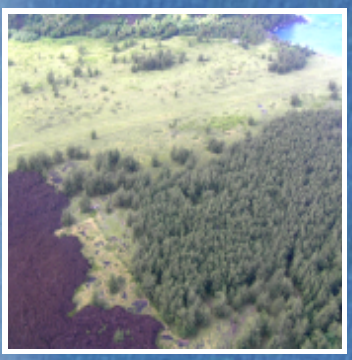

Pagan Airstrip Master Plan

Pagan, Northern Islands

AIP NO. 3-69-0004-01

FINAL REPORT

September 2008

Prepared for:

Commonwealth Ports Authority

EFC
ENGINEERS • ARCHITECTS
CORPORATION

PAGAN AIRSTRIP MASTER PLAN

Pagan, The Northern Islands Municipality,
Commonwealth of the Northern Mariana Islands

The preparation of this report was performed following the FAA Advisory Circular, Airport Master Plans, AC 150/5070-6B as a guideline. The objective of the study is to provide documentation that may assist the Commonwealth Ports Authority in the further development of the Pagan airstrip and to provide an Airport Layout Plan (ALP) in accordance with the latest FAA Western Pacific Regional ALP checklist. The contents of this report reflect the views of EFC Engineers & Architects Corporation, who is responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the official view or policies of the FAA or CPA.

Prepared for: **Commonwealth Ports Authority**
P.O. Box 501055
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August 2008

EFC ENGINEERS • ARCHITECTS Corporation

FINAL REPORT

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CHAPTER 1
INTRODUCTION

1.1 General

The Pagan airstrip is a grassy runway located on the island of Pagan in the Commonwealth of the Northern Mariana Islands (CNMI). The entire island of Pagan is publicly owned, including the runway, and administered by the Department of Public Lands (DPL). In 1981, a major volcanic eruption occurred on Pagan that resulted in the evacuation of the entire population. The volcanic eruption resulted in lava flow covering approximately half the length of the runway.

In June 2007, the Commonwealth Ports Authority (CPA) awarded a contract to EFC Engineers and Architects Corporation to prepare a Master Plan for the development of the Pagan Airstrip. Requests from the former residents of Pagan to return to the island and re-establish permanent settlements, combined with growing interest in developing the economic potential of Pagan and the other islands north of Saipan, have prompted the CNMI government, and particularly the Northern Islands Mayor's Office (NIMO) to prepare plans for infrastructure development on Pagan. The NIMO considers the development of the Pagan Airstrip and the provision of reliable air transportation services as critical infrastructure improvements required to facilitate the resettlement process and to stimulate economic activity in the Northern Islands.

1.2 Purpose and Scope

The primary objective of this study is to prepare a master plan that will support and guide future development plans for the Pagan airstrip. Future development should cost-effectively satisfy aviation demands while considering potential environmental and socioeconomic impacts and exploring options for avoiding, minimizing, or reducing impacts to sensitive resources.

This master plan will:

1. Compile and analyze data related to past and present conditions on Pagan, and evaluate the ability of existing facilities to meet current and projected aviation demands.
2. Identify and assess alternatives for effective planning, and select a course of action for development.
3. Document the issues that the proposed development of the Pagan airstrip will address.
4. Identify and discuss the proposed development through the technical, economic, and environmental investigation of concepts and alternatives.
5. Provide an effective graphic presentation of existing facilities and proposed improvements.
6. Discuss a schedule for the implementation of the proposed development.
7. Discuss a financial plan to support the planned improvements.
8. Document policies and future aviation demands, and satisfy local and federal regulations.

1.3 Information Exchange Meetings

Interviews and meetings with representatives of various CNMI government agencies, flight operators, and others were conducted. Records of these discussions and meetings are included in Appendix A "Work Activity Reports" and Appendix B "Information Exchange Meeting Notes" in this Master Plan.

Persons taking part in information exchange meetings included the following:

Juan R. Sablan	Commonwealth Ports Authority, Engineering
Valentin Taisacan	Mayor of the Northern Islands
Pedro R. Guerrero	Northern Islands Mayor's Office
Emilio A. Ayuyu	Northern Islands Mayor's Office
B.M. Aldan	Northern Islands Mayor's Office
Dr. Ignacio Dela Cruz	Dept. of Lands and Natural Resources, Secretary
Henry S. Hofschneider	Dept. of Lands and Natural Resources, Special Assistant to the Secretary
Jack Songsong	Dept. of Lands and Natural Resources, Director of Lands and Surveying
Manny Pangelinan	Dept. of Lands and Natural Resources
Alvin Cepeda	Dept. of Lands and Natural Resources

Vincent Torres	Dept. of Public Lands, Planning Division (GIS)
Jocelyn Aldan	Dept. of Public Lands, Planning Division
Deirdre McClarin	Coastal Resources Management, GIS Associate
Paul Radley	Division of Fish & Wildlife, Wildlife Biologist
Ronnie Rogers	Historic Preservation Officer, Chief Archeologist
John Gourley	Micronesian Environmental Services
Bobby Nato	Americopters, Controller
Andy Nehring	Americopters, Controller
Annette Donnor	Joint Guam Program Office, Public Information Office
Efrain F. Camacho	EFC Engineers & Architects

1.4 Field Survey of the Pagan Airstrip

EFC Engineers & Architects conducted a field survey in November 2007 to verify, document, and assess the existing conditions of the Pagan Airstrip. This field data was incorporated into the Master Plan.

1.5 Federal Guidelines

The Master Plan report and Airport Layout Plan (ALP) was prepared following the Federal Aviation Administration (FAA) guidelines. The document titles and descriptions of the FAA guidelines referenced for the preparation of this report are as listed below.

FAA Advisory Circular "AIRPORT MASTER PLANS"

AC 150/5070-6B

The FAA Advisory Circular (AC) 150/5070-6B provides guidance for the preparation of airport master plans that range in size and function from small general aviation to large commercial service facilities. According to the same document, an Airport Master Plan is defined as a concept of the long-term development of an airport. The Master Plan displays this concept graphically and documents the data and logic upon which the plan is based.

FAA Advisory Circular "AIRPORT DESIGN"

AC 150/5300-13

The FAA AC 150/5300-13 contains the FAA's standards and recommendations for airport design. These standards were used as a guideline in the preparation of the Airport Layout Plan (ALP) contained in this Master Plan report.

FAA Western Pacific Region "ALP CHECKLIST"

The ALP contained in this report follows the requirements listed in the FAA Western Pacific Region ALP Checklist list (Updated 02/10/06). The same document reflects FAA's drawing preparation requirements, per the following FAA Advisory Circulars:

- AC 150/5070-6B Airport Master Plans, Appendix F
- AC 150/5030-13 Airport Design, Change 9, Appendix 7
- AC 150/5340-1H Standards for Airport Marking
- AC 150/5235-4 Runway Length Requirements For Airport Design
- FAA Order 5090.3c Field Formulation of the NPIAS

1.6 Civil-Military Innovative Readiness Training (IRT) Application

EFC Engineers & Architects prepared the application for the Civil-Military Innovative Readiness Training for financial support. The application was submitted to CPA, then forwarded to the CNMI Office of the Governor by CPA in July 2008. A copy of this application is included in Appendix C "Civil-Military Innovative Readiness Training (IRT) Application" of this Master Plan.

CHAPTER 2
EXECUTIVE SUMMARY

2.1 Conclusion

It is recommended that the current runway length of 1,500 feet be extended to reach a total runway length of 3,000 feet.

It is also recommended that a windsock, distance marker and runway end marker be installed, and the erosion at the western end of the runway should be abated by constructing a riprap wall.

2.2 Forecast of Aviation Demand

Based on meetings with the Mayor of the Northern Islands Municipality, two flights per month is the best projection for the immediate (5 year) future. The anticipated aircraft will be single engine or twin engine, general aviation aircraft that fall within Aircraft Categories A and B, with maximum take off weights of less than 5,000 pounds.

Cargo out of Pagan may play a greater role than passenger service. Pagan Island's potential exports include agricultural produce, copra and coconut oil, and fish, all of which would require airlifting to market centers.

2.3 Facility Requirements

The recommended facilities mentioned in 2.1 above are what would be essential to a safe operation of the airfield.

2.4 Recommended Development

The recommended development is to extend the runway to allow for larger aircraft to operate. Currently, the only aircraft that can land and take off safely on the runway are those with a maximum weight limit of approximately 600lbs.

Extending the runway will involve removal of about 240,000 cubic yards of lava which cover an area of 2,100 ft x 250 ft x 12 ft in depth.

Runway distance and end markers, and the installation of a windsock would be needed. In addition, the west end of the runway is eroding and will need to be stabilized.

The existing grass lined runway needs to be flattened out by filling in the bomb craters. Also, it is highly recommended that the grass be trimmed. At present, wild cows and goats on the island graze on the runway keeping the grass trimmed. However, it is an uneven process and there are grass stubs that could potentially be hazardous to air traffic.

2.5 Financing

Even under the best conditions, the revenue expected from such a small operation as the Pagan airstrip will not be able to support its operations. Runway development is essential, however, so that Pagan residents displaced by the volcanic eruption can return to

the island and have a ready means of evacuation for medical or safety purposes in the future.

The Mayor of the Northern Islands Municipality envisions Pagan to be the future center of economic development in the Northern Islands. Pagan is the only island in the Northern Islands with sufficient flat land for a runway that can support fixed wing type aircrafts. Pagan is also capable of developing agricultural, tourism, commercial fishing, and other revenue generating industries, but these industries would depend on reliable air transportation.

There are currently no definitive plans to develop new infrastructure for Pagan or in the Northern Islands. CNMI is experiencing extreme economic difficulty making it unlikely for any funds to be made available, specifically, for the improvement to the Pagan Airstrip. Nonetheless, the Mayor of the Northern Islands is pursuing obtaining allocation on future CIP and other fundings for the improvement work.

Financing the Pagan airfield to bring it to a safe operational level can be achieved by a combination of several funding options such as the FAA AIP grants, local appropriation, and other grants.

The estimated improvement costs are $4,912,500.00.

CHAPTER 3
NATURAL SETTINGS

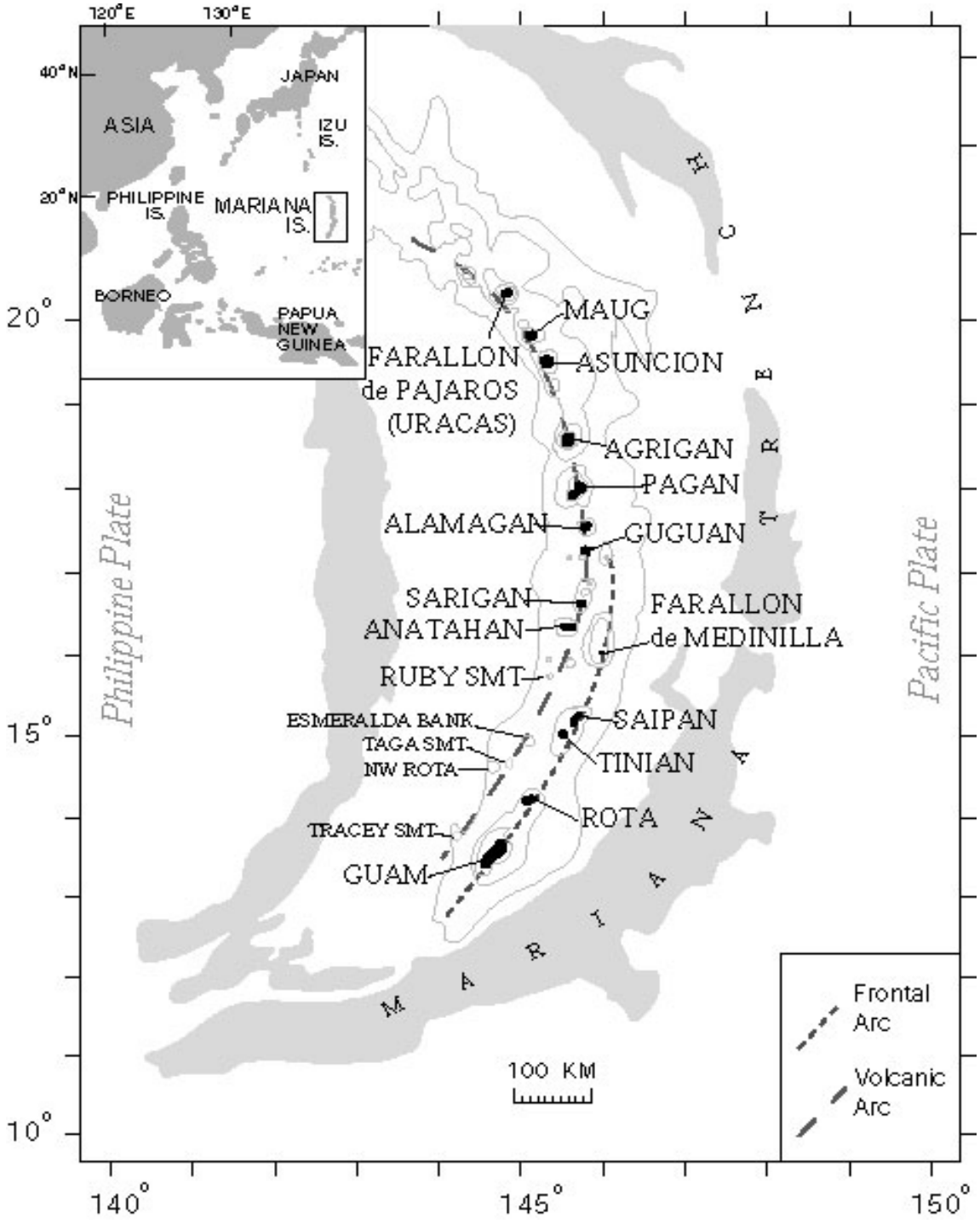
3.1 Geography

FIGURE 3A: Pagan Island
(Source: Landstat)

The Commonwealth of the Northern Mariana Islands (CNMI) is comprised of 14 volcanic islands located in the North Pacific Ocean along the Marianas Trench, just north of the island of Guam. The CNMI stretches over 375 miles from the southernmost island of Rota to the northernmost uninhabited island of Uracas, with a total land area of 176.5 square miles. [1]

The three southern islands of Saipan, Tinian, and Rota are the primary population centers; Saipan is the largest and most densely populated island in the CNMI. The ten islands north of Saipan are collectively referred to as the Northern Islands Municipality, and comprise a total land area of 55.3 square miles. [1]

Pagan Island is the middle and largest island of the Northern Island chain. It is located 320 miles north of Saipan at latitude 18˚10' N and longitude 145˚46' E. Approximately ten miles long and ranging in width from one-half to four miles, the island of Pagan covers an area of approximately 18.5 square miles. [1]



REGIONAL GEOLOGIC MAP

FIGURE 3B: The island chain of the Northern Islands along the Mariana Trench to the west.
(Source: USGS Open-File Report 2006-1386 Preliminary Geologic Map of Mount Pagan Volcan
Pagan Island, CNMI)

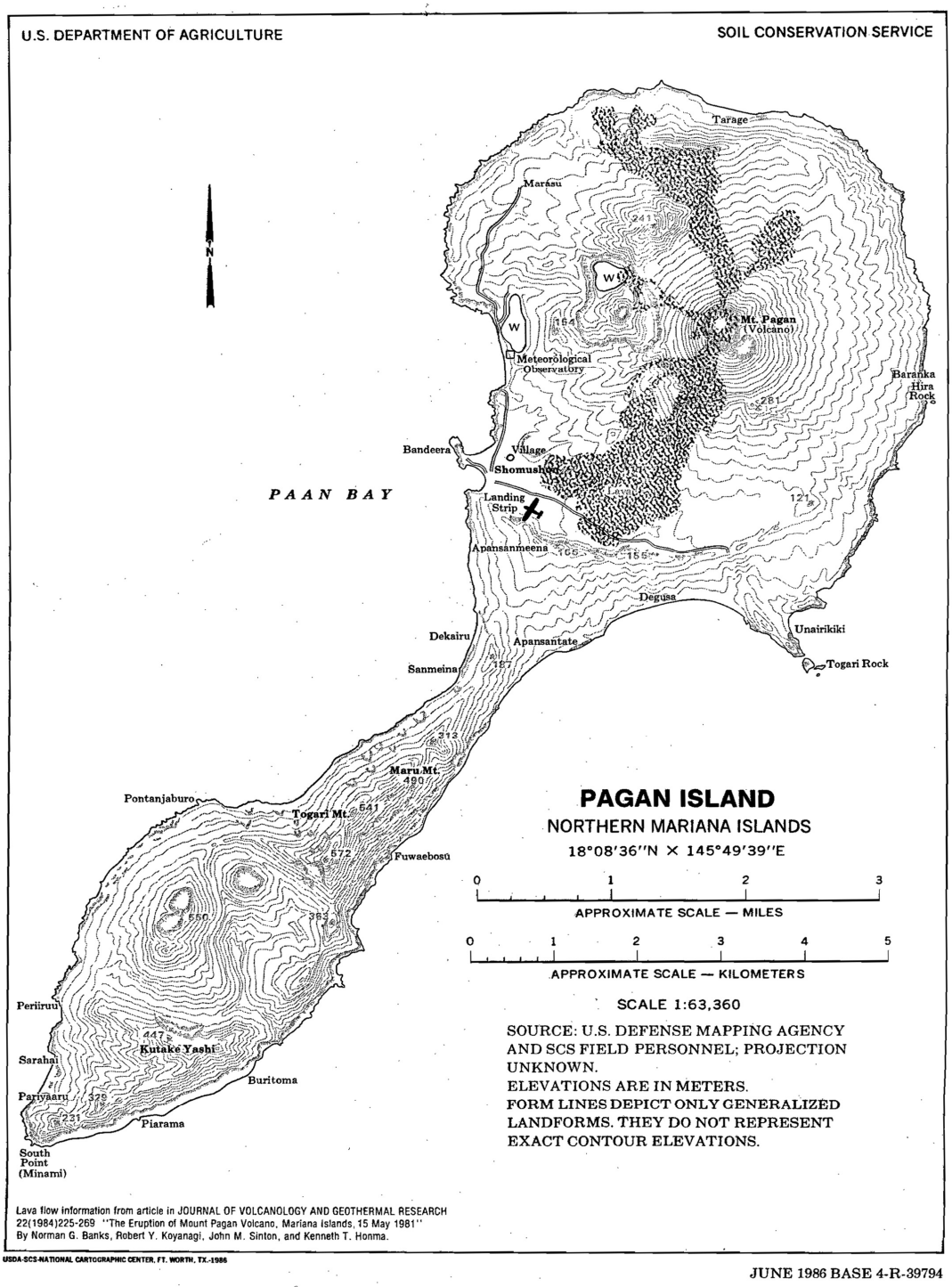


FIGURE 3C: MAP OF PAGAN ISLAND
(Source: The Northern Islands Development Plan, Mayor's Office of the Northern Islands, CNMI)

3.2 Topography

FIGURE 3D: Bandera Peninsula
The flat land right of the Bandera Peninsula is the Pagan Airfield. The black colored lava flow interrupts the runway.

