the fern patches were much more robust and dense and individual fern fronds averaged more than three feet in length. Scattered throughout this area were large numbers of pale, rose-lavender flowered ground orchids (*Spathoglottis plicata* Blume.).

Abandoned Coconut Grove

An Abandoned Coconut Grove covers much of the area between Middle Road to Beach Road and eastward into the Open Grass Scrub near the Sewage disposal plant (Figure 2). The coconut trees are irregularly spaced and range in size from single leafed seedlings to mature, nut bearing trees fifty feet in height (Figure 6). Some native trees such as *Neisosperma oppositifolia* (Lam.) Fosb. & Sachet and ahago (*Premna obtusifolia* R. Br.) can be found among the coconut trees and some of the coconut trees are festooned with great colonies of ferns and some orchids.

The ground layer is made up of ferns (*Nephrolepis* spp., *Asplenium pellucidum* Lam., *Polypodium punctatum* (L.) Sw., *P. scolopendria* Brum. f. and many grass and weed species.

The cover within the Abandoned Coconut Grove is very uneven. In some places the canopy is down and large, pure stands of napier grass or tangan-tangan fill the space. The topography is also uneven with many ravines and swales, but no very high places. This is the area in which an open sewer leach field was reported. The botanical team made an effort to find what was described as an open sewer pond, but concluded that it was one

of the low places where a dense colony of napier grass had developed after the pond had fallen into disuse.

Feral Scrub

Feral scrub describes the vegetation of that part of the study site where Harmon Village once stood. In this area are large numbers of planted landscape plants which are now flourishing and reproducing without human assistance. Many large Ficus and citrus trees, Plumerias, Philodendron and other vines, shrubs, bulbs, and ground covers are proliferating. These along with many spiny weeds and brambles and all types of left behind refuse make this a very unattractive part of the site (Figure 7). The vegetation of this part of the site was not included in the species list.

Endangered Species

No listed or proposed, threatened or endangered species (USFWS 1989, GEPA 1987) were found during this study. No such plants have been reported from this study site and there is no evidence to support the notion that endangered species may be present on this site.



Figure 7. Feral Scrub contained many types of [illegible]

F-1-7

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SPECIES LIST

The plant families in the following species list have been alphabetically arranged within four groups, Ferns, Gymnosperms, Monocotyledons, and Dicotyledons. The genera and species are arranged alphabetically within families. The taxonomy and nomenclature follow that of Fosberg, Sachet & Oliver (1979, 1982, 1987) and Stone (1970-71). For each taxon the following information is provided:

1. An asterisk before the plant name indicates a plant introduced to Guam since Magellan or by the aborigines.
2. The scientific name.
3. The Chamorro name and or the most widely used common name.
4. Abundance ratings are for this site only and they have the following meanings:

   Uncommon = a plant that was found less than five times.

   Occasional = a plant that was found between five to ten times.

   Common = a plant considered an important part of the vegetation

   Locally abundant = plants found in large numbers over a limited area. For example the plants found in grassy patches.

This species list is the result of an extensive survey of this site at the beginning of the rainy season (March 1990) and it reflects the vegetative composition of the flora during a single season. Minor changes in the vegetation will occur due to introductions and losses and a slightly different species list would result from a survey conducted during a different growing season.

CHECKLIST OF PLANTS FOUND ON THE HARMON ANNEX SITE, GUAM MARCH 1990

SCIENTIFIC NAME	COMMON NAME	ABUNDANCE
FERNS		
OPHIOGLOSSACEAE		
Ophioglossum nudicaule (L.) Swartz		Locally abundant
POLYPODIACEAE		
Asplenium falcatum Lam.		Occasional
Asplenium nidus L.		Locally abundant
Belvesia spicata		Common
Davallia solida (Forst. f.) Swartz	Pugua-machena	Locally abundant
Nephrolepis acutifolia (Desvaux) Christ		Locally abundant
Nephrolepis biserrata (Sw.) Schott		Common
Nephrolepis hirsutula (Forst.) Presl	Sword fern	Common
Polypodium punctatum (L.) Sw. = *Microsorium punctatum* (L.) Copel.		Common
Polypodium scolopendria Burm. f. =*Phymatodes scolopendria* (Brum.) Ching		Common
Pteris tripartita Sw.		Occasional
Pyrrosia adnascens (Swartz) Ching		Locally abundant
Thelypteris dentata)Frosk.) E. St. John		Occasional
Thelypteris opulenta (Kaulf.) Fosb.		Occasional
VITTARIACEAE		
Vittaria elongata Swartz		Occasional
GYMNOSPERMAE		
Cycas circinalis L.		Locally abundant
ANGIOSPERMS		
MONOCOTYLEDONES		
ARACEAE - Aroid Family		
**Alocasia macrorrhiza* (L.) D. Don	Papao apaca	Locally abundant
CYPERACEAE - Sedge Family		
**Cyperus alternifolia* L.	Umbrella sedge	Occasional
Cyperus ligularis L.		Occasional
Cyperus polystachyos Rottb.		Occasional
**Cyperus rotundus* L.	Chaguan humatag	Locally abundant
Fimbristylis cymosa R. Br.		Occasional
Fimbristylis dichotoma (L.) Vahl		Occasional
Fimbristylis tristachya R. Br.		Occasional

SCIENTIFIC NAME	COMMON NAME	ABUNDANCE
DIOSCOREACEAE - Yam Family		
**Dioscorea esculenta* (Lour.) Prain & Burkill	Yam	Uncommon
FLAGELLARIACEAE		
Flagellaria indica L.	Bejuco halum-tano	Common
GRAMINEAE - Grass Family		
**Brachiaria miliformis* (Presl) Chase = *Panicum miliforme* Presl (Fosberg)		Locally abundant
**Cenchrus echinatus* L.	Sandbur	Locally abundant
**Chloris inflata* Link	Finger grass	Occasional
**Chrysopogon aciculatus* Retz.	Infuk	Occasional
**Cynodon dactylon* (L.) Pers.	Grama	Common
**Dactyloctenium aegyptium* (L.) Beauv.	Crowfoot grass	Occasional
**Digitaria ciliaris* (Retz.) Koeler		Occasional
**Digitaria violascens* Link		Uncommon
**Echinochloa colonum* (L.) Link		Uncommon
**Eleusine indica* (L.) Gaertn.	Ragi	Common
**Eragrostis ciliaris* (L.) R. Br.		Common
**Eragrostis tenella* (L.) R. & S.	Lovegrass	Common
**Eustachys petraea* (SW) Desv.		Locally abundant
**Panicum maximum* Jacq.	Guinea grass	Locally abundant
**Paspalum conjugatum* Berg.		Occasional
**Paspalum orbiculare* Forst. f.		Occasional
**Paspalum paniculatum*		Occasional
**Pennisetum polystachyum* (L.) Schultes	Mission grass	Common
**Pennisetum purpureum* Schum.	Elephant grass	Common
**Saccharum spontaneum* L.	Wild cane	Occasional
**Sporobolus diander* (Retz.) Beauv.	Rat tail grass	Locally abundant
**Sporobolus fertilis* (Steud.) Clayton		Locally abundant
**Trichachne insularis* (L.) Nees	Cotton grass	Occasional
LILIACEAE - Lily Family		
Hymenocallis littoralis (Jacq.) Salisb.	Lirio	Locally abundant
MUSACEAE - Banana Family		
Musa x paradisiaca L.	Chotda	Uncommon
ORCHIDACEAE - Orchid Family		
Didymoplexis fimbriata Schtr.		Uncommon
Geodorum densiflorum (Lam.) Lindl.		Uncommon
Nervilia aragoana Gaud.		Uncommon
**Spathoglottis plicata* Bl.		Common
Taeniophyllum mariannense Schltr		Common
Zeuxine fritzii Schltr.		Uncommon

SCIENTIFIC NAME	COMMON NAME	ABUNDANCE
PALMAE - Palm Family		
Cocos nucifera L.	Niyog	Common
PANDANACEAE - Pandanus Family		
Pandanus tectorius Park	Pahong	Common
Pandanus dubius Sprengel	Pahong	Common
ANGIOSPERMS		
DICOTYLEDONES		
AMARANTHACEAE - Amaranth Family		
Achyranthes aspera L.	Chichitun	Locally abundant
Amaranthus spinosus L.	Kuletes	Locally abundant
Amaranthus viridis L.	Kuletes apaca	Locally abundant
ANNONACEAE - Custard-apple Family		
Annona reticulata	Bullock's heart	Occasional
Annona squamosa	Sugar apple	Occasional
Guamia mariannae (Safford) Merrill	Pal-pal	Occasional
APOCYNACEAE - Periwinkle Family		
Alyxia torresiana Gaud.	Nanago	Uncommon
Neisosperma oppositifolia (Lam.) Fosb. & Sachet		Occasional
ASCLEPIADACEAE - Milkweed Family		
**Asclepias curassavica* L.	Asuncion	Locally abundant
BARRINGTONIACEAE - Fish Poison Family		
**Barringtonia asiatica* (L.) Kurz	Punting	Uncommon
BORAGINACEAE - Heliotrope Family		
Heliotropium indicum L.	Bergen	Common
CASUARINACEAE - Ironwood Family		
Casuarina equisetifolia L. = *Casuarina litorea* L. (Fosberg)	Gago	Common
CARICACEAE - Papaya Family		
**Carica papaya* L.	Papaya	Common

SCIENTIFIC NAME	COMMON NAME	ABUNDANCE
CELASTRACEAE - Bittersweet Family		
Maytenus thompsonii (Merr.) Fosb.	Lululut	Occasional
COMPOSITAE - Sunflower Family		
**Bidens pilosa* L. = *Bidens alba* of Fosb.	Beggar's tick	Common
Conyza canadensis (L.) Cronq.	Horse-weed	Locally abundant
Chromolaena odorata (L.) King & Rob. = *Eupatorium odoratum* L.		Common
Emilia sonchifolia DC. ex Wight	Flora's paint brush	Occasional
Mikania scandens (L.) Willd.	Mile-a-minute vine	Common
Synedrilla nodiflora (L.) Gaertn	Saigon	Locally abundant
Tridax procumbens L.	Coat buttons	Locally abundant
Vernonia cinerea (L.) Less.	Chaguan-Sta.Maria	Occasional
CONVOLVULACEAE - Morningglory Family		
Cuscuta campestris Yuncker		Locally abundant
Ipomoea indica (Burm. f.) Merr.	Fofgu	Occasional
Ipomoea littoralis Blume	Lagun-tasi	Uncommon
Ipomoea triloba L.	Fofgu	Occasional
CUCURBITACEAE - Gourd Family		
Momordica charantia L.	Almagoso	Common
EUPHORBIACEAE - Spurge Family		
**Acalypha indica* L.	Hieber del cancer	Locally abundant
**Euphorbia cyathophora* Murray	Dwarf poinsettia	Locally abundant
**Euphorbia hetrophylla* L.		Locally abundant
**Euphorbia hirta* L.	Golondrina	Common
Glochidion marianum Muell.-Arg.	Chosgo	Occasional
Macaranga thompsonii Merr.	Pengua	Uncommon
Melanolepis multiglandulosa Reichb. f.	Alom	Occasional
**Phyllanthus acidus* (L.) Skeels	Iba	Uncommon
**Phyllanthus amarus* Schum. & Thon.	Maigo-lalo	Common
Phyllanthus marianus Muell.-Arg.	Gaogao-uchan	Locally abundant
GOODENIACEAE		
Scaevola sericea Vahl = *Scaevola taccada* (Gaernt.) Roxb.	Nanaso	Locally abundant
LABIATAE - Mint Family		
**Hyptis pectinata* (L.) Poit.	Mumutun	Locally abundant
**Hyptis suaveolens* (L.) Poit.	Mumutun	Locally abundant