Pagan Island consists of two stratovolcanoes joined by an isthmus. The stratovolcano at the northeast end of the island, Mount Pagan, has an altitude of 1,870 feet; the stratovolcano at the southwest end has an altitude of 1,797 feet. About 75% of Pagan Island consists of barren lava fields and mountainous terrain. Moderately sloping plains and basins characterize the western half of northern Pagan, while the southern half of the island is high, rugged, and largely inaccessible. Sandy beaches occur on the northwestern and eastern coasts. [2]

Mount Pagan was probably once a cone-shaped volcano that rose as high as 4,000 feet above sea level before it collapsed into a deep caldera approximately three and a half miles in diameter with cliffs that rise as high as 100 to 800 feet above sea level. The south caldera rim forms a prominent escarpment that runs from east to west across the isthmus and is of an estimated height of 70 to 120 feet. Immediately north of the escarpment is Pagan Plain, the largest area of flat land on the island. The airstrip is located on this plain, roughly parallel to the escarpment. Smaller areas of nearly flat land occur north and northwest of the Pagan Airstrip. [3]

Because of its size and relative flatness, Pagan Plain is generally considered to be the only area in the Northern islands that is suitable for an airstrip. Elsewhere on Pagan, and throughout the Northern Islands, the land is too rugged and inaccessible to be favorable for construction.

Though Pagan lacks streams, it has two lakes located north of the isthmus, both of which contain brackish water. Lagunan Sanhalom, or Inner Lake, lies just east of Mount Pagan, spans 42 acres, and is

surrounded by three sides of steep lava walls. Lake Laguna, or Outer Lake, is separated from Shomushon Bay by a barrier beach ridge. [3] [4]

3.3 Climate and Wind

The climate of the Northern Marianas archipelago is marine tropical, with a wet season from July to October, and a dry season from November to June. Humidity, temperature, and pressure stay fairly constant throughout the year. Average annual air temperatures range between 80 and 85 degrees Fahrenheit, with the highest temperatures generally occurring in June. Average annual rainfall ranges between 70 and 80 inches, with April being the driest month and September the wettest. [2]

Winds of 5 to 10 mph are normal with some increase of velocities toward evening. Short duration winds between 20 and 30 mph often accompany rain showers. Pagan is dominated by northeast trade winds, which bring frequent heavy showers during much of the year, except in late spring and early summer. Surface winds are prevailing easterly throughout the year with seasonal differences. From December to March, trade winds blow from the northeast. In August and September, winds blow from the southeast, south, and southwest. [2]

Tropical storms, tropical cyclones, typhoons and super typhoons are common in the islands and can generate cyclonic winds of 33-65 knots as well as storm surges. These disturbances occur most frequently during the wet season. Typhoons with sustained winds exceeding 140 knots, with gusts over 155 knots have been recorded on Pagan. [2]

3.4 Volcanic Activity on Pagan

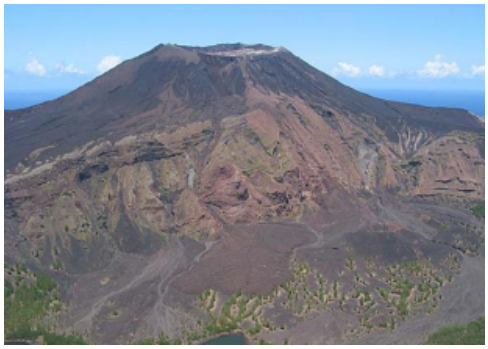


FIGURE 3E: Mount Pagan
(Source: USGS Open-File Report 2006-1386 Preliminary Geologic Map of Mount Pagan Volcano, Pagan Island, CNMI)

The Mariana Islands are exposed crests of the seismically active Mariana Arc. The Marianas Trench and the Northern Mariana Islands overlie an active subduction zone where the Pacific Plate, moving northwest at about 10.3cm a year, is passing beneath the Philippine Plate, moving west-northwest at 6.8cm per year. During the past century, more than 40 earthquakes of magnitude 6.5 to 8.1 have shaken the Marianas Trench. [3]

Few detailed investigations have been made of the geology and historic volcanic activity of Mount Pagan. Several eruptions were reported in the 1600s, a large eruption was reported in the 1870s, and volcanic activity was noted in the 1920s. The most recent major eruption of Mount Pagan occurred on May 15, 1981, and resulted in the evacuation of all 54 residents. This eruption continued until May 1985. The lava flow from this eruption covered an area of about five miles in the north-south direction, by four miles west-east. [5] [6]

Intermittent volcanic activities of Mount Pagan were subsequently recorded in September 1987, February 1988, August 1988, April 1992, and January 1993. The most recent volcanic activity of Mount Pagan was recorded on December 4, 2006, which included central vent eruption and explosive eruption. This continued for four days, and the Final Pagan Volcano Activity report was issued on December 11, 2006, which stated that no further ash emission from the volcano had been detected. [5] [6]

The U.S. Geological Survey (USGS) operated two seismometers on

the Pagan Island during the 1990s and in 2001. The island's volcanic activities are being monitored by Washington Volcano Ash Advisory Center (VAAC) and USGS in coordination with the CNMI Emergency Management Office, CNMI Office of the Governor. [7]

3.5 Volcanic Activity in the Region

FIGURE 3F: Anatahan Volcano
(Source: USGS)

Seventy-five miles north of Saipan and 245 miles south of Pagan on Anatahan Island is another active volcano. Anatahan Volcano is one of the most active volcanoes of the Northern Mariana Islands, and its volcanic and seismic activities are closely monitored. The island is about 5.6 miles long and two miles wide, and has an area of approximately 12 square miles. Its stratovolcano contains the largest known caldera in the CNMI. [5] [6]

Anatahan has not been inhabited since 1990, when residents were evacuated because of a strong earthquake. The first historical eruption, and a large and explosive one, occurred in May 2003. Since then, USGS and the CNMI Emergency Management Office (EMO) have operated observation stations on Anatahan to monitor volcanic activities through seismometer readings and over flight observations. The EMO and USGS issued a Declaration of a State of Emergency after the first eruption of Anatahan Volcano in 2003; a state of disaster has since been extended. The island is still considered unsafe for human habitation and all travel is restricted. [8]

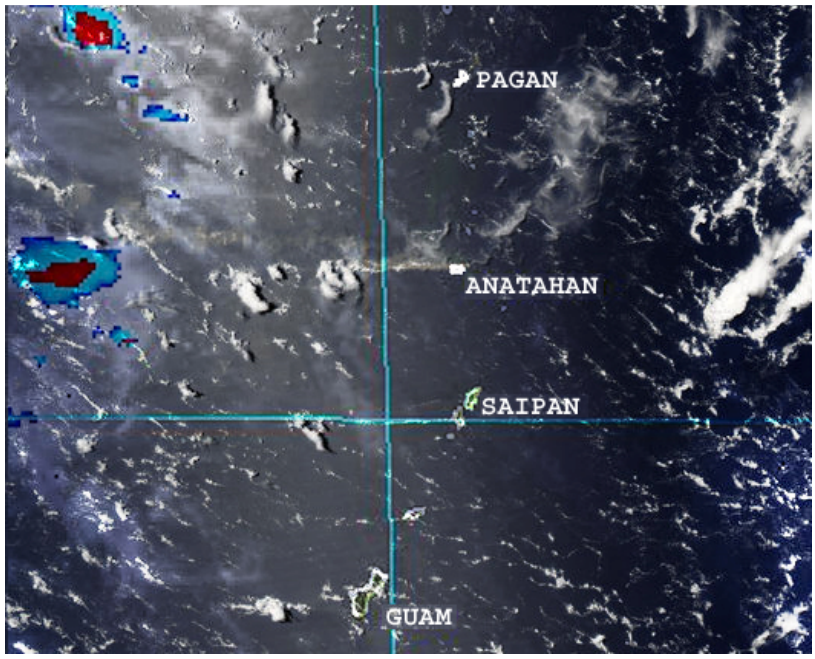


FIGURE 3-G NOAA SATELLITE IMAGE
The ash from Anatahan Volcano is blown downwind towards the west.
(Source: NOAA)

3.6 Volcanic Activity and Aviation Safety in the Northern Islands

Volcanic ash clouds can impact aviation safety. When an airplane flies into a volcanic ash cloud, the silicate particles in the cloud enter the engines and melt, which can lead to engine damage and malfunction. Volcanic ash reduces engine performance and may cause engine failure, depending on the concentration of gas and aerosols. Volcanic ash can abrade external components of aircraft, clog air-filter systems, and contaminate aircraft interior parts, including electronic systems, power generators, and navigation systems. [9]

Close monitoring of volcanic activity, emissions, and wind direction of the volcanoes in the Northern Islands is therefore critical to aviation safety in the region. When ash and gas plumes move away from volcanoes, the plumes lose altitude and form a curtain of ash

that can threaten aircraft in flight. In downwind areas, pilots experience difficulties distinguishing volcanic clouds from weather-related clouds. During normal easterly winds, volcanic emissions from Pagan and Anatahan Volcanoes are blown west of the CNMI and Guam. During more northerly winds, emissions are blown toward the CNMI and Guam and are experienced as a sulfur-scented haze. [9]

The USGS produces biweekly Recent Status Reports on volcanic activities in the CNMI. Recent alert levels have ranged from Aviation Color Code Green (i.e., low-level tremors with occasional small earthquakes, and visible weak gas and steam plume emissions) in July 2007, to Aviation Color Code Yellow (gas emissions, elevated levels of sulfur dioxide, and volcanic haze) in October 2007. The National Oceanic and Atmospheric Administration (NOAA) provides satellite imagery services, including meteorological information. Other U.S. agencies such as the National Aeronautics and Space Administration (NASA) and the research consortium UNAVCO provide advanced high-precision images, some of which are accessible to the public through the Internet and updated hourly or daily. [7]

The USGS and the Washington Volcanic Ash Advisory Center (VAAC) monitor Mount Pagan and the other volcanoes in the Northern Islands by analyzing satellite imagery. Volcanic cloud hazards are closely monitored by meteorological agencies, volcanic observatories, and air traffic control centers. The VAAC issues Volcanic Ash Advisories and provides information on volcanic clouds to aircrafts in flight and for planning purposes. The National Center for Environmental Prediction (NCEP) is responsible for issuing Volcanic Ash Forecast Transport and Dispersion (VAFTAD)

Models. [6] [7]

A National Volcano Early Warning System (NVEWS) is being formulated by the Consortium of U.S. Volcano Observatories (CUSVO) to establish a proactive monitoring program for active volcanoes. Although it is difficult to predict the future course of eruptions in the Northern Islands, the USGS observes the present state as having a relatively low level of volcanic activity, and anticipates larger explosive activity and eruptions of Volcanic Explosivity Index (VEI) levels 4 to 5. Depending on prevailing winds, such explosions could result in ash fall on nearby islands. For Anatahan, a massive explosive eruption level of VEH 6 or higher is considered unlikely. [6] [7]

3.7 Environmental Constraints and Planning Factors

Strong winds, rough seas, volcanic activity, typhoons, generally unpredictable weather, and capital expenditure requirements have hindered previous efforts to visit, survey, and develop infrastructure on Pagan. These obstacles are likely to exist as well for any planning and construction efforts of the Pagan Airstrip.

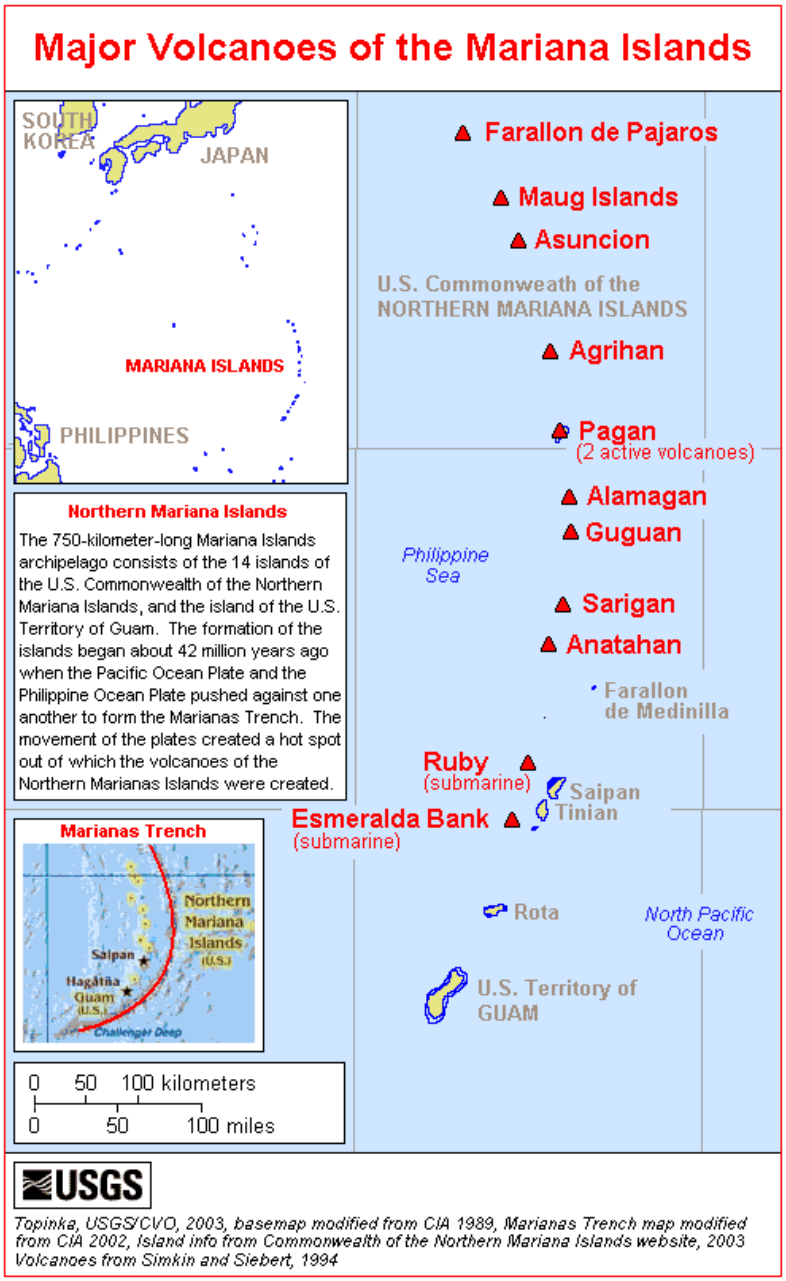


FIGURE 3H: MAP OF MAJOR VOCANOES OF THE MARIANA ISLANDS

(Source: USGS website)

FIGURE 3I: **"7.2 quake jolts Pagan, Saipan, and Tinian"**
A 7.2 magnitude earthquake followed by massive aftershocks jolted the Mariana Islands on October 31, 2007. The epicenter was 57.8 miles north-northwest of Pagan, and 138.26 miles north-northwest of Saipan and depth was 235 kilometers.
(Source: Saipan Tribune, November 1, 2007)

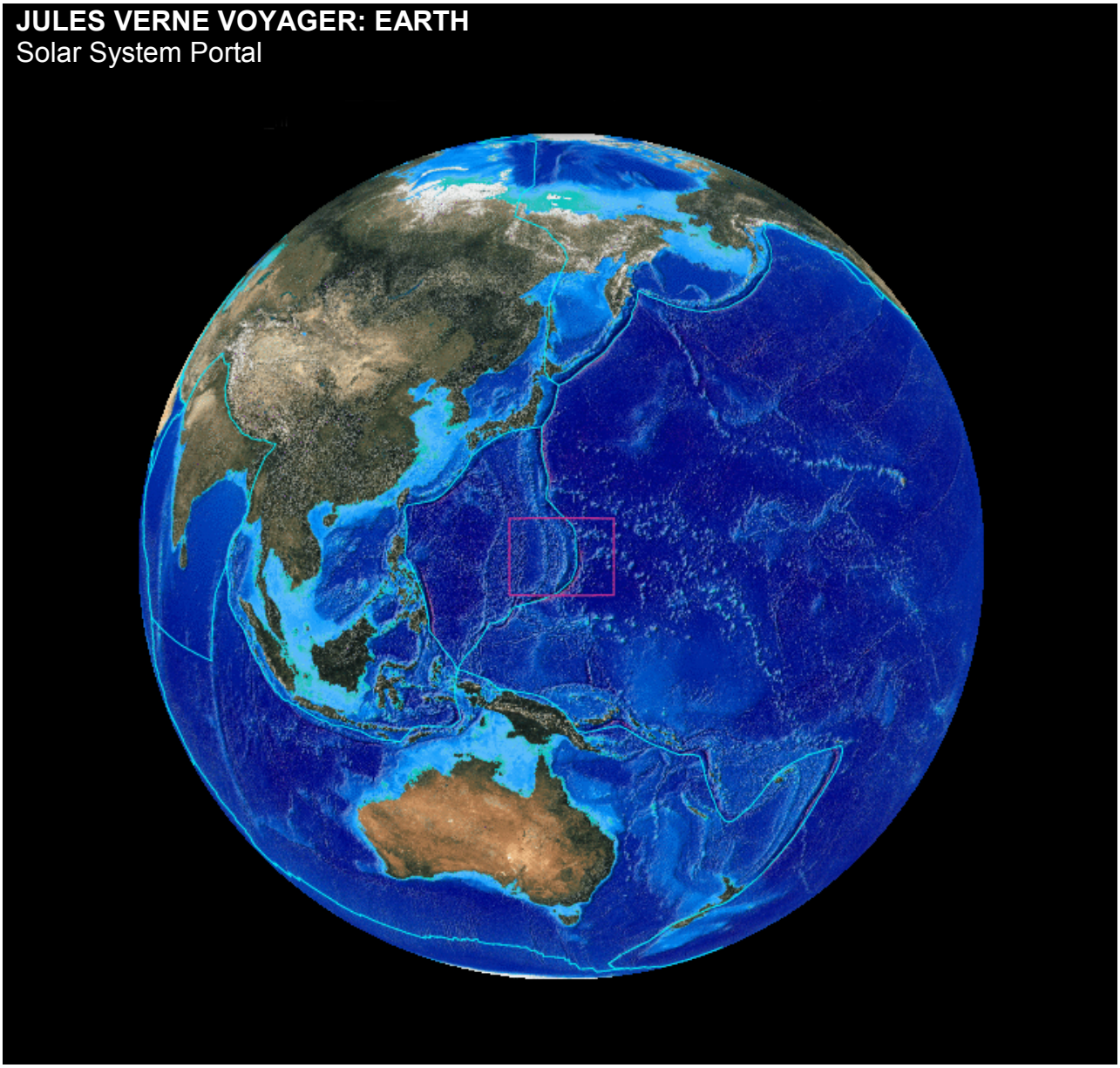


FIGURE 3J: NORTHERN MARIANA ISLANDS AND THE MARIANAS TRENCH
The Northern Mariana Islands is located along the Marianas Trench shown in the rectangle in the center of the image.
(Source: UNAVCO, Inc. Jules Verne Voyager mapping, Smithsonian Global Volcanism Program)