SCIENTIFIC NAME	COMMON NAME	ABUNDANCE
LAURACEAE - Laural Family		
**Cassytha filiformis* L.	Dodder	Locally abundant
LEGUMINOSAE - Pea Family		
**Abrus pecatorius* L.	Kolales Halomtano	Uncommon
**Adenanthera pavonina* L.	Kolales	Occasional
**Albezia lebbeck* (L.) Benth	Siris tree	Uncommon
**Alysicarpus vaginalis* (L.) DC		Occasional
**Caesalpinia major* Dandy & Excell.	Pakao	Common
**Calopogonium muncunoides* Desv.		Occasional
**Cassia alata* L.	Acapulco	Locally abundant
**Cassia occidentalis* L.	Amo tomaga	Occasional
**Crotalaria pallida* Ait. = *Crotalaria micronata* Desv.	Rattlebox	Occasional
**Desmodium triflorum* (L.) DC	Agsom	Uncommon
**Indigofera suffruticosa* Miller	Anilis	Locally abundant
**Indigofera spicata* Frosk.	Anilis	Locally abundant
Instia bijuga (Colebr.) O. Ktze	Ifil	Uncommon
**Leucaena leucocephala* (Lam.) deWit	Tangan-tangan	Common
**Medicago polymorpha* Benth		Locally abundant
**Mimosa pudica* L.	Sensitive plant	Locally abundant
**Pithecellobium dulce* (Roxb.) Bent.	Kamachile	Occasional
**Terammus labialis* (L.f.) Spreng.	Chaguan	Occasional
MALVACEAE - Hibiscus family		
**Hibiscus rosa-sinensis* L.	Cumamela	Uncommon
Hibiscus tiliaceus L.	Pago	Common
**Malvastrum coromandelianum* Garcke	False marrow	Common
**Sida acuta* Burm. f.	Escobilla papagu	Common
**Sida rhombifolia* L.	Escobilla dalili	Common
MELIACEAE - Mahogany Family		
Aglaia mariannensis Merr.	Mapunyao	Uncommon
MORACEAE - Fig Family		
Artocarpus mariannensis Trecul	Dokdok	Occasional
Ficus prolixa Forst. f.	Nunu	Occasional
Ficus tinctoria Forst. f.	Hoda	Occasional
MORINGACEAE - Moringa Family		
**Moringa oleifera* Lam.	Horseradish-tree	Uncommon
MYRSINACEAE - Myrsine Family		
Discocalyx megacarpa Merr.	Otot	Occasional

SCIENTIFIC NAME	COMMON NAME	ABUNDANCE
MYRTACEAE - Myrtle Family		
Eugenia palumbis	Agatelang	Uncommon
Eugenia reinwardtiana (Bl.) DC	Aabang	Uncommon
Psidium guajava L.	Guava	Uncommon
NYCTAGINACEAE - Four o'clock Family		
Boerhavia repens L.	Dafao	Common
Pisonia grandis R. Br.	Umum	Uncommon
OLEACEAE - Olive Family		
Jasminum marianum DC.	Banago	Common
PASSIFLORACEAE - Passion Flower Family		
**Passiflora foetida* L.	Love-in-a-mist	Occasional
**Passiflorasuberosa* L.		Occasional
PIPERACEAE - Pepper Family		
Piper guahamense Dc	Pupulo aniti	Locally abundant
POLYGALACEAE - Polygala Family		
**Polygala paniculata* L.		Common
POLYGONACEAE - Buckwheat Family		
**Antigonon leptopus* H & A	Candena de Amor	Locally abundant
RHAMNACEAE - Cascara Family		
Colibrina asiatica Brongniart	Gasoso	Occasional
RUBIACEAE - Coffee Family		
**Dentella ripens* (L.) J.R.&G. Forster	Borduegas	Locally abundant
Guettarda speciosa L.	Panao	Occasional
Ixora triantha Volkens	Ixora	Uncommon
Morinda citrifolia L.	Lada	Common
Morinda umbellata L.		Uncommon
**Paederia tomentosa* ?	Stink vine	Locally abundant
Psychotria mariana Bartl. ex DC	Ajgao	Occasional
**Spermacoce assurgens* R.& P.		Locally abundant
**Spermacoce erstii* Fosb. & Powell		Locally abundant

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SCIENTIFIC NAME	COMMON NAME	ABUNDANCE
RUTACEAE - Citrus Family		
Citrus macroptera Montro	Kahet	Occasional
Triphasia trifolia (Burm. f.) P. Wils.	Limon de china	Common
SAPINDACEAE - Soapberry Family		
**Allophyllus timoriensis* (DC.) Bl.	Nger	Occasional
SCROPHYLLARIACEAE - Figwort Family		
**Bacopa procumbens* (Mill.) Greenm.		Locally abundant
**Buchnera floridana* Sm.		Locally abundant
SOLANACEAE - Nightshade Family		
**Capsicum frutescens* L.	Doni sali	Common
**Cestrum diurnum* L.	Tintan-china	Occasional
**Physalis angulata* L.	Tomates chaka	Occasional
**Solanum nigrum* (L.) Senu lato	Nightshade	Occasional
STERCULIACEAE - Coca Family		
**Melochia compacta* Hochreut.	Sayafe	Common
**Waltheria indica* L.	Escobilla sabana	Occasional
TILIACEAE - Linden Family		
Elaeocarpus sphaericus K. Schum.	Yoga	Occasional
**Muntingia calabura* L.	Panama berry	Occasional
UMBELLIFERAE - Carrot Family		
**Centella asiatica* (L.) Urban		Locally abundant
URTICACAE - Nettle Family		
Elatostema calcareum Merr.	Tunpun ayuyu	Occasional
Laportea interrupta (L.) Chew	Palilolia	Occasional
**Pilea microphylla* (L.) Liebmann	Artillary plant	Locally abundant
Pipturus argenteus (Forst. f.) Wedd.	Amajayab	Occasional

SCIENTIFIC NAME	COMMON NAME	ABUNDANCE
VERBENACEAE - Verbena Family		
Callicarpa candicans (Burm. f.) Hochr.	Qualitav	Occasional
Clerodendrum inerme (L.) Gaertn.	Lodugao	Occasional
**Clerodendrum quadriloculare* (Banco) Merr.		Locally abundant
**Lantana camara* L.	Lantana	Occasional
**Lippia nodiflora* (L.) Rich.	Lippia	Locally abundant
Premna obtusifolia R. Br.	Alagao	Occasional
**Stachytarpheta dichotoma* Vahl	False verbena	Common
**Stachytarpheta jamaicensis* (L.) Vahl	False verbena	Common
**Stachytarpheta urticaefolia* (Salisb.) Sims F.	verbena	Common
Vitex parviflora Juss.		Occasional

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APPENDIX G-1

Archaeological Survey (Guam)

Archaeological Inventory Survey Harmon Annex Relocatable Over-The-Horizon Radar Site

Dededo Municipality, Territory of Guam Mariana Islands, Micronesia

by

Alan E. Haun, Ph.D.
Senior Archaeologist

Roderick S. Brown, M.A.
Supervisory Archaeologist

and

Bradley J. Dilli, B.A.
Supervisory Archaeologist

Prepared for

Wilson Okamoto & Associates, Inc.
1150 S. King Street
Honolulu, Hawaii 96814

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PHRI
Paul H. Rosendahl, Ph.D., Inc.
Archaeological • Historical • Cultural Resource Management Studies & Services
365 Makaala Street • Hilo, Hawaii 96720 • (808) 969-1703 • FAX (808) 961-4998
P.O. Box 12235 • Tamuning, Guam 96911 • (671) 649-3045 • FAX (671) 649-2611

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INTRODUCTION

BACKGROUND

Under a contractual agreement with Wilson Okamoto & Associates, Inc., in conjunction with an amendment to their open-end contract with the Department of the Navy, Pacific Division, Naval Facilities Engineering Command (PACNAVFACENGCOM) to prepare environmental impact documents (Contract No. N62742-86-0-001), Paul H. Rosendahl, Ph.D., Inc. (PHRI) conducted an archaeological inventory survey of the Harmon Annex Relocatable Over-the-Horizon Radar Site project area, situated in Dededo Municipality, Territory of Guam. The survey was conducted in conjunction with an inventory survey of similar proposed sites on the Island of Tinian. The overall objectives of the present survey were (a) to determine the nature and locations of archaeological and historic resources that might be affected by the proposed projects, (b) to assess the significance of all identified archaeological/historic resources, and (c) to recommend treatments for any significant archaeological/historic resources. The surveys were conducted in compliance with the amended National Historic Preservation Act of 1966, the National Environmental Policy Act, Executive Order 11593, the Archaeological and Historic Conservation Act of 1974, and related Naval regulations.

The present project was conducted in connection with earlier surveys on Guam by Bishop Museum (Kurashina et al. 1987) and PHRI (Haun 1988, 1989; Haun and Donham 1989a,b). The survey by Kurashina et al. was conducted during the initial phase of environmental studies for electronics facilities on Guam. Because the Kurashina et al. survey was conducted within the general vicinity of the present project area, the report on the survey contains detailed information (general environmental setting, previous archaeological work, and historical documentary research) relevant to the present project. Since the report will be included in the EIS this report will be in, that information is not repeated here.

The present survey was conducted March 14-22, 1990 by a crew of five under the direction of Senior Archaeologist Dr. Alan E. Haun. Crew members included Supervisory Archaeologist Bradley J. Dilli and Field Archaeologists David Highness, Hoski Schaafsma, and Mark Donham.

SCOPE OF WORK

The basic purpose of an inventory survey is to identify—to discover and locate on available maps—sites and features of potential archaeological/historical significance present within a specified project area. An *inventory survey* usually constitutes the initial level of archaeological investigation. It is conducted to identify and inventory all archaeological/historical resources within a specified project area. An inventory survey determines both the nature and location of the identified archaeological/historical resources. It gathers information from the resources sufficient for evaluating their significance as defined by the appropriate laws, regulations, and guidelines. Finally, it facilitates formulation of realistic recommendations and estimates for such further work as might be necessary or appropriate. Such work could include *further data collection*—work involving detailed recording of sites and features, and limited excavations; and possibly subsequent *mitigation*—data recovery research excavations, construction monitoring, interpretive planning and development, and/or preservation of sites and features with significant scientific research, interpretive, and/or cultural values.