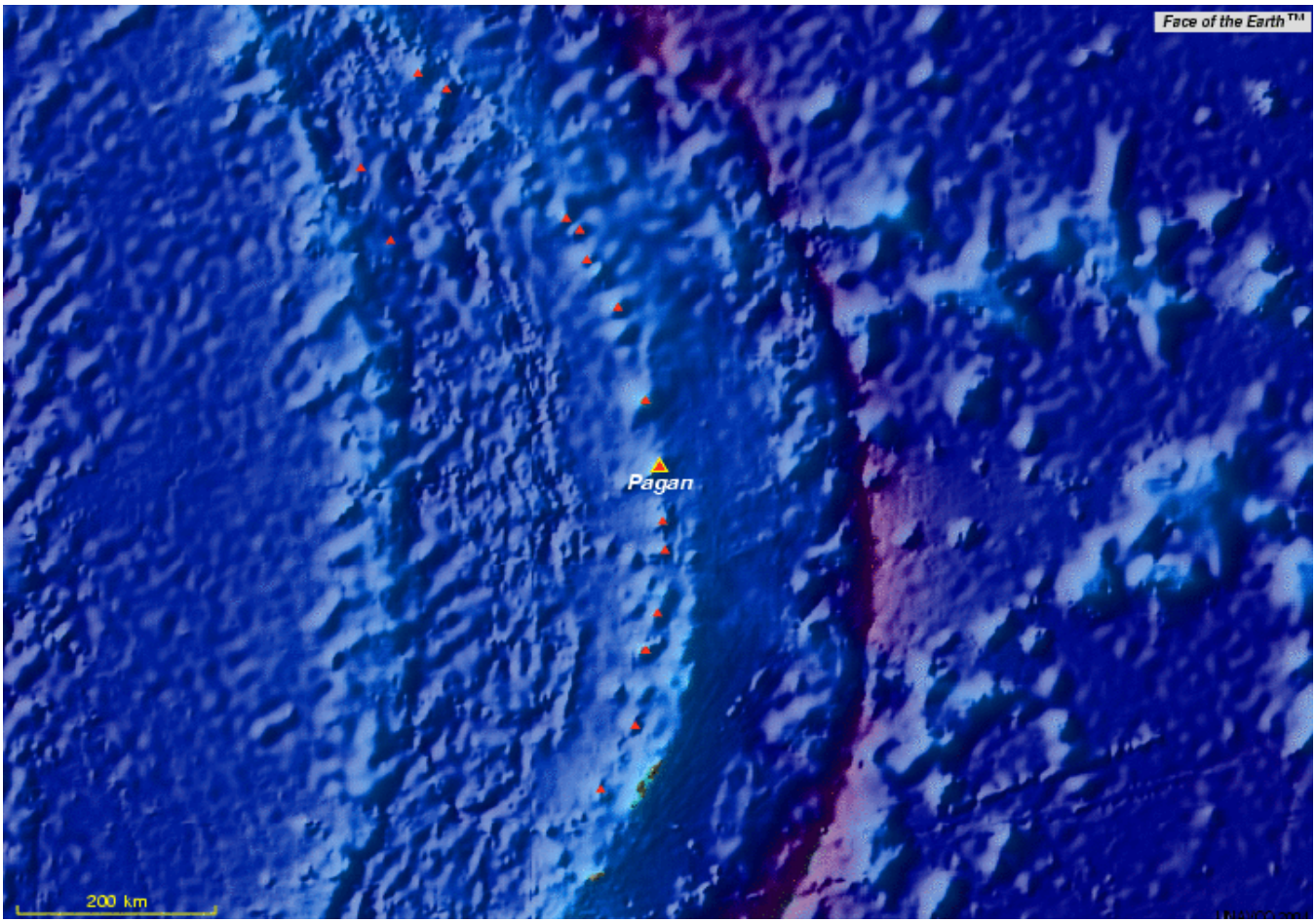


FIGURE 3K: FACE OF THE EARTH SURROUNDING PAGAN
The island chain of the Northern Islands along the Mariana Trench to the west.
(Source: UNAVCO, Inc. Jules Verne Voyager mapping, Smithsonian Global Volcanism Program)

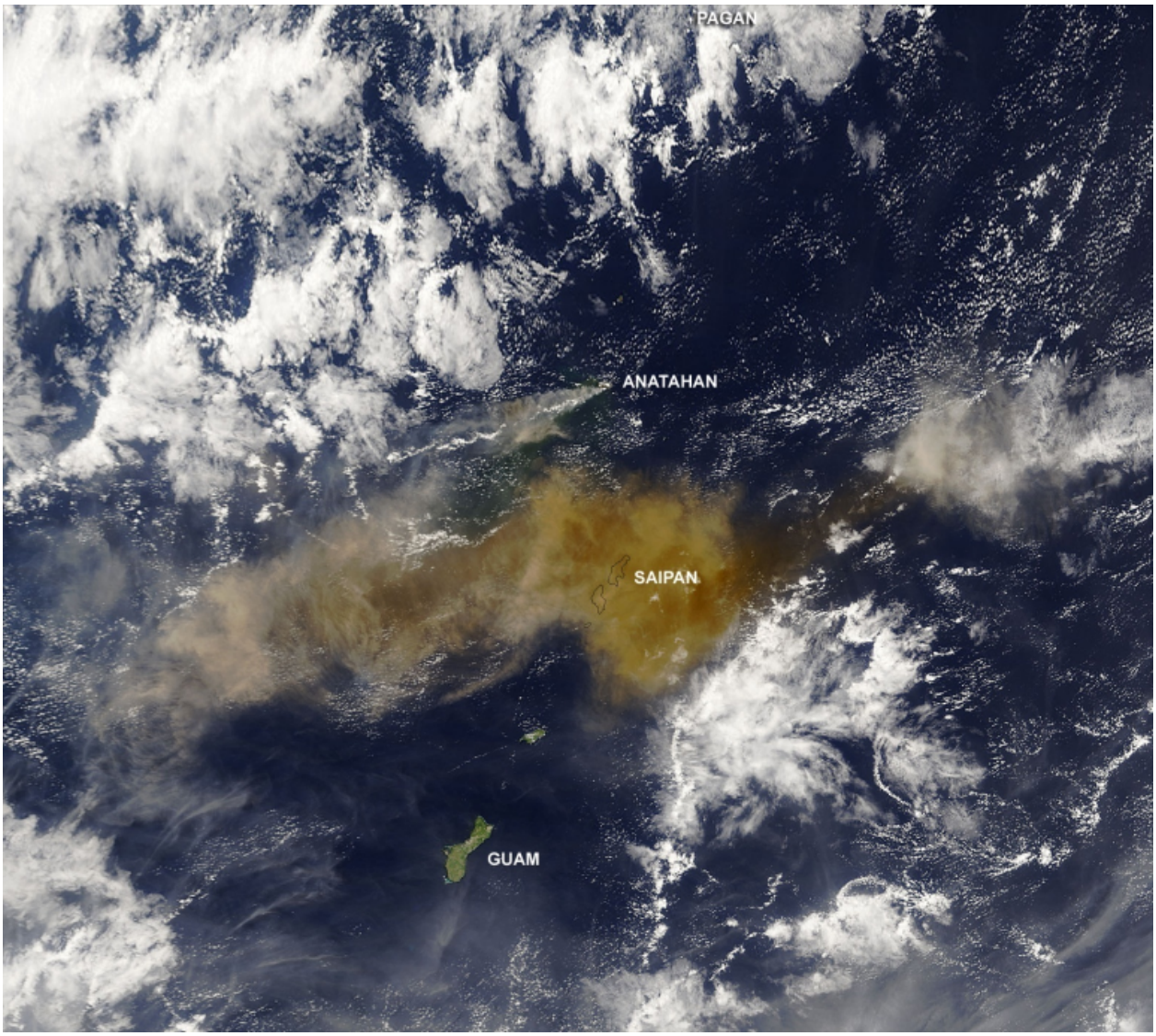


FIGURE 3L: NASA SPACE STATION IMAGE OF PLUME CAUSED BY THE ERUPTION OF ANATAHAN VOLCANO

A thick cloud of ash erupts from the Anatahan Volcano in this Terra MODIS image collected on April 6, 2005. According to the Washington Volcanic Ash Advisory Center, a series of low-level eruptions starting on April 4 caused this plume. The explosive eruption of Anatahan Volcano on April 6, 2005 sent a plume of ash up to 15,200 meters into the air. This is the largest eruption at the volcano since its first recorded eruption on May 10, 2003. This image was acquired about eight hours after the eruption began. By this time, the ash had spread south to entirely cover Saipan and Tinian, the islands immediately south of the volcano. Aircraft were warned to avoid the area because volcanic ash could destroy jet engines.
(Source: NASA website)

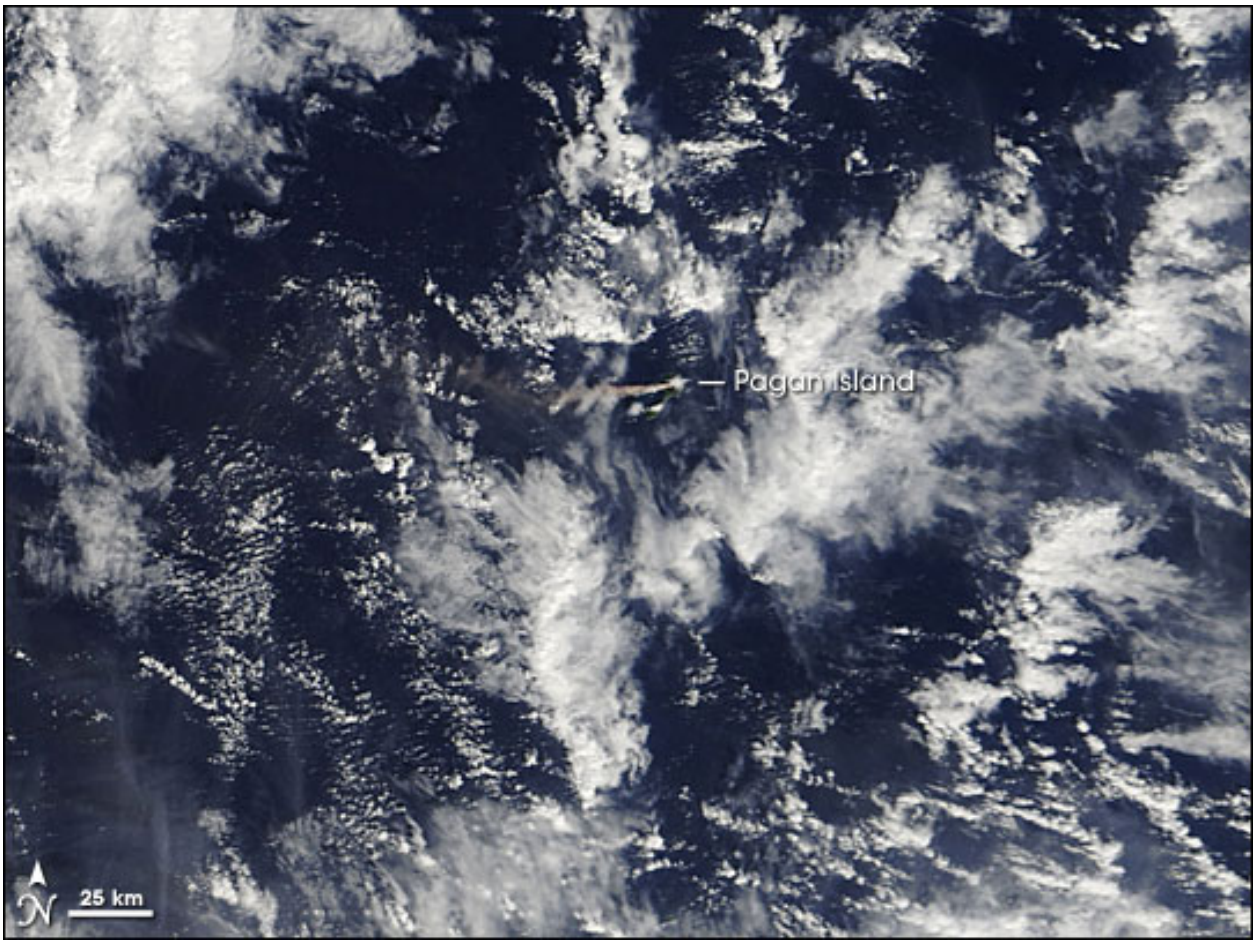


FIGURE 3M: NASA SPACE STATION IMAGE OF PLUME CAUSED BY PAGAN VOLCANO

Pagan Island released a plume of ash and/or steam in early December 2006. The Moderate Resolution Imaging Spectroradiometer (MODIS) flying onboard NASA's Terra satellite captured this image of the volcano on December 6, 2006. In this image, the plume appears slightly darker than the nearby cloud cover. While the clouds are white, the plume is pale beige. Winds blow the plume to the west, and it quickly dissipates over the Pacific. Pagan Island is one of the most active volcanoes in the Mariana Islands. The island includes two stratovolcanoes composed of layers of hardened ash and lava, and consolidated volcanic rocks. In the north is Mount Pagan, which is 570 meters high. In the south is South Pagan, which is 548 meters high. Recorded eruptions dating back to the 17th century have all come from the north volcano.

(Source: NASA website, MODIS Rapid Response Team, Goddard Space Flight Center)

Benigno R. Fitial,
Governor
Timothy P. Villagomez,
Lt. Governor

COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS

Emergency Management Office

Office of the Director

Gregorio A. Deleon
Guerrero, Director
Mark S. Pangelinan, Dep.
Director

December11, 2006 3:45p.m.

Final Pagan Volcano Activity

Acting Governor Timothy P. Villagomez would like to inform the General Public that according to the Washington Volcano Ash Advisory Center (VAAC) and USGS in coordination with the Emergency Management Office, Office of the Governor has **reported that no further ash emission from the volcano on the Island of Pagan have been detected**, this is according to the latest satellite observation. The last ash emission was reported on December 08, 2006 at 433p.m. Low-level ash emissions would move toward the west or northwest direction at 23 to 29 miles per hour.

Present condition on Pagan: **NORMAL**

The USGS and EMO will continue to monitor the volcano on Pagan closely for additional activity.

No Further Advisories will be issued unless conditions change.

Update:
By:act

FIGURE 3N: CNMI LATEST REPORT ON FINAL PAGAN VOLCANO ACTIVITY
(Source: CNMI Emergency Management Office website)

COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS

Benigno R. Fitial
Governor

Timothy P. Villagomez
Lieutenant Governor

DECLARATION OF A STATE OF EMERGENCY

JAN 23 2006

Volcanic Eruption on Anatahan

I, BENIGNO R. FITIAL, pursuant to the authority vested in me as Governor of the Commonwealth of the Northern Mariana Islands pursuant to Article III, Section 10 of the Commonwealth Constitution and 3 CMC § 5121 of the National Disaster Relief Act of 1979, declare a State of Emergency for the island of Anatahan. This Declaration of a State of Emergency is in accordance with the recommendations and justifications presented by the Emergency Management Office (EMO), Commonwealth of the Northern Mariana Islands and the United States Geological Survey (USGS) such recommendations and justifications being attached and incorporated by reference. I further declare that the island of Anatahan is unsafe for human habitation and do therefore restrict all travel to the island of Anatahan except for such travel deemed to be for scientific purposes, provided however, that such scientific expeditions be permitted only upon prior notification to the Director of EMO or his designee. I also declare that the off-limits zone shall continue to be maintained from thirty (30) nautical miles to ten (10) nautical miles around the island of Anatahan.

This Declaration of Emergency shall take effect immediately and shall remain in effect for thirty (30) days unless I, prior to the end of the thirty (30) day period, notify the Presiding Officers of the Legislature that the state of emergency has been lifted or has been extended for an additional period of thirty (30) days. The underlying justification for any such further extension, as with the Declaration of a State of Emergency, shall be set forth in a detailed communication to the Legislature.

BENIGNO R. FITIAL

xc: Lt. Governor
Senate President
House Speaker
Mayor of the Northern Islands
Director, Emergency Management Office
Commissioner, Department of Public Safety
Attorney General
Secretary of Finance
Special Assistant of Management and Budget
Special Assistant for Programs and Legislative Review

FIGURE 3O: CNMI LATEST DECLARATION OF A STATE OF EMERGENCY ON ANATAHAN ISLAND
Anatahan Island is a volcanic island of the Northern Islands. The explosive volcanic activity began suddenly in May 2003. CNMI EMO continues today to monitor volcanic and seismic activities and updates safety information for the public.
(Source: CNMI Emergency Management Office website)

Global Volcanism Program
Pagan » Summary

Smithsonian
National Museum of Natural History

PAGAN

Country:	United States	
Subregion Name:	Mariana Islands	
Volcano Number:	0804-17=	
Volcano Type:	Stratovolcanoes	
Volcano Status:	Historical	
Last Known Eruption:	2006	
Summit Elevation:	570 m	1,870 feet
Latitude:	18.13°N	18°8'0"N
Longitude:	145.80° E	145°48'0" E

Pagan Island, the largest and one of the most active of the Mariana Islands volcanoes, consists of two stratovolcanoes connected by a narrow isthmus. Both North and South Pagan stratovolcanoes were constructed within calderas, 7 and 4 km in diameter, respectively. The 570-m-high Mount Pagan at the NE end of the island rises above the flat floor of the northern caldera, which probably formed during the early Holocene. South Pagan is a 548-m-high stratovolcano with an elongated summit containing four distinct craters. Almost all of the historical eruptions of Pagan, which date back to the 17th century, have originated from North Pagan volcano. The largest eruption of Pagan during historical time took place in 1981 and prompted the evacuation of the sparsely populated island.