The significance of any archaeological remains identified within the project area was to be assessed in terms of (a) the National Register criteria contained in the Code of Federal Regulations (36 CFR Part 60), and (b) the criteria for evaluation of traditional cultural values prepared by the National Advisory Council on Historic Preservation. In order to facilitate future client management decisions regarding site treatments, sites were to be further evaluated in terms of three PHRI CRM (Cultural Resource Management) value modes, which are discussed in detail in the Conclusion section of this report.

PROJECT AREA DESCRIPTION

The project area is a c. 275-acre rectangular parcel located in the Harmon Annex of Anderson Air Force Base (Figures 1 and 2). The long axis of the project area is oriented approximately 60° east of north. The northeastern project area boundary is located immediately south of the existing Finegayan Naval Housing Complex, while the southwestern boundary is located immediately south of the Harmon Beach Road. The southwest portion of the project area encompasses a portion of the mostly abandoned U.S. military Harmon Village housing complex.

The project area is divided roughly into thirds by roads which cross the parcel perpendicular to its long axis. The northeastern third of the parcel lies between the southern

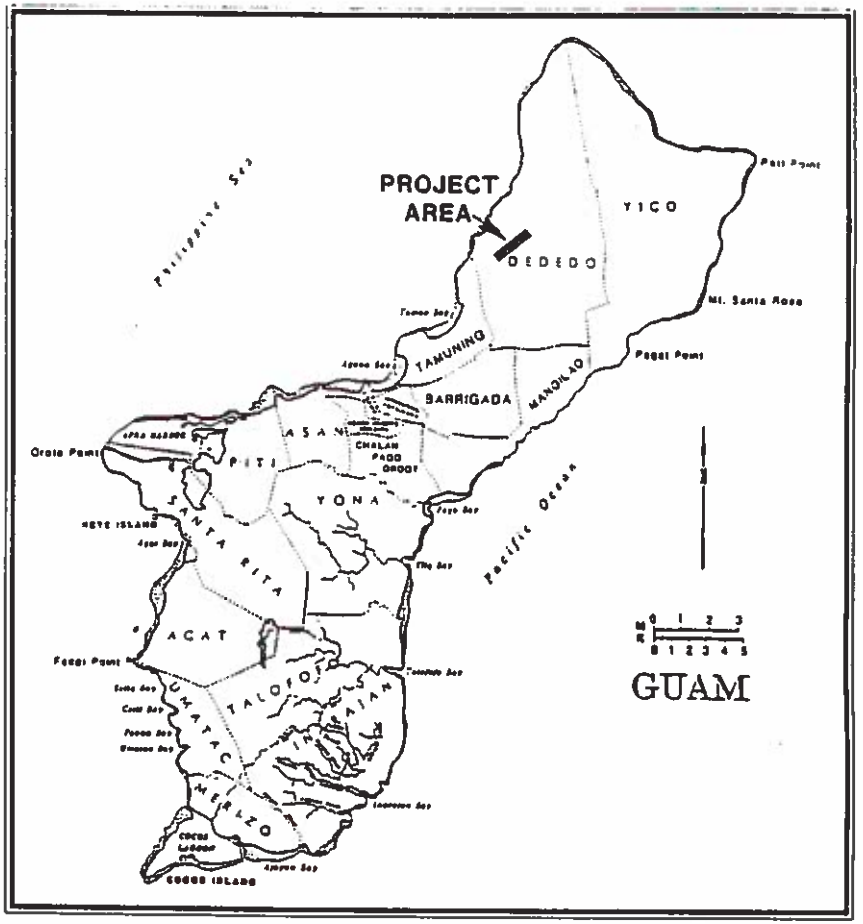


Figure 1. PROJECT LOCATION MAP

ARCHAEOLOGICAL INVENTORY SURVEY
HARMON ANNEX RELOCATABLE OVER-THE-HORIZON RADAR SITE

Dededo Municipality, Territory of Guam
Mariana Islands, Micronesia

PHRI Project 89-777 *May 1990*

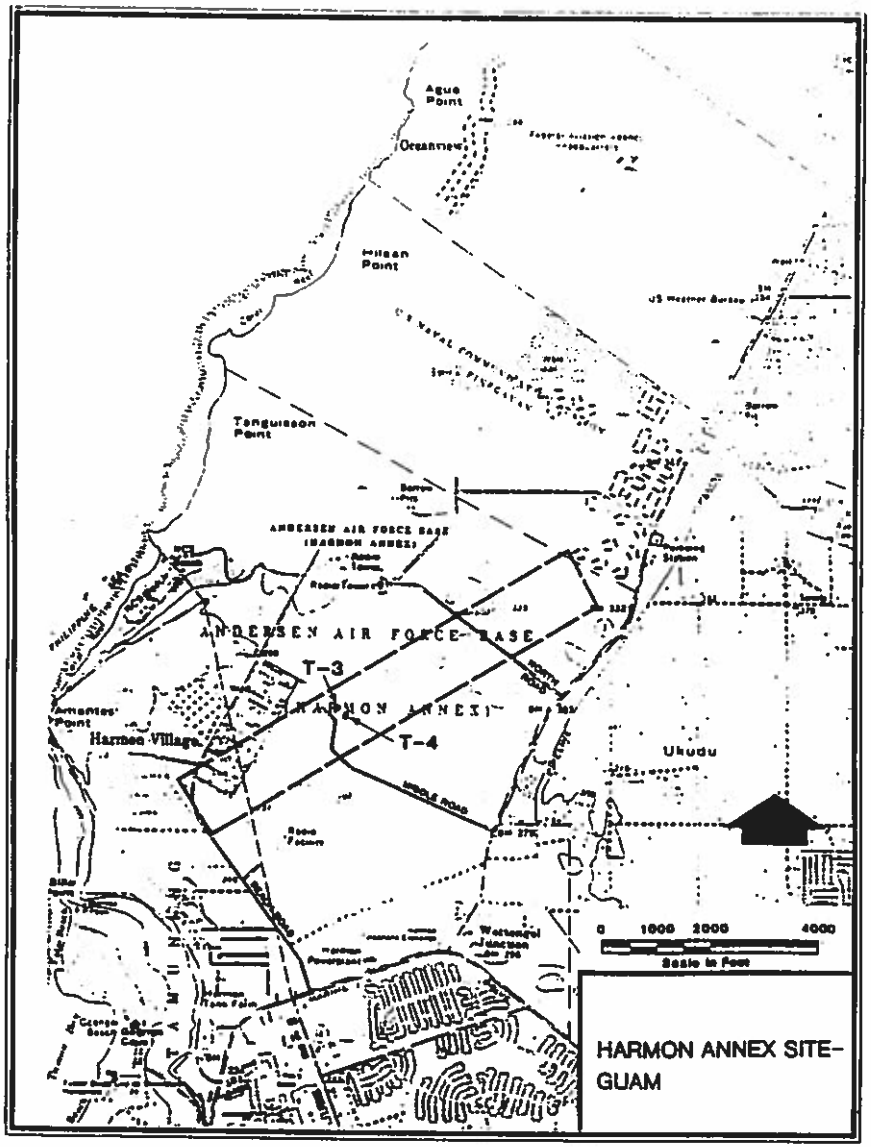


Figure 2. PROJECT AREA AND SITE LOCATION MAP

G-1-3

extent of the Finegayan Naval Housing complex and the paved road which leads to the Naval Publications Building. This third of the project area is dominated by a sizeable depression which, in some areas, consists of wet swamp land. The remainder of the northeastern area is relatively flat. Vegetation in this portion of the project area is dominated by dense low grasses, isolated pago (*Hibiscus tiliaceous* L., noni (*Morinda citrifolia* L., agao, and, in some areas, marsh reed grass. Closer to the housing complex the dominant vegetation changes to a thick secondary jungle growth. Vegetation noted in this area includes an overstory dominated by camachili trees, scattered banyan trees (*Ficus Benghalensis* L.), and a thick undergrowth of vines, including cats claw (*Caesalpinia sepiaria* Roxb.), morning glory (*Ipomoea* sp.), unidentified ferns, and pago.