FIGURE 3P: INFORMATION ON MOUNT PAGAN VOLCANO
(Source: Smithsonian National Museum of Natural History Global Volcanism Program website)

Global Volcanism Program
Pagan » Summary

Smithsonian
National Museum of Natural History

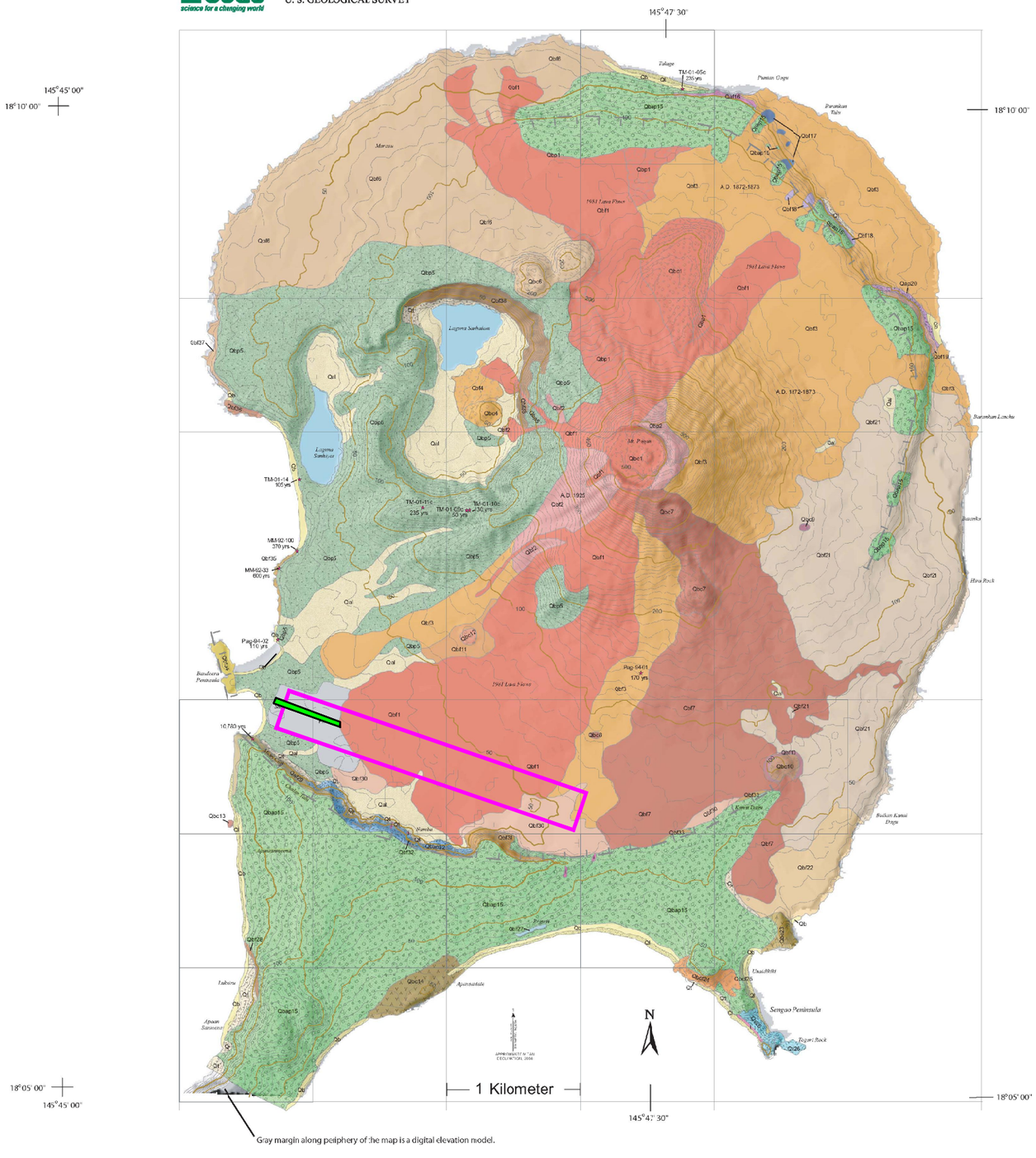
PAGAN ERUPTIVE HISTORY

Area of Activity		Start Year	Start MoDy		Stop Year	Stop MoDy	Eruptive Characteristics CERF	SIGC	ENPF	FLDS	FDMT	VEI	Volume L / T
North Pagan		2006	1204		2006	1208	x---	----	x---	----	----	1	
North Pagan		1993	0115e		1993	11 . .>	x---	----	x---	----	--x-	2	
North Pagan		1992	0413		1992	0413	x---	----	x---	----	----	1?	
North Pagan		1988	0824		1988	1012	x---	----	x---	----	----	2	
North Pagan	?	1988	0216		....	....	x---	----	?---	----	----		
North Pagan		1987	0904		1987	0904	x---	----	x---	----	----	1	
North Pagan (summit and north flank)		1981	0515		1985	0501>	xxx-	----	xx--	x---	-x--	4	7 / 8
("eruption" actually a grassfire)	X	1966	0523		....	....							
South Pagan, cone within caldera	?	1929	....	?	1930	....	x---	----	?--?	----	----		
		1925	02 . .		1925	0505	x---	----	x---	x---	----	2	
North Pagan		1923	02 . .?		1923	0326e	x---	----	x---	x---	----	3	
North Pagan		1917	....		....	....	x---	----	x---	----	----	2	
North Pagan		1909	....		....	....	x---	----	x---	----	----	2	
North pagan		1873?	....		....	....	x---	----	x---	x---	----	3?	
South Pagan		1864	....		....	....	----	----	x---	----	----	1?	
North Pagan		1825e	....		....	....	----	----	x---	----	----	2?	
North Pagan (west flank maar)	C	1800t	....		....	....	x---	----	xx--	----	----		
North Pagan		1669	....		....	....	----	----	x---	?---	----		
North Pagan	C	1580t	....		....	....	----	----	xx--	----	----		
North Pagan	C	1350v	....		....	....	----	----	xx--	----	----		

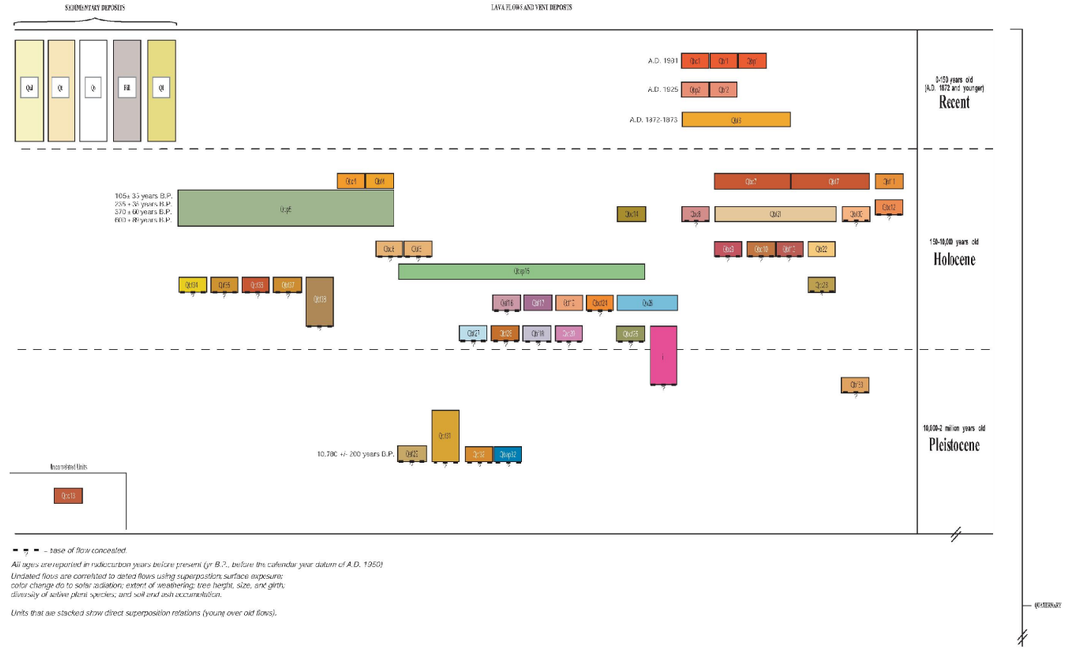
FIGURE 3Q: ERUPTIVE HISTORY OF MOUNT PAGAN VOLCANO
(Source: Smithsonian National Museum of Natural History Global Volcanism Program website)

U.S. DEPARTMENT OF THE INTERIOR
U. S. GEOLOGICAL SURVEY

Open-File Report 2006-1386



Mount Pagan
CORRELATION OF MAP UNITS



Legend

- 100m contour
- 10m contour
- Caldera boundary
- littoral deposits
- maar
- phh
- spatter
- surge
- tuff
- tuff breccia
- undiff pf
- Radiocarbon locality
  All ages are reported in radiocarbon years before present (yr B.P., before the calendar year datum of A.D. 1950)

PRELIMINARY GEOLOGIC MAP OF MT. PAGAN VOLCANO, PAGAN ISLAND,
COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS

By

By Frank A. Trusdell, Richard E. Moore, and Maurice K. Sako

2006

CONTOUR INTERVAL 10 M
DATUM IS MEAN SEA LEVEL
SHORELINE PLOTTED TO FIT THE APPROXIMATE LINE OF MEAN HIGH WATER
Projection: UTM 55N
Datum: WGS84

FIGURE 3R: PRELIMINARY GEOLOGIC MAP OF MT. PAGAN VOLCANO, PAGAN ISLAND

CHAPTER 4
SOCIAL SETTINGS

4.1 Historical Overview

The Northern Mariana Islands were first settled around 1500 BCE by seafaring canoe voyagers who originated from Southeast Asia. These first settlers were the ancestors of the modern-day Chamorros, one of two indigenous ethnic groups in the Northern Marianas. The Portuguese explorer Ferdinand Magellan arrived on the islands in 1521 and in 1565 the islands were officially claimed for Spain. In the early 1800s, another group of islanders arrived on Saipan and were granted permission by the Spanish government to settle there. These islanders were the ancestors of the modern-day Carolinians, the second indigenous group of people in the Northern Marianas. [2] [10]

The Spanish period in the Northern Marianas ended in 1898, when Spain was defeated in the Spanish-American War. Spain then sold the Northern Mariana Islands to Germany. Germany administered the colony until Japan seized the islands in 1914, at the beginning of World War I. In 1919, The League of Nations awarded the islands to Japan by mandate and the Japanese administration in the Northern Marianas lasted until 1945. With the end of World War II, and the islands subsequently became part of the United Nations Trust Territory of the Pacific Islands, along with other Micronesian jurisdictions. The United States administered the Trust Territory until the people of each island jurisdiction decided their future political status. [2]

In June 1975, the people of the Northern Marianas voted to become a United States Commonwealth, and in 1976, the President signed into

law the Covenant to Establish a Commonwealth of the Northern Mariana Islands in Political Union with the United States of America. The CNMI Constitution was ratified by the people of the Northern Marianas in 1977. The islands remain a self-governing Commonwealth in political union with the United States to this day. Most U.S. federal laws apply, with limited exceptions.

4.2 Economic Development

Throughout the Spanish, German, and Japanese administrations, economic development on Pagan was primarily based on subsistence fishing and horticulture, though the level of activity varied from administration to administration. [11]

Copra production was a major export industry that first developed on Pagan during the Spanish era, and was expanded during the German administration. The greatest period of economic activity, however, occurred during the Japanese administration. Village development took place in the Shomushon area, where the Japanese built homes, barracks, stores, and other buildings. A small-gauge railway, a sugar mill, a rope manufacturing plant, a small sulfur mining operation, a hospital, religious shrines, cisterns and a water catchment system were also built by the Japanese. [2]

During the buildup to World War II, the Japanese constructed a military base with airport facilities. Bunkers, caves, and tunnels along the coastlines were also established. Pagan supported an estimated 5,000 to 8,000 people during the war, mostly Japanese military personnel. [2]

Residents on Pagan and the Northern Islands historically farm, fish, and raise livestock and chickens for subsistence. [11] Prior to the 1970's

most inhabitants lived in a small settlement on the north side of Laguna Lake. A movement from Laguna to Bandera occurred in the early 1970's in order to be near the harbor. Until the 1980 eruption the habitation to a close, all residents lived at or in the vicinity of Bandera Peninsula and the former Japanese village of Shomushon. Public facilities at that time included a power plant, copra warehouse, church, dispensary, and a one-room school house. [2]

Pagan Residents has relied on quarterly deliveries of supplies by cargo boats chartered by the Northern Islands Mayor's Office to supplement their way of life. These cargo boats bring mail, clothes, food, cigarettes, fuel, alcohol, tools and other items to give or exchange with the island's inhabitants. Records show no indication of stores on Pagan or evidence of cash exchanges among residents for goods or services. Some Pagan residents have also participated in the USDA Needy Family Food Distribution Program and its succeeding programs. Food shipments are made by field trip vessel. [2]

During the November 2007 field trip conducted by EFC Engineers and Architects, Pagan residents reported receiving occasional visitors, including federal or local government delegations, tourists on cruise ships, and Coast Guard ships. They often assist these occasional visitors with tours of the island and supplies of food. Exchanges of goods take place as well. The residents indicated receiving word from the U.S. Coast Guard to expect more frequent visits to the islands, and said they were preparing for these visits by growing more agricultural produce to sell to the crew members.

Prehistoric:	Subsistence fishing and horticulture.
Spanish:	Subsistence fishing and horticulture (until forced removal of island's residents to Saipan and Guam in the late 1690s); Whaling primarily by American and British whalers (1830s-1860s). Includes shore visits for resource procurement; Copra plantation 1865-1869 (*La Sociedad Agricola de la Concepcion* established by George Johnson under lease agreement with Spanish government on Guam); Copra production 1888s by itinerant Carolinian workers. Copra bought by a Captain Williams, master of the ship *Esmeralda*.
German:	Copra production under land lease to Pagan Company (1899-1914)
Japanese:	Copra production; Rope making; Commercial fishing
Postwar:	Copra production by the Northern Islands Development Company (1951-1960s); Subsistence fishing and farming by island's resident population until island was declared off-limits following a volcanic eruption in 1981; Betel nut exports; Feral cattle and swine hunting; Commercial fishing by Saipan-based boats

TABLE 4A: A BRIEF OVERVIEW OF "PEOPLE USE" OF PAGAN THROUGH EACH OF THE HISTORICAL TIME PERIODS…. (Source: Russell, Scott. 2003. A Land Use History of the Northern Islands. Unpublished report to Micronesian Environmental Services. 23 pp.)

4.3 Population

The first organized census of Pagan was taken by the Japanese administration in 1920. Between the 1920s and 1940s, the indigenous population ranged from 90 to 150. In 1925 a volcanic eruption resulted in the temporary evacuation of all Pagan residents. In the 1930s a large influx of Okinawan and Japanese nationals into Pagan occurred, and by 1940 several hundred people lived on the island. During the war, Pagan supported between 5,000 and 8,000 people, mostly Japanese military personnel. [11]

With the exception of a small detachment of U.S. Marines stationed on Pagan in 1950, no one had lived on the island from 1945, until groups from Saipan and Agrihan migrated there in 1951. A 1954 census recorded a total of 90 residents on Pagan, 73 of whom were Chamorros and 17 of whom were Carolinians, living primarily in the lowlands west and southwest of Mount Pagan. Most of these individuals were transients from Saipan and Agrihan who were hired to harvest coconuts, and who also maintained small gardens and raised livestock. Just prior to the 1981 volcanic eruption, Pagan was inhabited by 56 residents. All 56 residents were safely evacuated from the island and permanently relocated to Saipan. Though resettling in Pagan is still not officially permitted, a few individuals have relocated to Pagan since the 1981 eruption, or intermittently reside there. [11]

Because of the lack of infrastructure and public services such as healthcare and educational facilities, population figures for the Northern Islands, including Pagan, have historically been in flux. According to the US Census Bureau 2000 Update (July 10, 2001), the total population of the Northern Islands has declined from 104 persons in 1980, to 36 persons in 1990, 8 persons in 1995, and 6 persons in 2000. The Census 2000 information does not distinguish the population between the different islands within the Northern Islands Municipality. [12]

Voter registration records available at the Commonwealth Election Commission, however, may be more accurate indicators of the number of people who consider the Northern Islands their permanent residence. The most recent records, dated November 1, 2007, show that 102 people registered to vote in the Northern Islands election district. Actual population figures are likely to be higher, since voter registration records do not include minors and others ineligible to vote,

or citizens who failed to register but who would still be considered residents of the Northern Islands. No official population information exists which distinguish the population between the different islands within the Northern Islands Municipality. [13]

The Northern Marianas Mayor's Office (NIMO) estimates a total population of over 200 persons currently residing in the 10 islands of the Northern Islands Municipality, particularly Agrihan and Alamagan. NIMO also projects this figure to reach over 1,000 once basic infrastructures are established, and consistent and reliable transportation and other governmental services are in place in the Northern Islands. [15] [Source: NIMO, Meeting Notes #001]

4.4 Proposed Development Plans

In 2001 the Northern Islands Mayor's Office prepared an Economic Development Plan to guide the permanent resettlement of Pagan and the Northern Islands. The Northern Islands Development Plan seeks Capital Improvement Projects (CIP) funding and loans for the provision of essential infrastructures to assist in the resettlement and economic development of the Northern Islands. Proposed infrastructure development for Pagan includes the airport runway and terminal facilities, water, electrical power, solid waste disposal, and sewer treatment facilities, a public school, public roadways, a transportation system for passengers and cargo, a reliable communications system, port facilities, and other public facilities. [14] [15]

Economic industries proposed by the Northern Islands Mayor include commercial fisheries, agriculture, aquaculture, mariculture, film and television, ecotourism and volcanic mineral mining. [14]

Pagan is envisioned to be the future transportation hub for the Northern Islands. The lack of reliable transportation is the key for economic developments. A fleet of fishing boats regularly use Pagan as storm shelter and refueling base. Such activities indicate the potential of further economic activity and resettlements on Pagan. [Source: NIMO, Meeting Notes #007]

Nature-based attractions and activities that would support ecotourism on Pagan include black sand and white sand beaches, two lakes, volcano tours, scuba diving, caves, numerous walking trails, cliff-line and deep-sea fishing, geothermal springs, and rock-climbing. In addition, the numerous cultural and historic sites on Pagan are potential tourist attractions, including prehistoric artifacts, Japanese-era shrines and monuments, the old Shomushon village, and World War II relics. NIMO sees great potential for future development of the fisheries and ecotourism industries. It was noted that NOAA has awarded $90,000 for a remote island fishing station on Alamagan island, and investors are interested in stationing a yacht in Pagan bay to provide diving tours.

[Source: NIMO, Meeting Notes #001]

With respect to volcanic mineral mining, the northern area of Pagan contains large quantities of pozzolan, a glassy material that was generated during the volcanic eruption of 1981. Pozzolan is used as a strengthening agent in construction materials. One private company was issued a permit to mine pozzolan on Pagan; only limited mining was conducted, however, and in 2006 the permit was terminated for repeatedly failing to abide by the permit conditions. In 2007 the CNMI government created a multi-agency task force to conduct a comprehensive feasibility and environmental impact study of pozzolan mining on Pagan. A consultant was also contracted by the

government to evaluate the quantity and quality of the pozzolan deposits on Saipan. Initial reports indicate that the quality of Pagan pozzolan may be acceptable for commercial use. The final report has not yet been released.

According to the Northern Islands Mayor, if the airstrip is restored, Pagan would be established as the transportation hub for the Northern Islands. Visitors and residents seeking to travel to any of the Northern Islands would first have to fly into Pagan, and then board vessels to the neighboring Northern Islands. This transportation scheme would also facilitate commerce among the Northern Islands communities, and between the Northern Islands and the larger population centers on Saipan, Tinian, and Rota.

[Source: NIMO, Meeting Notes #001]

Based on recommendations by the US Geological Survey, two programs are being implemented that would support future efforts to resettle Pagan and the Northern Islands. Seismographs are being installed and are being monitored locally to provide more accurate data of any threat of eruptions. Secondly, the CNMI government is implementing an early warning system and evacuation plans on each of the Northern Islands.