The middle portion of the project area lies roughly between the Naval Publications Road and a paved road which, in this report, will be referred to as the middle road. The southwestern third of this area is dominated by thick jungle growth with an overstory of coconut (*Cocos nucifera* L.) and betel palm (*Areca catechu* L.), and scattered soursop (*Annona muricata* L.), tangan-tangan (*Leucaena glauca* [L.] Benth.), papaya (*Carica papaya* L.), and pago. The understory consists of thick unidentified grasses, vines, and ferns. This area also encompasses the slope and top of a hill which then slopes northeast down to the Naval Publications Road. Vegetation from the top of the hill to the Naval Publications Road is dominated by thick unidentified savanna-type grasses. Two depressions within this area are covered with thick swordgrass (*Miscanthus floridulus* (Labill.) Warburg ex. Schum. & Lauterb.), and elephant grass (*Pennisetum purpureum* Schumacher, Beskr., Guin.).

The southwestern third of the parcel consists of the area between the Middle Road and Harmon Beach Road. The topography of this area is basically flat with a slight slope to the southeast. Large portions of this area appear to have been mechanically disturbed prior to the present field work. Several large mounds of bulldozed material were noted throughout this area; also noted were sewer lines and leaching pits, most likely associated with the now abandoned Harmon Village Military Housing Complex. Two large borrow pits were also encountered during the survey. Vegetation in this area is dominated by thick jungle growth with an overstory of betel palm, coconut, pandanus (*Pandanus odoratissimus* L.f.), sweetsop (*Annona squamosa* L.), and various other fruit trees. The understory is dominated by thick ferns and vines and, in disturbed areas, stands of tangan-tangan and lemonchina (*Triphasia trifolia* [Burm. f.] P.Wils.).

The Island of Guam has been subdivided into geologic blocks by Tracey et al. (1964). Using Tracey's scheme, the limestone plateau of north Guam is comprised of the Machanao and Barrigada blocks. The main geologic component of both blocks is the Mariana Limestone formation. The formation is divided into two separate members. The main body of the Mariana Limestone Formation, which is not given a separate member name, constitutes most of the northern plateau and comprises the more northerly Machanao Block. The present project area is situated within this geographic region. The southern portion of the plateau is comprised of the Agana argillaceous member and constitutes the Barrigada block.

The plateau is a virtually flat platform of reef-associated limestone that, through tectonic activity, has been subsequently lifted above sea level and tilted slightly to the southwest. Soil deposition on the plateau is characterized by a thin mantle of Guam clay, or by scattered pockets of the clay in depressions within the limestone. Guam clay is a red, granular, friable clay that constitutes the most extensive soil unit on Guam.

FIELD METHODS AND PROCEDURES

The parcel was examined by way of pedestrian survey, by a crew of four. Transect intervals were approximately 45 meters. In densely forested areas, or areas of dense ground cover, crew members cleared surface debris in an effort to locate cultural materials.

When an archaeological feature was found, the entire survey crew was notified and the transect was halted. The crew cleared the surface in the vicinity of the feature in an attempt to locate additional features or associated artifacts. Features were flagged with day-glo pink-and-blue flagging tape, a temporary PHRI feature letter designation was written on the flagging, the approximate location of the find was recorded on a field map, the find was briefly described in a field notebook, and the transect was continued.

After the initial transect survey, all features were revisited and recorded in detail on standard PHRI Site Survey Record forms. Recording included a determination of approximate dimensions, scaled mapping, written descriptions, and black-and-white photography (PHRI Temp. Roll No. 777-1).

FINDINGS

During the present survey, two historic sites were identified (Sites T-3 and T-4). Site T-3 includes all features related to the U.S. military, and Site T-4 encompasses all Japanese-related features.

Site T-3

Site T-3 includes three rectangular concrete pads of unknown function or era of construction (Features A, B, and C) (Figure 3). Vegetation at the site consists of low unidentified grasses and ferns, and scattered tangan-tangan and noni. Sword grass covers a portion of Feature A.

Feature A - Feature A is a rectangular concrete pad oriented 76° east of north. The pad is 17.6 m long and 12.3 m wide. Two squared curbs, 0.2 m wide and 0.3 m high, form the sides of the pad and run the length of the long axis. Two troughs, 0.20 m wide, 0.16 m deep, and 0.36 m from the interior edge of the curb also run the length of the pad. A third trough, with the same dimensions as above, oriented perpendicular to the long axis of the pad, is located 3.5 m from the southwest end of the pad. The floor of the pad is 0.25 m above the present ground surface. No portable remains were located in the vicinity.

Feature B - Feature B is located approximately 18.0 m north-northwest of Feature C and 82.0 m south-southeast of Feature A. The feature consists of a rectangular concrete pad oriented 76° east of north. The pad is 7.7 m long and 5.0 m wide. Three smaller pads, raised 0.10 m above the surface of the larger pad, are aligned on the surface of the larger pad. The smaller pads are each 2.5 m long and 1.20 m wide. The long axis of the smaller pads is perpendicular to the long axis of the larger pad. Four bolts, least approximately 0.2 m from each of the four corners of each pad, protrude from the surface of the smaller pads.

Feature C - Feature C is approximately 59.0 m south-southeast of Feature A. The feature consists of a rectangular concrete pad 5.8 m long and 4.7 m wide. The long axis of the pad is oriented approximately 76° east of north. Two smaller pads, with their long axes oriented perpendicular to the long axis of the larger pad, are aligned on the surface of the larger pad. Each of the smaller pads is 2.4 m long, 1.2 m wide, and are 1.20 m apart. The small pads are raised 0.12 m above the surface of the larger pads.

Site T-4

Site T-4 is a small scatter of Japanese bottles with two associated possible tent pads. The site is located approximately 75 m north of the northernmost point of the Middle Road, and approximately 130 m west of Feature A at Site T-3. The total site measures approximately 50 m E-W by 25 m N-S. The possible tent pads are small, leveled and cleared rectilinear-shaped areas with concentrations of limestone pebbles at one end. Each of the leveled areas is approximately 5 by 8 m. The associated limestone pads are about 2 m long and 3 m wide. Portable remains noted within the immediate vicinity of one of the pads include several Japanese blue Kirin sake and brown Dai Nippon beer bottles, one .50 caliber shell casing, and one small blue enamel bowl. In addition, many pieces of melted glass, both blue and brown, were noted in the vicinity. Vegetation in the immediate site area is dominated by an overstory of coconut and betel palms, pandanus, and lemonchina. An understory of ferns, vines, and barringtonia limited ground visibility in the area.