[Source: NIMO, Meeting Notes #001]

4.5 Regional Setting and Land Use

4.5.1 Land Ownership

All land on Pagan is publicly owned and administered by the Department of Public Lands (DPL). Establishing essential infrastructure, including transportation systems, will require the DPL to appropriate

port areas for construction and installation of seaports and airports. The Pagan Airstrip has yet to be appropriated to the Commonwealth Ports Authority (CPA) in order for CPA to proceed with the planning, funding, and authorizing of the construction of the Pagan Airstrip. [Source: Dept. of Public Lands, Meeting Notes #003]

4.5.2 Proposed Homestead Program

The Northern Islands Development Plan calls for the creation of a homestead program on Pagan that would grant residents fee simple title to land and facilitate the resettlement process. Currently, residents of Pagan do not title to any land, though some individuals and families may have claimed de-facto residency near, or on, the Pagan Airstrip boundaries. These claims must be further investigated and processed by Department of Public Lands.
[Source: Dept. of Public Lands, Meeting Notes #003]

Several areas on Pagan have been identified as acceptable for potential homestead designation. Although the old Shomushon village was evacuated after the 1981 eruption, the area is still considered suitable for settlement. Shomushon is located along the Bandera Peninsula and north of the Pagan Airstrip. Other suitable homestead areas that have been identified include Regusa, a fairly accessible and gently sloping land southeast of Mt. Pagan that spans approximately 400 hectares, and Marasu, located approximately four miles north of the old Shomushon village. [16]

A Northern Islands Residential and Agricultural Homestead Act and the Homestead Waiver Act are currently under consideration by the CNMI legislation. NIMO advocates granting agricultural homestead to the individuals who have been continuously occupying parcels of public land in Pagan, but have not been granted homestead permits.

[Source: NIMO, Meeting Notes #010]

4.5.3 Military Exercise Activities in the Northern Islands (Farallon de Mendinilla)

The southernmost island of the Northern Islands, Farallon de Mendinilla, the closest island of the Northern Islands chain to Saipan, is presently being leased by the United States for military exercises as part of the Covenant agreement between the U.S. and the CNMI. The uninhabited 200-acre coral island is located approximately 150 miles north of Guam, 45 miles north of Saipan, and 275 miles south of Pagan Island. [1] Farallon de Medinilla is the Pacific Fleet's only U.S.-controlled range available for live-fire training bombing exercises of the forward deployed naval forces. The target range is frequently used as a high-fidelity scenario-based target, for the purpose of training fighter pilots to develop and maintain proficiency in precision-guided arms and specific target engagement.

EMO and the Office of the Governor, in conjunction with the US Naval Forces Marianas (N3) Guam, regularly issue Area Advisories to inform the general public of the schedule and dates of the US Military Unit live fire trainings on the island of Farallon De Medinilla. The general location of these live fire trainings are on Farallon De Medinilla Training Area (R7201) on a ten nautical mile radius on all quadrants. Due to the danger imposed, EMO advises the general public, especially fisherman, commercial pilots, and marine tour operators, to stay away from this area during the schedule time and dates. This information is announced on local newspapers, as well as on the EMO website. [8]

4.6 Proposed Developments

4.6.1 Volcano Monitoring System

USGS and the CNMI Emergency Management Office have been working together on monitoring volcanoes in the CNMI since 1981. Under the Stafford Act (Public Law 93-288), the USGS has the responsibility to issue timely warnings of potential geologic disasters to the affected populace and civil authorities. The ash hazard caused by volcanoes in the CNMI affects both local and trans-pacific aviation activities, as well as military aviation activities. USGS is pursuing to install a real-time geophysical monitoring network for high-threat volcanoes including Mt. Pagan. This modern digital seismic instrumentation enables deformation monitoring (tiltmeters, GPS, tide gauges, InSAR) and up-to-date hazard assessments as outlined in the National Volcano Early Warning System. [17]

NIMO has high expectations on this project, as it is necessary to assess real-time volcanic hazards for any resettlement on the island, as well as providing safety advisories of volcano and earthquake hazards and preparing evacuation procedures that would protect and foster nearby population as well as economic activities such as fishing. Unmonitored, the potential for volcanic and seismic hazards inhibits economic development and any prospective resettlement in Pagan. Vigilance is of greater importance with the planned reoccupation and ongoing resettlement of residents.

[Source: NIMO, Meeting Notes #006]

Since Mt. Pagan is the most active volcano in the Mariana Island Arc, as much data as possible should be collected in order to ascertain how these types of volcanoes work. [17] A continued support for

maintaining the seismic instrumentation and data analysis is critically important in monitoring the internal state of the volcanoes in the Northern Islands. Residents are encouraged to operate portable seismographs and learn to recognize the common signals caused by earthquakes, volcanic tremor, weather conditions, cultural noise, or instrumental problems, and detection of warning signals should be communicated by radio with EMO in Saipan. Residents, in conjunction with civil authorities, should prepare safety procedures and evacuation plans. It is essential that a log of seismic activity is kept and relayed to USGS for further analysis. [18]

However, despite of planning efforts by USGS and EMO, funding for this project is not in place. It reported that in 2007, CNMI government lobbied the US Congress for at least $2 million for the system. According the implementation play by USGS, full monitoring and hazard assessment will cost approximately $7 million to complete. This is to be followed by the establishment of a Marianas Volcano Observatory to maintain the monitoring network and issue warnings to the general public, with operational costs running approximately $500,000 annually. USGS requested $800,000 for fiscal year 2007 to establish a monitoring network on Pagan and complete its hazard assessment, but the US President's FY2008 budget request didn't include any funds for the CNMI volcano monitoring and hazard assessment. [19]

4.6.2 Pilot Studies on Geothermal Energy

A former USGS scientist is leading a research team to study the possibility of producing electricity through geothermal energy of the volcano in Pagan. Pagan is the proposed site for a geothermal power

plant. In June 2008, the Office of Insular Affairs (OIA) approved a $220,000 grant for the pilot reearch, jumpstarting this project. [20]

US Department of the Interior officials met with CNMI local government on energy issues, and OIA flew to Pagan to conduct preliminary research. The team also met with CNMI Governor Fitial to discuss federal funding and various other issues, including the volcano monitoring system for the Northern Islands.

[Source: NIMO, Meeting Notes #006]

The research team is seeking federal assistance to finance their logistics in the remote and uninhabited volcanic islands of Pagan and Alamagan. The first step is an assessment of the geothermal potential and the cost to utilize the energy. Subsequent survey includes exploration and drilling to locate the power sources. [21]

NIMO and the CNMI government have high expectations on this geothermal project to be promising as an alternative energy. CNMI government expressed that they will work closely with the US government, including its military which eyes the site for training purposes, to develop the potential of geothermal energy in Pagan Island. [22]

4.6.3 Military Relocation to Guam

Plans for the U.S. military transfer from Okinawa to Guam may also involve the CNMI, including the Northern Islands.

The US military conducted a survey of Pagan in 2003. However, no details of this survey or any reports are available. [Source: Dept. of Public Lands, Meeting Notes #003. Joint Guam Program Office, Meeting Notes #007]

At an August 2007 Guam Industry Forum held in preparation for the military buildup, military planners specifically mentioned Pagan and Sarigan of the Northern Islands as possible sites for full-scale amphibious assault trainings. The use of the old Tinian airstrip was also mentioned, which may bear implications for the Pagan airstrip as well. [Source: CNMI Historic Preservation Office, Meeting Notes #005]

More specific and concrete details of the military's proposed activities for CNMI and the Northern Islands are not available. All plans are considered purely speculative at the present time. According to the Joint Guam Program Office, which is coordinating military planning efforts in the region, Environmental Impact Statement (EIS) will influence the final determination of site uses in the region. A draft EIS is not expected to be ready for review until 2009.
[Source: Joint Guam Program Office, Meeting Notes #007]

Massive construction expected to take place in Guam presents an opportunity to use the yet untapped resources of pozzolan on Pagan. It is expected that a major portion of the estimated $15 billion investment involves concrete construction, and the CNMI government expresses willingness to expedite the mining of pozzolan and bring the much needed revenues to the CNMI. Also, NIMO is eager to explore possibility or mining lava rocks as construction material. The lava rocks can be used as a non-skid material for road pavement, airport runways, and similar projects, as well as be used for manufacturing cement bricks and blocks for home and building construction projects. Mining of these abundant volcanic products is expected to bring revenue resources to the Northern Islands, and NIMO is urging appropriate agencies to prioritize mining projects in Pagan. [23]

While much of the military activities are focused on Tinian, the Department of Defense is also considering using other islands for training purposes. The Marine Corps is conducting a training concept study as well as looking throughout the CNMI, as far as Pagan, to enhance its training activities. [24]

Despite the military's interest in Pagan and the Northern Islands, no definitive plans have been announced.

[Source: Joint Guam Program Office, Meeting Notes #007]

4.6.4 Mariana Trench Marine National Monument

The creation of a Mariana Trench Marine National Monument is being proposed by Pew Charitable Trusts and considered by the White House. Pew Charitable Trusts, a nonprofit organization dedicated to planning and evaluating public policies, has been proposing this project to the White House, and their Economic Impact report states that a decision will be made in 2008, whether or not President George Bush will consider designating the vast areas in the northernmost part of the CNMI archipelago as a marine sanctuary. [25]

The proposed marine national monument is approximately 115,000 square miles, if designated, would make it the second largest marine reserve in the world, encompassing three islands of the Northern Islands: Maug, Asuncion, and Farallon de Pajaros. There are no commerce, transshipment, or other use of these islands which are preserved under the CNMI constitution to be *"used only for the preservation and protection of natural resources, including but not limited to bird, wildlife, and plant species"* [CNMI Constitution, Article XIV, Section 2]

Since the public announcement of this proposal in March 2008, there

have been active discussions in the local community. Opponents of the proposal argue that the prohibition of commercial fishing in the area will cause damages to the local fishing industry. It will also prevent all future extraction of minerals, gas, and oil in the region. Proponents argue that the sanctuary would lead to more recreational activities and increase in tourism, and the advantages of creating the marine monument outweigh the potential future fishing and mining value.

Active discussions and presentations continue to inform the public about the proposal. The proposal is yet to be discussed by the government at federal and local levels, as well as the local community.

Census 2000 Update (July 10, 2001)

The CNMI's total population was 69,221 persons, as of April 1, 2000, according to the US Census Bureau's first release on the CNMI 2000 Census. By island, Saipan's population was 62,292, Tinian's was 3,540, Rota's was 3,283, and the Northern Islands' was 6 persons, as of April 1, 2000.

Compared to Five Years ago, 1995 Census, the CNMI population increased by 10,375 persons (or 18 percent) from the 1995 count of 58,846 persons. By island, Saipan's population increased by 9,694 persons (or 18 percent); the Northern Islands'declined by 2 persons (or -25 percent), from the 1995 Census.

Compared to Ten Years Ago, 1990 Census, the CNMI population increased by 25,876 persons (or 60 percent) from the1990 count of 43,345 persons. By island, Saipan's population increased by 23,496 (or 60 percent) from 38,896 in 1990; the population in the Northern Islands declined from 36 to 6 persons, a decline of 83 percent.

Compared to Twenty Years Ago, 1980 Census, the CNMI population increased over three times, by 52,441 (or 313 percent) from the 1980 count of 16,780 persons. By island, Saipan's population increased 329 percent (or over 3 times) from 14,549 in 1980; the population in the Northern Islands declined from 104 to 6 persons, a decline of 95 percent.

CNMI Population by Island: 1980 to 2000

	Population			
ISLAND	2000	1995	1990	1980
CNMI Total	**6 9,221**	**5 8,846**	**4 3,345**	**1 6,780**
Saipan	6 2,392	5 2,698	3 8,896	1 4,549
Tinian	3,540	2,631	2,118	866
Rota	3,283	3,509	2 ,295	1 ,261
Northern Islands	6	8	36	104

FIGURE 4A: CENSUS 2000 POPULATION OF CNMI

US Census Bureau 2000 data does not distinguish population between the different islands of the Northern Islands Municipality.
(Source: 2000 Census of Housing and Population, 1995 Census of Population and Housing, and 1990 Census of Population and Housing.)

votecnmi.gov.mp

CNMI Voter Registration Statistics
Results as of: November 1, 2007

District	Village	Count
ED No. 1A	San Antonio	780
ED No. 1B	San Vicente	2417
ED No. 1C	Koblerville	1029
Total		**4226**

District	Village	Count
ED No. 2	Chalan Kanoa/Susupe	1160
Total		**1160**

District	Village	Count
ED No. 3A	Oleai	880
ED No. 3B	Garapan	2340
Total		**3220**

District	Village	Count
ED No. 4A	Tanapag	602
ED No. 4B	San Roque	528
ED No. 4C	Capitol Hill	436
ED No. 4D	Northern Islands	102
Total		**1668**

District	Village	Count
ED No. 5	Kagman	2075
Total		**2075**

District	Village	Count
ED No. 6	Tinian	1271
Total		**1271**

District	Village	Count
ED No. 7	Rota	1564
Total		**1564**
Grand Total		**15184**

FIGURE 4B: **Registered voters in the Northern Islands election district as of November 1, 2007**
(Source: Commonwealth Election Commission)

Benigno R. Fitial, Governor
Timothy P. Villagomez, Lt. Governor

Emergency Management Office
OFFICE OF THE GOVERNOR
COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS

Mark S. Pangelinan, Acting
Director

FARALLON DE MENDENILA

August 01, 2008
2:40 P.M.

AREA ADVISORY

The Emergency Management Office, Office of the Governor, in conjunction with the U.S. Naval Forces Marianas (N3) Guam, Governor Benigno R. Fitial would like to inform the general public that the U.S. Military Unit would be conducting **LIVE FIRE TRAINING** on the Island of **Farallon De Mendenilla** . The schedule dates and time are as follows:

AUGUST 04 TO AUGUST 08 2008 FROM 8:00 A.M. TO 7:00 P.M. - LIVE FIRE TRAINING

The general location of this activity will be on the island of Farallon De Mendenilla Training Area (R7201) on a ten nautical mile radius on all quadrants.

Due to the danger imposed by this activity, Governor Benigno R. Fitial is advising the general public especially fisherman, commercial pilots and marine tour operators to stay away from this area during the time and dates indicated.

The cooperation and understanding of the general public is greatly appreciated.

Should you have any questions, please do not hesitate to contact the Emergency Management Office, Operations Section at telephone numbers 322-9528 and 322-9529, VHF Marine 16, and HF Single Side Band Radio on 5.205.0.

FIGURE 4C: EMO Area Advisory
Area Advisories are issued and made available on EMO's website to warn the general public, including commercial pilots and marine tour operators of the danger of live fire training in the designated military training area.
(Source: Emergency Management Office website)

FIGURE 4D: Pew Charitable Trust's Proposed Mariana Trench Marine National Monument
(Source: Economic Impact Study, Pew Charitable Trusts)

(INSERT FIGURES HERE)

PAGAN ISLAND

PAGAN 1
N 2004562.997
E 368525.436

BOMB PIT
RADIO ANTENNA
POT 1
N 2004313.144
E 368882.3202
NAIL SET ON SOLID ROCK
JAPANESE AIRPLANE
MACHINE GUN
EXISTING WAY
4WHEELER
PAGO TREE
BUNKERS
BUNCKERS
BUNCKERS
POT 7
N 9,275.7230
E 10,998.9268
NAIL SET
MACHINE GUN
OLD JAPANESE
STOR RM
OLD JAPANESE BLDG
OLD JAPANESE
WATER TANK
COR 3
CLIFF LINE
CLIFF LINE
EDGES OF CLEARINGS
001 S 04
743,227 sq.m.
001 S 05
744,054 sq. m.
PROPOSED
HOMESTEAD
AREA

S 05°47'20" E
106.5318
S 54°59'49" E
435.6990
N 67°25'20" W
374.8406
S 19°48'37" W
152.4003
N 19°48'37" E
152.4003
N 70°11'23" W
2438.4048
S 70°11'23" E
2438.4048
N 19°48'37" E
304.8006
S 19°48'37" W
285.5297
N 63°19'45" E
62.1435
N 53°04'26" E
82.9034
N 61°33'42" E
34.1550
N 63°34'19" E
46.8710
N 57°04'31" E
39.0094
N 27°49'46" E
56.0339
S 59°28'14" E
33.9482
S 66°32'23" E
46.8184
S 65°57'48" E
42.5562
N 65°25'35" E
179.6626
N 16°09'06" E
113.6139
N 68°03'18" E
139.9640
N 68°03'18" E
216.0970
S 12°25'06" E
859.2536
N 12°22'27" W
20.0000
S 68°03'18" W
216.7259
N 74°59'49" W
220.3023
N 66°28'31" W
216.1877
N 76°46'16" W
278.1820
S 82°16'37" W
379.3611
S 78°47'36" W
219.4935
N 82°36'54" E
157.3192
N 61°04'15" E
112.1721
N 67°48'20" E
57.3391
N 73°47'41" E
49.7776
N 63°31'53" E
52.2337

FIGURE 4E: PAGAN ISLAND SURVEY MAP BY DEPARTMENT OF PUBLI C LANDS

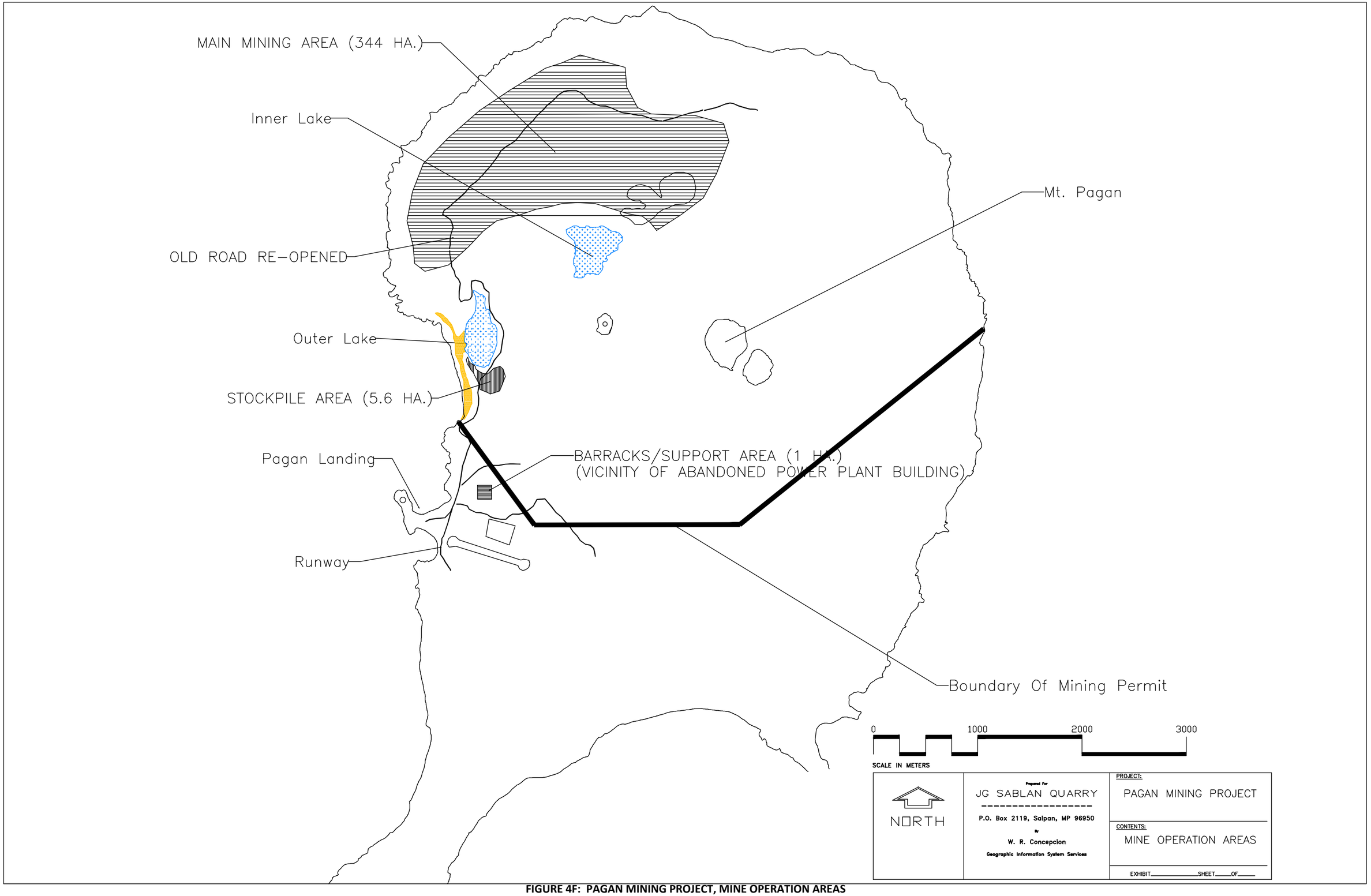


FIGURE 4F: PAGAN MINING PROJECT, MINE OPERATION AREAS

CHAPTER 5

EXISTING CONDITIONS

5.1 General

This chapter documents the general conditions and existing facilities of the Pagan Airstrip. The background section provides a brief historical overview of the airstrip. The inventory section identifies the existing physical conditions. This chapter also describes infrastructure limitations on Pagan which may constrain future economic development and aviation demand, and restrict the extent to which the Pagan Airstrip and associated facilities can be expanded.

5.2 Historical Background

The construction of the Pagan Airstrip and its supporting installations began during the Japanese era, around 1935, as Japan was preparing for war. An estimated 200 Japanese and 400 - 500 indigenous residents from surrounding islands were brought to Pagan to initiate construction of the airstrip and supporting facilities in the basin just south of Mount Pagan, near the Bandera Peninsula and the old village of Shomushon. [25]

In 1937, the Japanese military took over the construction and built a military base and a complex airfield with rainwater drainage ditches, water storage cisterns, bunkers, pillboxes, and defense guns. [25] On EFC's field survey, a local resident described a hangar was also carved into the escarpment cliff face, and was destroyed in the 1970s.

Except for handwritten notes by Shin'ichi Kameoka, a surviving Japanese Navy officer who was stationed at the military base in Pagan during World War II, most documentation on Japanese military activities does not exist today.

Official documents relating to the Pagan military base were maintained and kept at the headquarters for the Japanese Central Pacific Fleet located in Garapan, Saipan, and were completely destroyed during bombings followed by landings by the U.S. Marines, and severe ground battles. [25]

The Japanese navy officer's notes describe the Pagan military base as follows:

Outline of Japanese Military Base in Pagan:

1. Airfield: Total area 80,000 square meters. North-south length 600 meters, East-west length 730 meters.
2. Hangars: 10 zero fighters were housed.

3. Naval Barracks: 4 buildings
4. Fuel Storage and Arsenal: Dugout at escarpment. 200 drums of fuel tanks were stored.
5. Air Raid Shelters: Two concrete bunkers built at west of airfield. Housed about 20 persons each. Other shelters were carved into the escarpment.
6. Cut and flatten peak of Bandera Peninsula
7. Dock: 30-meters length at Bandera Lagoon

According to the same notes, the runway was approximately 2,000 feet long and 170 feet wide. The west end of the facility was on fill, as much as 15 feet thick, and the eastern end cut into lava flow with excavations up to 20 feet deep. Concrete drainage ditches were built on either side of the runway and were utilized for water catchment, but these facilities have since been destroyed. (Figure 5-G) [4] [25]

During World War II, U.S. fighter planes bombed Pagan, severely destroying the airstrip and Japanese fortifications, as well as the Shomushon village and harbor. The bombings started in June 1944, and succeeded in completely destroying most facilities of the Japanese military base within 48 hours. The U.S. Navy continued frequent aerial bombings for 14 months until the

surrender by the Japanese Empire in August 1945. The massive bombing raids by formations of about 15 to 30 fighter planes dropped an estimated 400 tons of bombs and many incendiary bombs. This scarred the airstrip making it almost unusable, and many bomb craters still mark the existing runway. [25]

In the 1960s, Pagan residents and American Peace Corps volunteers took on the task of repairing the airstrip. In 1970, US Air Force Civic Action Team, “Prime Beef” (Prime Base Engineer Emergency Force) rebuilt the runway. The bomb craters were repaired and the runway was given a smooth surface of crushed volcanic rock. During the reconstruction, which lasted almost a year, the team built a headquarters building, latrine buildings, a generator station, and a plumbing system. None of these temporary structures exist today. [11]

The 1981 eruption of Mt. Pagan covered nearly half of the airstrip with lava. The existing runway measures approximately 1,900 feet in length.

Photo 5-A: Aerial view of Pagan Airstrip from southeast. The grass-covered runway of the existing portion of the runway is highlighted in this photograph. The runway starts by the edge of the black sand beach at the Bandera Peninsula, and is abruptly terminated by the lava flow at the west end.

c. 1935 Japanese colonists began construction of airport
c. 1937 Japanese military began construction of naval base
1945 Japan’s surrender of WWII
1947 Mariana Islands became part of the US Trust Territory

1967 Pagan residents and Peace Corps volunteers cleared the airstrip for the first touchdown since 1944
1970 US Air Force Civic Action Team “Prime Beef” rebuilt and extended the runway from 1,200 to 3,000 feet
1978 CNMI entered into a Commonwealth arrangement in political union with the United States
1981 Mt. Pagan erupted and lava flow partially covered the airstrip leaving approximately 1,600 ft runway length

FIGURE 5A: TIMELINE OF EVENTS

FIGURE 5B: Preliminary Geologic Map of Mt. Pagan Volcano:
The most recent lava flow in 1881 is shown in red. The pink and orange represent older lava flows in 1925 and 1873, respectively. The gray color shows a fill which follows the outline of the Japanese military base. [Source: USGS Preliminary Geologic Map of Mount Pagan Volcano, 2006]

5.3 Inventory and Description of Existing Airstrip Facilities

5.3.1 Description of Existing Airstrip

Today the Pagan Airstrip is a grassy strip extending approximately 1,900 feet long and 120 feet wide, bearing South 69°49’15” East. The conditions of the airstrip are continuously deteriorating and have undergone only minor repairs since the 1981 eruption. Cattle and goats are commonly seen grazing on the airstrip, which keeps the grass somewhat under control. Pagan residents will also occasionally trim the grass when there is fuel available for their grass cutters. Otherwise, there is no regular maintenance of the runway.

The width of the existing clearance is approximately 250 feet. The main strip measures at a width of approximately 56 feet, and at a length of approximately 1,900 feet. The runway slopes up significantly from west to the east.

At the west end of the runway is an abrupt drop off to the beach, approximately 20 feet deep.

See Photos 5-E, 5-H.

The east end of the runway is interrupted by the lava flow, which abruptly rises to a height of approximately 15-20 feet. The lava is of a type known as aa, a slow-moving flow that solidifies in loose, sharp, and brittle chunks. Pockets of grass, ironwood (Casuarina sp.) trees, and fern-like plants were observed within the lava flow.

See Photos 5-L, 5-M, 5-N.

The runway is grassy, with short shrubs and ironwood trees all along the sides. The surface is irregular, with potholes and thick patches of

 grass. There is a low

berm on each side of the runway, as well as old bomb craters of varying depths, as deep as approximately 7 feet.

5.3.2 FAA Airport Master Record of TT01

Pagan Airstrip is listed by FAA as a public airport located near the village of Shomushon. FAA assigned the Location Identifier of Pagan Airstrip as TT01. The current FAA Airport Master Record (Effective Date: October 25, 2007) contains information collected during the last inspection in September 1980.

According to the FAA Airport Master Record, for a 12-month period ending September 26, 1980, Pagan Airstrip had 240 aircraft operations: 79% air taxi and 21% general aviation. Air taxi is defined as a chartered aircraft, and more broadly as a part of general aviation, which refers to all flights other than military and scheduled airline flights.

Figure 5C: Pagan Airstrip, listed as Location Identifier TT01 by FAA

The regional control facility is Honolulu Control Facility Center, and flight service station is Honolulu Flight Service Station. NOTAMs ("Notice To Airmen" aeronautical information and alerts) are provided by Honolulu Airport.

5.3.3 Non-existence of Other Facilities

The grass-covered airstrip is the only functional element of the existing Pagan Airstrip. There are no existing public utilities on the island. No terminal facilities are present at the site, nor any navigational aids, visual approach aids, runway markings, lights, windsocks, or signage. An existing trail, utilizing the old Japanese road system, is in fair condition and serves as an access road to the airstrip. Drums of fuel are stored at the edge of the airstrip.

Historical aviation facilities include old hangars, maintenance buildings, and bunkers, built by the Japanese military, of which a few remain scattered within the boundaries of the old Japanese military airport, all in deteriorated state. Remains of hardstands on both the north and south of the runway, taxiways and hangars, and ditches along the north and west that drain to cisterns in the northwest are present. Figure 5-G graphically depicts the inventory of the existing remains in the surrounding areas of the Pagan Airstrip.

FIGURE 5D: AIRPORT MASTER RECORD OF TT01 PAGAN AIRSTRIP

FAA Location Identifier

Location/Facility/Hours Ident Tie-In Fac Cntr

PAGAN AIRSTRIP ARPT, SHOMU-SHON, CQ TT01 HNL ZHN

FIGURE 5E: FAA INTERNATIONAL CIVIL AVIATION ORGANIZATION (ICAO) LOCATION IDENTIFIER: The ICAO location Identifier of Pagan Airstrip is listed by FAA NAS Aeronautical Information Management Enterprise System (NAIMES) as above. The PilotWeb site provides aeronautical information and access to current NOTAM information derived from the United States Consolidated NOTAM Office at the FAA Air Traffic Control Systems Command Center in Herndon Virginia.

(Source: FAA website)

FIGURE 5F: CRM MAP OF PAGAN AIRSTRIP (Source: CNMI Costal Resources Management)

FIGURE 5-G: DIAGRAM OF HISTORICAL REMAINS

Photo 5-B: Aerial view of runway. Numerous bomb craters remain along the side of the runway.

Photo 5-C: Aerial view of runway.

Photo 5-C: Aerial view of runway.

Photo 5-E: Runway west end looking towards northwest and Bandera Peninsula. The ground drops abruptly to the black sand beach at the west end of the runway

Photo 5-F: View of entire length of existing runway facing east, towards the lava flow.

Photo 5-G: View of entire length of existing runway looking towards west.

Photo 5-H: Bandera Peninsula and black sand beach to the west of runway. The Japanese military cut and flattened the peak of the peninsula.

Photo 5-I: Bandera Peninsula was cut and flattened by Japanese military.

Photo 5-J: Escarpment along south side of the airstrip.

Photo 5-K: Numerous bomb craters over entire airfield. Only the runway portion was restored to usable

condition.

Photo 5-L: The lava flow abruptly interrupts the runway at the west.
Photo 5-M: Lava flow covers about 3/5 of the proposed property.

Photo 5-N: The lava flow covering the runway is of a type known as aa, a slow- moving flow that solidifies in loose, sharp, and brittle chunks.
Photo 5-O: Old lava stratum is exposed at the drop off along the west edge of the runway. The lava of this stratum appears to be a different type called pahoehoe, which is smooth and liquid, which has cooled and crystallized into a solid mass.

Photo 5-P: Japanese concrete bunker near the east side of the runway.
Photo 5-Q: Japanese concrete bunker near the east side of the runway.

Photo 5-R: Japanese water tank.
Photo 5-S: Japanese airplane ruin remains at the west end of the runway. Bomb crater is visible in the foreground of this photograph.

Photo 5-T: Japanese machine gun ruin remains at north of airstrip.
Photo 5-U: Japanese zero fighter ruin remains at south of airstrip surrounded by bomb craters.

5.4 Existing Infrastructure and Limitations of Future Development

Like the rest of the Northern Islands, Pagan has received minimal infrastructure development in the last three decades. Limited infrastructure necessarily imposes a constraint on future economic development, aviation demand, and the extent to which the Pagan Airstrip and associated facilities can be developed. Future economic development for the island will depend on improvements to utilities as well as improvements to inter-island and intra-island transportation facilities.

There are no ongoing or future plans for any critical infrastructure improvements on Pagan Island. During the 5-year projected period, the CNMI government does not appear to have funds to conduct infrastructure improvements throughout the CNMI, which includes Saipan, Tinian, Rota Islands, as well as the entire Northern Islands Municipality.

The following is a summary of the existing infrastructure on Pagan:

• No potable running water. Pagan residents rely on rainwater catchments which provide water for cooking and drinking; the water must be boiled before it is consumed. Wells supply water for bathing.

• No power distribution system. For basic electricity, Pagan residents have relied on generators and solar panels installed on the roofs of their homes. The solar panels charge batteries for minimal lighting and radio communications.

• No sanitary sewer system, nor any other wastewater disposal facilities. Pagan residents rely on outdoor latrines.

• No solid waste disposal facilities. Pagan residents dispose of paper and yard wastes by burning; all other solid wastes are stored and

then removed during quarterly visits by cargo ships for eventual disposal at the Marpi Landfill on Saipan.

• No seaport or docking area for ships and boats.

• No reliable communications system.

• No healthcare facilities and public safety services.

• No public roadways and ground transportation systems. Inland roads are nonexistent and limited only to walking trails. Residents also travel by all-terrain vehicles.

Most of the existing paths and trails are remnants of the roads built by the Japanese. The roads were constructed as one-lane loose-surface grade, all-weather roads. Due to lack of maintenance, these roads have deteriorated into trails. To support economic development, there will be a need to improve the roads, including grading, compacting of the existing system, drainage improvements, and realignment.

The existing dock at Shomushon Harbor was constructed by the Japanese prior to World War II. It has since been in a state of disrepair, making it impossible for vessels other than shallow draft boats to land. Presently, vessels anchor in the deeper parts of the Harbor. There is a need to repair or reconstruct the existing dock and construct a port for future development and commercial activities to take place. Also, during tropical storms and typhoons, it will be necessary to secure vessels on land.

The proximity of the seaport and airport to one another must also be considered in the planning process. The two transportation resources could be designed to integrate their cargo/passengers to allow smooth transitions from air to sea and vice versa. Should any future planning

 for developing the harbor arise, it is may be considered in conjunction with the development of the airstrip.

Grass Runway as of today. Lava flow has cut the runway length.

Extent of the Pagan Airfield Area

FIGURE 5H: AERIAL VIEW OF PAGAN AIRSTRIP

FIGURE 5I: PARCEL SURVEY PLAT OF PAGAN AIRSTRIP

CHAPTER 6
AVIATION FORECASTS

6.1 Overview of Aviation Forecasts and Scope

Forecasts of future levels of aviation activity are used to guide airport planning and decision-making. Forecasts should be realistic, based upon the latest available data, be supported by information in the study, and provide sufficient justification for airport planning and development.

For the purposes of the Pagan Airstrip Master Plan, it was intended that only existing forecasts, if any, and past aviation activities would be used along with data gathered during public involvement interviews in order to arrive at a reasonable aviation forecast that would guide planning and development for the Pagan Airstrip. Formal forecasts utilizing complex forecasting tools and techniques, including peak period forecasts, are not deemed necessary for this master plan because of the factors that limit aviation demand and the extent to which the airport can be developed. These limiting factors include the lack of basic infrastructure on Pagan, the limited availability of land, and continued volcanic activity on Pagan Island.

6.2 Historical Aviation Data

Charter flights to Pagan and the other Northern Islands began in the late 1980s and continue today. From the 1980s to 2000, flight service to the Northern Islands was provided by one company, Macaw Helicopters. Macaw Helicopters was bought out by Americopters in

 2000, and Americopters is the only company that provides flight service to the Northern Islands today. Aviation data obtained from

Americopters thus far dates only from the year 2004 through October 2007; data prior to 2004 has not yet been located.

Though flight records prior to 2004 are not available, according to interviews with Americopters pilots, on average there have been approximately 10 trips to Pagan per year since the 1980s. Most flights to Pagan involve visits to the other Northern Islands. Most flights to Pagan are therefore by helicopter, using a Bell 206, since the other Northern Islands lack airstrips. Some flights have been made to Pagan using a Cessna Skymaster and a Cessna 172. Total passenger and cargo weight for helicopters and Cessnas is limited to 700lbs, in order to accommodate extra fuel.

Passengers traveling to Pagan and the other Northern Islands have been primarily federal and local government officials. Clients for charter flights have included federal agencies (U.S. Fish and Wildlife Service, U.S. Geological Survey), the U.S. military, the Northern Islands Mayor's Office and other local government agencies (Emergency Management Office, the Governor's Office, the Department of Public Lands, the Board of Election), Medevac patients residing in the Northern Islands, the Scripps Institute of Oceanography, and the Carnegie Institute of Washington. Nearly all flights, whether by helicopter or Cessna, have carried the maximum load of four passengers, not including the pilot.

	2004	2005	2006	2007
January	1	0	0	0
February	1	0	1	1
March	0	1	1	0
April	2	1	1	0
May	0	1	1	1
June	1	3	2	0
July	0	1	0	1
August	2	0	0	1
September	2	0	0	0
October	1	0	1	1
November	2	1	0	N/A
December	0	1	1	N/A
TOTAL	12	9	8	5

Table 6A: Number of Flights to Pagan per Month, 2004-2007
(Source: Americopters)

	2004	2005	2006	2007
Medevac	7	1	0	0
Govt- Local	2	3	3	1

Govt- Federal 2 4 5 3
Military 0 0 0 1
Other 1 1 0 0
Table 6B: Pagan Charter Flight Clientele, 2004-2007
(Source: Americopters)

ENGINEERS ENGINEERS ENGINEERS ENGINEERS • ARCHITARCHITARCHITARCHITECTSECTSECTSECTS
Corporation Corporation Corporation Corporation 2004 2005 2006 2007 Bell 206 12 6 7 4
Cessna 0 3 1 1
Table 6C: Type of Aircraft Used on Charter Flights to Pagan, 2004-2007
(Source: Americopters)

6.3 Aviation Forecasts for the Pagan Airstrip

Although it is difficult to predict future aviation demand for Pagan, it is reasonable to expect that demand will increase to two monthly flights on general aviation aircraft carrying six to eighteen passengers as well as cargo if the airstrip is restored. These flights may be increased to weekly flights after five years, if improvements in infrastructure are made and the island is effectively marketed.
(Source: NIMO, Meeting Notes #009)
Factors to explore in future studies include:
• Markets to be served by the Pagan Airstrip (i.e., tourists, residents, federal and local government);
• Potential air cargo activity to and from Pagan (i.e., local produce, fish, and other perishable goods, supplies, equipment, etc.);
• Development of pozzolan mining industry
• Category and class of aircraft; and
• Types of fuels used by aircraft.