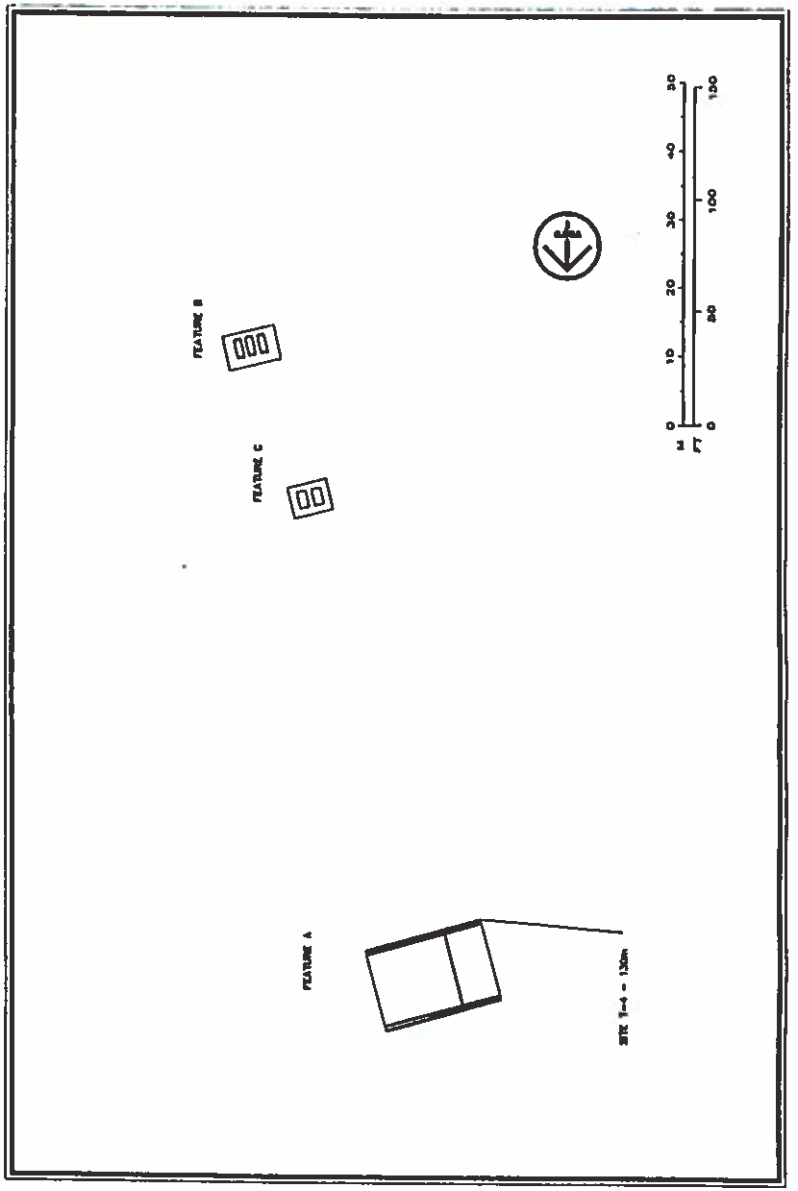


Figure 3. SITE T-3

CONCLUSION

DISCUSSION

During the present research, the functions of the concrete pads constituting Site T-3 could not be determined. They are, however, presumed to be related to U.S. military presence during or shortly after World War II. Site T-4, based on the evidence, is interpreted as a probable Japanese military encampment dating to World War II, or before that time.

GENERAL SIGNIFICANCE ASSESSMENTS AND RECOMMENDED GENERAL TREATMENTS

General significance assessments and recommended general treatments for identified sites were formulated upon completion of the field work. Significance categories used in the site evaluation process are based on the National Register criteria for evaluation, as outlined in the Code of Federal Regulations (36 CFR Part 60). The purpose of the National Register is to list properties that are "...significant in American history, architecture, archaeology and culture..." (NHPA Sec 101 [a][1]). A property has significance if it satisfies each of two categories comprising the National Register criteria for evaluation (36 CFR Part 60.4): (1) the site must possess integrity of location, design, setting, materials, workmanship, feeling, and association; and (2) it must be characterized by at least one of the following:

(a) It must be associated with events that made significant contributions to broad patterns of history;

(b) It must be associated with the lives of persons significant in the past;

(c) It must embody distinctive characteristics of a type, period, or method of construction, or represent the work of a master, or possess high artistic value or represent a significant and distinguishable entity whose components may lack individual distinction (representative examples of site types); or

(d) It must have yielded, or may be likely to yield, information important in prehistory or history (information content) (36 CFR Part 60.6)

Sites were assessed for potential cultural significance using guidelines prepared by the Advisory Council on Historic Preservation (ACHP) entitled "Guidelines for Consideration of Traditional Cultural Values in Historic Preservation Review" (ACHP 1985). The guidelines define cultural value as "...the contribution made by an historic property to an ongoing society or cultural system. A traditional cultural value is a cultural value that has historical depth" (1985:1). The guidelines further specify that "[a] property need not have been in consistent use since antiquity by a cultural system in order to have traditional cultural value" (1985:7).

In order to facilitate future client management decisions regarding site treatments, sites are further evaluated in terms of PHRI CRM (Cultural Resource Management) value modes which are derived from the previously mentioned state and federal evaluation criteria. The archaeological sites are evaluated in terms of potential scientific research, interpretive, and/or cultural values. *Research value* refers to the potential of archaeological resources for producing information useful in the understanding of culture history, past lifeways, and cultural processes at the local, regional, and interregional levels of organization. *Interpretive value* refers to the potential of archaeological resources for public education and recreation. *Cultural value* refers to the potential of archaeological resources to preserve and promote cultural and ethnic identity and values.

Based on the above federal/state criteria, all sites identified during the present inventory survey are tentatively assessed as significant solely for information content (Criterion D) because they have yielded and/or are likely to yield information important for historical studies of Japanese and American wartime technology and strategy. Based on the CRM value modes, Site T-3 is assessed as having moderate research value, and low interpretive and cultural values, and Site T-4 is assessed as having low research, interpretive, and cultural values.

No further work is recommended for Site T-4. This site has been measured mapped, described, photographed, surface collected, and plotted. Data collected from the site during the present survey is considered sufficient. If Site T-3 is to be destroyed, further documentation as to functional interpretation is recommended. This would require in-depth documentary research and, if the documentary research fails to provide a reasonably complete record of the site, may require additional field data collection. Adequate documentation might also require oral historical research involving island residents and military members who occupied the sites, if they could be located. If Site T-3 is to be left intact, then no further work at the site is necessary.

It should be noted that the evaluations and recommendations presented within this final report have been based on a surface inventory survey of the project area. There is always the possibility, however remote, that potentially significant, unidentified cultural remains will be encountered in the course of future archaeological investigations or subsequent development activities. In such situations, archaeological consultation should be sought immediately.

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