6.4 Factors Affecting Aviation Activity

Factors presently affecting aviation activity for Pagan include the limited and transient population of Pagan, the lack of infrastructure, continued volcanic activity, the cost of travel, and the condition and short length of the Pagan Airstrip due to lava flow, which limit the types of aircraft that may enter Pagan to helicopters and small planes. Over the long term, plans to develop ecotourism and other industries on Pagan, to resettle the island and create homesteads, to establish Pagan as a transportation hub for the Northern Islands, and to develop infrastructure, including the airstrip and regular flights, are likely to increase aviation demand in the future.
Other factors to consider for future studies include:
- Economic characteristics, including national, regional, and

specific local activities that distinguish the geographic area that would be served by the Pagan Airstrip (i.e., ecotourism, mining, the U.S. military buildup in Guam and possibly the CNMI);

- Demographic factors, including leisure time, recreational activity, disposable income of the CNMI population;
- Geographic attributes, such as distances between Pagan and Saipan, the main center of commerce in the CNMI; physical characteristics of Pagan which may stimulate holiday traffic and tourism; and farming and fishing industries.
- Factors related to fuel, including price and availability.

FIGURE 7A: Cessna Skymaster used for chartered flights to Pagan by Americopters (Source: Cessna)

CHAPTER 7
FACILITY REQUIREMENTS

7.1 General

This chapter summarizes facility requirements for Pagan Airstrip based on aviation demand forecasts and other information collected, which are presented in this Master Plan.

7.2 Planning and Design Criteria

This section examines the aircraft models currently used by commercial air carriers in the Mariana Islands. General aviation activity in the CNMI includes commuter flights, international scheduled flights and charter flights. Aviation activity in Pagan has been limited to charter flights.

7.2.1 Cessna Models 336 and 337 “Skymaster”

Since prior to the eruption of Mt. Pagan in 1981 to present, Pagan has been served by only special charter flights which are the principal mode of travel to and from the island. Air taxi operations fly out of Saipan International Airport using small Cessna’s or similar aircrafts. Americopters is a Guam/Saipan-based air carrier providing commercial helicopter and airplane services. Americopters flies routinely to the Northern Islands on chartered flights and survey flights with stops at the Pagan Airstrip, using the Cessna Skymaster, a twin-engine, twin-boom, civil utility aircraft. The combination of a tractor and pusher engine is characteristic of this model. The Cessna Skymaster has short

FIGURE 7B: Piper PA-32 “Cherokee Six” used for Saipan-Tinian commuter route by Freedom Air. (Source:

Freedom Air)
FIGURE 7C: Piper “6X” is the latest updated model of the Piper PA-32 family. (Source: Piper)

takeoff and landing capabilities, with a seating capacity of five passengers including a pilot. Its high-wing design makes it suitable for surveying or sightseeing purposes. The Cessna Skymaster series was first produced in 1963 until Cessna ceased its production in 1982. [27]

7.2.2 Piper PA-32 “Cherokee Six”

For reference purposes, Freedom Air, a commuter air carrier in the Mariana Islands, will also be considered here. Presently, in addition to its Saipan-Rota-Guam route, Freedom Air provides regular commuter air transportation between Saipan and Tinian. There are 13 scheduled flights daily departing from Saipan International Airport at approximately one-hour intervals. The flight time is 10 minutes to Tinian International Airport, and after 10 minutes of ground time for passenger deplaning and enplaning, the same aircraft is bound on its return trip to Saipan. The primary aircraft used is Piper PA-32 “Cherokee Six”, of which Freedom Air possess five, since acquiring the first one in 1978. Freedom Air also possesses Cessna 172, Cessna 150, Piper Apache, Piper Aztec and Piper Navaho in its fleet for chartered flights.

The Piper Cherokee Six is a six or seven seat, single engine, tricycle gear aircraft manufactured in the US by Piper Aircraft. The Cherokee Six is commonly used for passenger and small air cargo commercial operations. The popular PA32 was reintroduced as the Piper 6X which is currently in production. [28]

The Piper Apache, Aztec and Navajo are twin engine, tricycle gear airplanes. The seating capacities are 5, 6, and 7, respectively.
FIGURE 7D: Cessna Model 172 “Skyhawk” (Source: Freedom Air)
FIGURE 7E: Cessna Model 150 (Source: Freedom Air)

Another air carrier in Tinian, Taga Air, operates chartered flights between Saipan and Tinian. Taga Air owns a fleet of four Piper PA-32-300 manufactured between 1968 to 1972, in addition to two Cessna 172.

7.2.3 Cessna Models 150 and 172

Cessna Models 150 and 172 are single-engine, high wing, tricycle gear airplanes, as listed in FAA AC 150/5300-13. Model 150 has a seating capacity of two, and Model 172 Skyhawk has a seating capacity of four,

and both are the most produced light aircrafts in aviation history since they were first introduced to the market in the mid 1950's. [27]

The light gross weight and aerodynamic rear fuselage enables the Cessna Model 150 to climb fast, have high ceilings, and require short runway length. [27]

Model 172 Skyhawk is also used as a trainer aircraft by the US Air Force and Army. The its high-wing design, stability at low airspeeds, and relatively low stall speed, makes the 172 Skyhawk suitable for search and rescue operations, and is the primary platform for the Civil Air Patrol's operations. Some aircrafts are equipped with satellite digital imaging system for aerial surveillance operations. [27] [29]

Freedom Air and Taga Air, the two air carriers providing Saipan-Tinian flights, possess these aircrafts in their fleet and utilize them for chartered flights.

FIGURE 7G: Short 360 operated by Freedom Air (Source: Freedom Air)

FIGURE 7F: Short 330 operated by Freedom Air (Source: Freedom Air)

7.2.4 Short Models 330 and 360

Freedom Air flies the Short Models 330 and 360 on its Saipan-Rota-Guam commuter flight route.

The Short 330 is a small transport aircraft with a seating capacity of 30, created by Short Brothers since the mid 1970's. These passenger aircraft were designed as short-range regional and commuter airliners, relatively inexpensive and reliable. The production ended in the early 1990's with a total of 136 being built, including freighter and military versions. [29]

The Short 360 is a similar commuter aircraft which is a 36-seat derivative of the Short 330 introduced in 1981. Several improved versions have been introduced giving a higher cruise speed. The production ceased in 1991 after 165 deliveries. [29]

Freedom Air operates two return flights daily, originating at Guam International Airport. The morning and evening flights make a brief stop at Rota International Airport both to and from Saipan International Airport.

The Short Models 330 and 360 require a runway length of 4,000 feet. For Model 360, the take-off field length at maximum take-off weight (26,000 lbs) is 4,000 feet (ISA, sea level) and 4,760 ft (ISA, +15C, sea level), and the landing field length at maximum landing weight (25,700 lbs) is 3,970 feet. It should be noted that a scenario of using such larger passenger aircraft such as these could not be justified for the aviation activities in Pagan in the projected future. [29]

Federal Air Regulations (FAR) Part 139 governs the certification and

operation of airports served by scheduled and unscheduled air carrier
 aircraft with seating capacities of more than 30 passengers. These regulations specifically address crash, fire and rescue (ARFF) facilities and operations, refueling safety, snow and ice control, wildlife hazard management, management staff qualifications, pavement maintenance, and required runway and taxiway marking, signage and lighting. The Short 300 series aircraft would require compliance to the FAR Part 139 requirements. Such extensive improvements are beyond the scope and role of Pagan Airstrip in the projected near future, and unjustifiable due to cost and practicality. Pagan Airstrip would not be designed to be used by these larger passenger aircrafts.

7.2.5 Airport Classification

For airfield design purposes, the FAA has established a set of airport classifications known as Airport Reference Codes (ARC) applicable to each airport and its individual runway and taxiway components. The primary determinants of these classifications are the most critical types of aircraft a runway is intended to serve, and the form of instrument approach, if any. Each ARC consists of two components relating to an airport's design aircraft: Aircraft Approach Category, and Airplane Design Group.

Generally, Aircraft Approach Category applies to runway and runway related facilities. Airplane Design Group primarily relates to separation criteria involving taxiways and taxilanes.

Table 7-A summarizes the FAA design standards associated with both ARC classifications potentially applicable to Pagan Airstrip.

7.2.6 Design Aircraft

The aviation activity forecast in Pagan in the near future is unlikely to exceed the current commercial aviation demand in Tinian. Therefore, the equipment currently being used to provide air taxi service between Tinian and Saipan would be adequate for the project air traffic to and from Pagan.

The majority of aircraft operations at Pagan Airfield is expected to be single-engine, or twin-engine, general aviation aircraft that fall within Aircraft Categories A and B. Most of these aircrafts have maximum take-off weights of less than 5,000 pounds.

The most demanding class of aircraft expected to regularly use Pagan

Airstrip are those in Airport Reference Code (ARC) A-I and B-I. ARC A-I include the Piper Cherokee Six, Cessna 150, and Cessna 172. Piper PA-32 Cherokee Six with a passenger seating capacity of 5, is the most commonly used commercial passenger aircraft in the Mariana Islands. Other aircrafts such as the Piper Navajo and Piper Aztec are categorized as ARC B-I.

It is anticipated that the family of aircraft anticipated to be in service during the forecast period is Approach Category B and Design Group I (small airplanes), or an ARC designation of B-I (small airplanes). This means that the airport is designed to serve aircraft that have an approach speed of 91 knots or more, but less than 121 knots. The aircraft wingspan will be limited to less than 49 feet, and aircraft weight group limited to less than 12,500 lbs.

Tables 7-B and 7-C provide comparative data for aircrafts currently in use in the Mariana Islands.

ITEM ARC A-I & B-I (small airplanes) Aircraft Approach Speed <121 kts Aircraft Wingspan < 49 ft. Aircraft Weight Group (lbs) < 12,500 Approach Visibility Minimums Visual or > 3⁄4 mile

Runway Design:

Runway Width 60 ft. Blast Pad Width 80 ft. Blast Pad Length Beyond Runway End 60 ft. Safety Area Width 120 ft. Length beyond Runway End 240 ft. Obstacle Free Zone Shape A Width (W) 250 ft. Vertical Height (H) NA Slope (S) NA Object Free Area 250 ft. Width 250 ft. Length Beyond Runway End 240 ft. Gradient (maximum) 2.0%

Runway Setbacks: From Runway Centerline to: 700 ft. Parallel Runway Centerline 125 ft. Hold Line 150 ft. Parallel Taxiway 125 ft. Aircraft Parking Line 125 ft. Building Restriction Line 370 ft. Helipad for:

Small Helicopters (<6,000lbs) 300 ft. Medium Helicopters (< 12,000 lbs) 500 ft. Heavy Helicopters (> 12,000 lbs) 700 ft.

Taxiway Design:

Width 25 ft. Safety Area Width 49 ft.

Taxiway and Taxilane Setbacks: From Taxiway Centerline to:

Parallel Taxiway/Taxilane 69 ft. Fixed or Moveable Object 45 ft. From Taxiway Centerline to: Fixed of Moveable Object 40 ft.

Runway Protection Zone:

Width at Inner End 250 ft. Width at Outer End 450 ft. Length 1,000 ft

TABLE 7A: FAA AIRPORT DESIGN STANDARDS

(Source: FAA AC 150/5300-13)

AIRCRAFT TAKE-OFF LENGTH LANDING LENGTH

Take-Off Length Max. Weight Landing Length

Piper PA-31P Navajo

Over 50’ obstacle: 2,200 ft Ground run: 1,440 ft

7,800 lbs Over 50’ obstacle: 2,700 ft

Ground run: 1,370 ft

Piper PA-32 Cherokee Six
Over 50' obstacle: 1,500 feet Ground run: 1,050 feet
3,400 lbs Over 50' obstacle: 1,000 feet
Ground run: 630 feet
Piper 6X Over 50’ obstacle: 2,028 ft
Ground run: 1,284 ft Flaps 25 deg
3,600 lbs Over 50’ obstacle: 1,822 ft
Ground run: 911 ft Flaps 40 deg
Cessna 150L Over 50' obstacle: 1,385 feet
Ground run: 735 feet
1,600 lbs Over 50' obstacle: 1,075 feet
Ground run: 445 feet
Cessna 172M Over 50' obstacle: 1,525 feet
Ground run: 865 feet
2,300 lbs Over 50' obstacle: 1,250 feet
Ground run: 520 feet
Cessna 172 Turbo Diesel
Over 50' obstacle: 1,755 feet Ground run: 840 feet
2,552 lbs Over 50' obstacle: 1,335 feet
Ground run: 575 feet
Cessna 206 Stationair
Over 50' obstacle: 1,810 feet Ground run: 910 feet
3,600lbs Over 50' obstacle: 1,395 feet
Ground run: 735 feet
Cessna 336 Skymaster
Over 50' obstacle: 1,145 feet Ground run: 790 feet
3,900 lbs Over 50' obstacle: 1,395 feet
Ground run: 575 feet
Cessna 337F Skymaster
Over 50' obstacle: 1,675 feet Ground run: 1,000 feet
4,630 lbs Over 50' obstacle: 1,650 feet
Ground run: 700 feet
Short 360-100 Over 50' obstacle:
ISA, Sea Level : 4,000 ft ISA + 15C, Sea Level : 4,760 ft
26,000 lbs Over 50' obstacle:
ISA, Sea Level : 3,970 ft

TABLE 7B: RUNWAY LENGTH REQUIREMENTS (Source: Aircraft Performance Data, Rising Up Aviation)

AIRCRAFT NUMBER OF SEATS
MAXIMUM TAKE-OFF WEIGHT
MAXIMUM LANDING WEIGHT

Piper PA-23-160 Apache 5 3,800 lb 3,800 lb
Piper PA-23-250 Aztec 6 4,800 lb 4,800 lb
Piper PA-31 Navajo 7 6,200 lb 6,200 lb
Piper PA-32 Cherokee Six 6 3,400 lb 3,400 lb

Cessna 150 2 1,600 lb 1,600 lb
Cessna 172M 4 2,300 lb 2,300 lb
Cessna 206 Stationair
6 3,600 lb 3,600 lb
Cessna 336, 337 Super Skymaster
4 4,630 lb 4,400 lb
Short 330 30 22,600 lb 22,300 lb
Short 360 36 26,453 lb 26,100 lb
TABLE 7C: AIRCRAFT WEIGHTS
(Source: FAA AC150/5300-13)

7.3 Airfield and Landside Requirements

The following presents the airfield requirements to meet projected traffic demands. The projected needs of the Pagan Airstrip would limit improvements to items that are essential to enhance the safety and operational efficiency of the critical elements. These include site improvements and clearing of obstacles, and providing adequate runway length, runway safety areas, clear approach, and navigational aids, as described below.

7.3.1 Development Concept

The initial development concept is to maintain the alignment of the existing runway and extend it by clearing out a portion of the lava that presently covers it. The predominant direction to fly into Pagan is from the west, over the water, and onto the airstrip. The existing turf runway gradually slopes upward, and then is abruptly cut off by a wall of lava that is approximately 10 to 15 feet high. This lava wall can be excavated and lava material may then be used for filling and grading. The rectangular proposed property boundary measures 8,000 feet in length and 1,000 feet in width aligned to the existing runway, making it feasible for further extensions of the runway, and expansions of landing areas, should further expansions become necessary in the future.

7.3.2 Layout

Pagan Airstrip occupies the site of the abandoned Japanese military airfield built prior to, and during, World War II, located near the isthmus between the two volcanoes that comprise Pagan Island.

The considered property boundary consists of 743,227 square meters of public land, which needs to be appropriated to the Commonwealth Ports Authority (CPA). The rectangular proposed property boundary measures 8,000 feet in length aligned to the existing runway, and 1,000 feet in width.

Corporation Corporation Corporation Corporation The airstrip layout consists of a single runway with a turf surface, and follows almost exactly the Japanese military runway. The Japanese military built the airfield on a fill. The remains of hardstands on both the north and south sides of the runway, taxiways and hangars are present to this day.

The predominant approach to the runway is over the ocean. The peak of the Bandera Peninsula to the northwest of the runway is said to have been cut and flattened by the Japanese military, but may need to be further cut for safe approach of aircraft. The west end of the airstrip is located adjacent to the lagoon and beach. It is suggested that the entire Bandera Peninsula and some real estate in the airstrip approach environ be reserved and appropriated under the control of CPA for future harbor and air transportation activities.

7.3.3 Site Improvement

Site preparation involves clearing and removing the lava. In order to extend the runway length to 3,000 feet and grading the runway protection zone of 1,000 feet in length, lava must be removed about 2,100 feet in length beyond the east edge of the existing runway.

Site improvements include removal and or trimming of trees, filing the depressions, possibly with crushed volcanic rock, and compacting the runway.

The berm on either side of the runway may have to be periodically breached in order to release stormwater, although Pagan soil is generally highly permeable.

The drop-off area on the western end of the runway, adjacent to the beach, would be stabilized with rip-rap.

7.3.4 Runway

7.3.4.1 Runway Length

The existing landing field has a single runway as listed below. This data is based on the FAA Airport Master Record, inspection date September 1980, updated October 2007.

Runway 11/29 1,500’ x 120’ Turf-gravel runway

• No lighting or approach aids

• Estimated runway pavement strength: 4,000 gross aircraft pounds based on limited use

Runway 11/29 is currently 1,500 feet long. The runway length is barely sufficient for small aircraft to land and take off due to the lava flow that abruptly cuts off the runway in the direction of travel. In order to accommodate the small aircraft commonly used for flights to Pagan, the lava flow obstruction must be removed, and the runway length extended.

The runway length requirements for an airport are based on five primary factors: airport elevation, mean maximum temperature of the hottest month, runway gradient (difference in runway elevation of each runway

end), critical aircraft type expected to use the airport, and stage length of the longest nonstop trip destination. Aircraft performance declines as each of these factors increase. For Pagan Airstrip, since the airport elevation is close to sea level, the daily maximum temperature will become the primary factor in determining runway length requirements.

Pagan Airstrip elevation is 34 feet above sea level according to the FAA Master Records. The mean maximum temperature is 85 degrees Fahrenheit. (Using these data, runway length requirements, FAA's generalized recommended runway lengths are derived as summarized in Table 7-D.)

 As shown in the same table, FAA recommends a minimum runway length of 3,000 feet for A-I/B-I aircraft (95% of fleet) using the facility. The current runway length of 1,500 feet does not meet the minimum standards given the airport elevation and mean daily maximum temperature. An extension of the runway length is possible by removing the existing lava flow located towards the east of the runway.

AIRPORT AND RUNWAY DATA:

Airport Elevation 34 feet

Mean daily maximum temperature of the hottest month 85 deg. F

RUNWAY LENGTHS RECOMMENDED FOR AIRPORT DESIGN:

Small Airplanes with Less than 10 passenger seats

95 percent of these small airplanes 3,000 feet

100 percent of these small airplanes 3,600 feet

TABLE 7D: Runway Length Requirements

(Source: FAA AC 150/5325-4B Runway Design)

7.3.4.2 Runway Width

Runway 11/29 is listed as 150 feet wide. However its actual usable width is 56 feet. This width of 150 feet exceeds the FAA standard of 60 feet for ARC B-I runways. However, the 150 feet width includes the entire grassy area. The actual proposed runway width would be designed at 60 feet, and the gross width including the object-free area on both sides of the runway would be designed at a total of 250 feet.

7.3.5 Taxiways

No taxiways will be provided. Movement of aircraft is limited to direct access into, and out from, a parking area adjacent to the runway area.

7.3.6 Parking Area

A parking area will be provided adjacent to the runway area. The size of aircrafts will be primarily limited to 6-seater small aircraft, ARC B-1.

7.3.7 Airfield Marking & Lighting

Markings on the runway would, at a minimum, be placed at the ends and sides.

Lighting will not be considered at this time. However, lighting along the runway may be provided by the air carriers in the future, as necessary.

7.3.8 Airspace and Navigational Aids

The old and currently non-functioning windsock would be replaced.

7.3.9 Terminal Building Facilities

A simple, concrete structure, open-air pavilion could be constructed in the clearing on the west end and southern side of the airstrip to provide shelter and serve as a waiting area for passengers. Temporary vehicle parking would be provided close to this pavilion.

7.3.10 Fuel Storage

A simple concrete storage building would be located adjacent to the parking area. As the airstrip would be unattended, a self-serve facility would be provided.

7.3.11 Future Airport Traffic Control Center

Airport Traffic Control Center is beyond the scope of this expansion, and not included in the Master Plan.

7.3.12 Service and Hangar Areas

Service areas may be provided adjacent to the parking area. Hangars or other service facilities are beyond the scope of this expansion, and not included in the Master Plan. However, locations for such future facilities may be designated near the parking area.

7.3.13 Boundary Fence

Fencing to keep out animals, particularly cows and goats, is optional but not a priority especially under conditions of limited funding.

7.3.14 Access Road

Road improvements should also be considered to provide access to the airstrip. The existing trails in the vicinity of the airstrip could be used as access roads, and may be regraded and compacted. Expected modes of ground transportation are jeeps and tractors, dirt bikes and ATVs, as well

as bull carts.
Future developments, such as commercial or commuter aviation, relocation plans of previous residents, or implementation of homestead programs, may demand major improvements of the road system for increased vehicular transportation, and should be planned accordingly at the time they occur.

7.3.15 Preservation of Historical Remains

Several historical remains from the Japanese military period are situated inside the proposed property boundary. These include a Zero fighter, a machine gun, an abandoned airplane, and a concrete bunker. As these historical remains are located near the perimeter of the property and do not stand in close proximity to the runway or landing areas, they do not require immediate removal. These historical elements should remain undisturbed, and would likely be a focus of visitor interest.

CHAPTER 8
ALTERNATIVES & ASSESSMENT

8.1 General

This chapter identifies and evaluates alternatives for meeting the facility requirements and future aviation demand for the Pagan airstrip described previous chapters, and makes recommendations for action based on the evaluation the environmental impact of the options.

Runway location and orientation are paramount to airport safety, efficiency, economics, and environmental impact. Environmental factors considered include the impact of proposed land use, wildlife, and historical/archeological features. Also, in FAA AC 150-5070-6B “Airport Master Plan”, it is described that planners should identify potential environmental impacts by considering the categories outlined in the aforementioned document as a guideline. The same FAA AC also states that “the evaluation of potential environmental impacts should only be done to the level necessary to evaluate and compare how each alternative would involve sensitive environmental resources”. This chapter also attempts to identify key environmental issues and considerations that address the unique setting and operating environment of the Pagan Airstrip of each alternative.

8.2 Identification and Evaluation of Options

Topographic restrictions and limited availability of flat land in Pagan restrict expansion and improvement options to the existing airstrip.

The following development alternatives have been identified and evaluated.

8.2.1 Option 1

OPTION 1: Construct a new runway in another location.

Evaluation:

Aerial surveys, topographical maps, and interviews with agencies that include the Department of Lands and Natural Resources and the Department of Public Lands, indicate that the only extensive area of flat land in the Northern Islands is found on Pagan, in the basin known as Pagan Plain, where the existing runway is located. Surveyors at the Department of Lands and Natural Resources have commented that the Pagan Plain is the only feasible location for an airstrip on Pagan as well as the rest of the Northern Islands; all other areas are too rugged or steep. (Source: Dept. of Public Lands, Meeting Notes #003)

Therefore, Option 1 will be eliminated from consideration, because it is not feasible to construct a new runway in another location on Pagan. The area where the airstrip is currently located is the only extensive area of flat land on the island, and therefore, the only feasible location for an airstrip.

8.2.1 Option 2

OPTION 2: Realign and extend the existing runway.

Evaluation:

There is room on the south of the existing airstrip and between the edge of the lava flow and the escarpment to realign the runway.

Realignment, however, is likely to affect the crosswind component. Americopters pilots have described the crosswind component for the existing alignment as “ideal” – no more than five degrees by one estimate (Source: Americopters, Meeting Notes #004). Further studies would be required in order to determine how realignment would change the crosswind factor.

In addition, realigning and extending the runway may raise concerns for the natural and cultural resources found alongside the airstrip and all the way up to the escarpment, including World War II bombers,

bunkers and other historical artifacts. Preservation of such historical features must be noted. There are several historical remains from the Japanese military period inside the tentative property line, but they are located near the perimeter of the property and do not stand in close proximity to the existing runway or landing areas. However, realigning the runway would disturb these historical artifacts. Visible historical artifacts around the airstrip is plotted and indicated on the Airport Layout Plan.

The realigned runway length would only be about the same as the existing runway, which does not meet the runway facility requirements for current or projected aviation demand. Also, the Runway Protection Zone on the eastern end of the realigned runway will be located close to the escarpment, and would limit any extensions of the runway, as the length of the realigned runway will be restricted by the escarpment of which the height is estimated around 70 to 120 feet. Although realigning the runway would require less removal of lava rock, topographic restrictions critically limit the functional requirements, future expansions, and safety of the airstrip.

For the above reasons, it is not advisable to realign the runway.

8.2.3 Option 3

OPTION 3: Maintain the alignment of the existing runway and extend it by clearing out a portion of the lava that presently covers it.

Evaluation:

According to Americopters pilots, the current alignment of the airstrip with respect to prevailing winds is close to ideal, with the greatest crosswind component estimated to be no more than five degrees. Option 3 would maintain the crosswind factor that pilots have indicated as favorable for aviation, and it would be possible to extend the runway by 1,000 feet or more by removing the lava. The excavated lava material may then be used for filling and grading.

Environmental considerations are likely to be minimal under this option because the area has already been disturbed by clearing as well as lava overflow. Few, if any, trees would have to be removed under this option. The historical remains around the runway need not be disturbed.

The rectangular tentative property boundary measures 8,000 feet in length and 1,000 feet in width aligned to the existing runway, making it feasible for further extensions of the runway and expansions of landing areas, should further expansions become necessary in the future.

This option also minimizes the impact of the project to environmental features, as well as enabling future development. The environmental impact is further discussed in Chapter 11.

8.2.4 Option 4

OPTION 4: No action

Evaluation:

No action would mean the continued deterioration of the existing Pagan Airstrip. Aviation demand is not likely to increase under this scenario, since the airstrip would limit the types of aircraft that can land and the extent to which economic activities can be expanded on Pagan and the rest of the Northern Islands. The resettlement program proposed by the Northern Islands Mayor's Office (NIMO) would be more difficult to implement as well without access to reliable air transportation for residents, investors, perishable goods and other commodities.

In NIMO's plan to foster future economic development as well as enabling the relocation of Pagan's displaced residents, the Pagan Airstrip is expected to play a critical role. The existing hazards of the runway which pose a risk for planes need to be corrected, and the airstrip developed into a safe and usable state. The runway, shortened by lava coverage, should be extended for safe landing and take-off, and the craters should be filled.

By taking no action, the airstrip will continue to deteriorate, and it is a matter of time for the runway to eventually become unusable. Option 4 does not enable future economic development in Pagan nor open up any possibilities of future activities on Pagan, as travel to Pagan will continue to be severely limited without reliable inter-island transportation. As Option 4 does not present an active solution for the development of Pagan or the airstrip, Option 4 is eliminated from consideration.

8.2.5 Environmental Impacts

In Chapter 11, Section 11.3.E, Table 11-D IMPACTS (POTENTIAL) MATRIX FOR THE FOUR PROPOSED ALTERNATIVES is included, which lists up the potential impacts on wildlife and biological resources for each of the options presented above.

8.3 Recommended Actions

8.3.1 Recommended Option

OPTION 3 is the recommended course of action. Under this option, the runway would be maintained as a grassy strip and would be extended to a total length of 3,000 feet including the safety area for aircraft, with potential for future extension of the runway.

OPTION 3 conforms to the intent of applicable FAA design standards for safety and allows for future growth beyond the planning period, and provides the best balance of planning factors and tenets. It is technically feasible considering the site constraints. It is socially and politically feasible, and satisfies projected aviation demands and user needs. As described in Chapter 11, OPTION 3 has only a slightly higher potential environmental impact than the No Action alternative.

8.3.2 Recommended Property Boundary

FAA AC 150/5300-13 Airport Design states that the Runway Protection Zone (RPZ) should be on airport property. However, such critical areas that affect the operation of the Pagan Airstrip primarily lie outside the western end of the tentative property boundary currently considered by CPA and Department of Public Lands. If the new runway is to be shifted eastward so that the west RPZ be completely inside this

 tentative property line, it would include tremendous site work just to remove the lava rock on the property and clear the land at the east end of the runway, which may amount to an additional estimated $10 million. Financial feasibility and aviation demand in the planning period do not justify it, and therefore, it is recommended that the property line be reconsidered to include all the areas on the western end of the airstrip to be appropriated for CPA and designated for use by the airstrip. Since all land in Pagan is public land, there are presently no residents or landowners, nor do any stakeholders exist, that would be affected by the appropriation of this area for CPA's use. As also summarized in Chapter 10, it is also suggested that the entire Bandera Peninsula and some real estate in the airstrip approach environ be reserved and appropriated under the control of CPA for future harbor developments. In addition, the peak of the Bandera Peninsula may need to be cut to ensure safe approach to the runway. A historical stone monument from the Japanese period is included within the RPZ but will not impact the approach of the runway. An

existing tin house of a resident stands outside the RPZ.

CHAPTER 9
AIRPORT LAYOUT PLANS

9.1 Airport Layout Plan Drawing Set

The Airport Layout Plan Drawing Set is intended to detail the recommended development by this master plan for the Pagan Airstrip. FAA has developed an Airport Reference Code (ARC) which is a coding system that relates airport design and planning standards to two components: the operational and physical characteristics of aircraft operating at an airport. The coding system was explained in Chapter 7 Facility Requirements, and as previously discussed, planning standards specified for an Airport Reference Code B-I (small airplanes) will be applied. The use of these planning standards ensures that the airport will be designed to serve the Piper PA-32 Cherokee Six, which is the most commonly used commercial passenger aircraft in the Mariana Islands, up to the Piper Navajo and Aztec models, and meet the forecasted aviation activity.

The Airport Layout Plan drawing set (5 sheets, including cover sheet) is included at the end of this section in reduced format. The full-size (24” x 36”) drawings are considered the official ALP to be approved by FAA, and a part of this Master Plan document.

For federally funded airports, all existing facilities as well as improvements shown on the ALP must conform to the FAA design standards that existed at the time of plan approval, unless specific waivers are granted. There are no deviations from FAA standards for the proposed facilities.

9.1.1 Airport Layout Plan and Data Table

FIGURE 9-2 Airport Layout Plan (ALP) is a graphical representation of the results of the studies and analysis presented in the text describing the facilities at Pagan Airstrip. The plan is designed to meet the requirements established by the Federal Aviation Administration in Advisory Circular 150/5070-6B, “Airport Master Plan”, and was developed using current FAA standards applicable to the forecast aviation activity at the airstrip. The plan depicts existing facilities and proposed developments as determined from the review of the aviation

activity forecasts, facility requirements, and alternatives analysis.
The Data Table contains basic airport and runway data.
As discussed in Chapter 8, and also summarized in Chapter 10, it is highly recommended that the tentative property line be revised. The ALP shows a Recommended Property Line which includes all airport facilities and areas designated for airport use, such as the Runway Protection Zone (RPZ), to be entirely within the airport property boundary.

9.1.2 Airport Airspace Drawing

FIGURE 9-3 Airport Airspace Drawing depicts obstacle identification surfaces for the airstrip development, contained in 14 CFR Part 77, Objects Affecting Navigable Airspace. The dimensions and criteria employed in determining these imaginary surfaces are those outlined in Federal Aviation Regulations (FAR) Part 77 Objects Affecting Navigable Airspace. These surfaces are defined for the purpose of identifying natural or man-made objects that could affect air navigation at an airport. The surfaces can be penetrated, but any penetrations must be

 reviewed by FAA to determine the possible effects on the visual approach and departure procedures.

9.1.3 Inner Portion of the Approach Surface Drawing

Figure 9-4 The Inner Portion of the Approach Surface Drawing also depicts obstacle identification surfaces for the airstrip development, contained in 14 CFR Part 77, Objects Affecting Navigable Airspace, and depicts the plan and profile view of the inner portion of the approach surface to the runway. The runway protection zone (RPZ) is the most critical safety area under the approach path and should be kept free of obstructions. No structure should be permitted nor the congregation of people allowed within the RPZ. Control of the RPZ by the airport owner is recommended. It is desirable, therefore, that CPA acquire adequate property interests in the RPZ to ensure compliance with the above.
The west RPZ for Runway 11/29 extends beyond the land over water. A historical stone monument from the Japanese period is included within the RPZ but will not impact the approach of the runway. An existing tin house of a resident stands outside the RPZ.

9.1.4 Airport Property Map

Figure 9-5 Airport Property Map depicts the tentative property boundary of the airstrip, and the recommended property boundary. The recommended property boundary completely encompasses the existing grass airstrip, as well as all areas designated for airport use. The tentative property boundary is 8,000 feet in length, of which about 1,500 feet length of wooded terrain is exposed beyond the east edge of the lava flow. As all property on Pagan is public land, this 743,227 square meters of public land needs to be appropriated to CPA.

PHOTO 9-A The RPZ extends westward above the water, including the historical stone monument from the Japanese period. The flattened peak of the Bandera Peninsula is also visible further beyond.

(INSERT FIGURES HERE) 5 SHEETS

AIP NO. : 3-69-0004-01

COMMONWEALTH PORTS AUTHORITY

COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS

SAIPAN 96950

SIGNATURES VICINITY MAP LOCATION MAP VICINITY MAP

RUNWAY DATA

TOP CLIFF LINE

AIRPORT DATA

RUNWAY END DATA

PROJECT TITLE:

PAGAN AIRSTRIP MASTER PLAN

In

Pagan, Northern Islands, CNMI

For

-FUTURE R/W END

EL. 98' (EST)

400

400

20:1_ULTIMATE APPROACH SURFACE

CONICAL SURFACE

EL. 90

-CONICAL

SURFACE

200

200

DESIGNER:

HORIZONTAL SURFACEH

20:Y ULT**IMATE APPROACH SURFACE**

-HORIZONTAL

SURFACE

FUTURE R*/W* END EL. 82' (EST)

4000 2000

10000

8000

6000

2000

4000

6000

8000

10000

12000

APPROACH PROFILE

RUNWAY 11
APPROACH PROFILE
RUNWAY 29

Engineers & Architects

Corporation

Suite 301 Bank of Hawaii Building Marina Heights **Business Park** P.O. Box 502415 Saipan, **MP 96**950–2415
Tel: (670) 322–7814 FAX: (670) 322-6044 E-mail: **efcosai**pan.com

CONSULTANT:
TRUE
MCNETIC

HORIZONTAL SCALE

2000 1000
0
2000
4000
6000

VERTICAL SCALE

HORIZONTAL SURFACE EL. 240'

7:1 TRANSITION

RUNWAY 29 EL 98' (EST.)

200
100
0
200
400
600

RUNWAY 11

EL 82' (EST.)

200 **150 100 TOU 150** -200

SEAL:

20:1 APPROACH – SURFACE
L-7:1 TRANSITION
--20:1 APPROACH
SURFAC

HORIZONTAL
SURFACE EL. 240'

THIS **WORK WAS PREPARED BY ME OR UNDER MY SUP**ERVISION

4000
4000
5000
5000
5000
4000

Symbol
Revision
Date
By

ISSUE:

DESIGNED:
APPROVED:

DRAWN:
SCALE:

AS SHOWN

AIRPORT AIRSPACE PLAN

CHECKED:
DATE:

SCALE:

1'=2000" HORIZ **1"=200* VERT**

JANUARY 2008

PROJECT NO.

NOTES:

SHEET TITLE:

AIRPORT AIRSPACE PLAN

SURFACE ELEVATION

SURFACE END OF RUNWAY 11 (FUTURE) END OF RUNWAY 29 (FUTURE) | HORIZONTAL SURFACE

CONICAL SURFACE (UPPER LIMIT) APPROACH SURFACE (11) – UPPER LIMIT APPROACH SURFACE (29) – UPPER LIMIT | TRANSITIONAL SURFACE (11) – UPPER LIMIT | TRANSITIONAL SURFACE (29) – UPPER LIMIT |

ELEV 82 98 240 440 332 348 240 240

1. ALL ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL (MSL).

F.A.R. PART 77 SURFACES SHOWN BASED ON ULTIMATE RUNWAY LENGTH OF 3,000 FEET. GROUND PROFILE REPRESENTS TERRAIN ALONG

EXTENDED RUNWAY CENTERLINE. 4. SEE INNER APPROACH SURFACE PLAN (FIGURE 9-3)

FOR CLOSE-IN OBSTRUCTIONS.

3.

DRAWING NO.:

USOS MAPS USED FOR BASE ISLAND OF PAGAN (1:25000)

FIGURE 9-2

SHEET NO.:

SHEET: –

OF

PROJECT TITLE:

PAGAN AIRSTRIP MASTER PLAN

END OF FUTURE **RPZ**

In

Pagan, Northern Islands, CNMI

For

END OF FUTURE RPZ

ROACH SU

FUTURE 20: 1 APPROACH SURFACE

20: 1 A

-

LAVA FLOW TO BE **REMOVED** TOP EL bo'-104' FUTURE R/W END EL 98' (EST)

EXISTING R/W END EL 92 (EST.

FUTURE 20: 1 APPROACH SURFACE

EXISTING FLAG POLE TO BE REMOVED TOP EL. 100' (EST)

DESIGNER:

EXISTING & FUTURE R/W END EL. 82' (EST)

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Suite 301 Bank of Hawaii Building Marina Heights **Business Park** P.O. Box 502415 Saipan, **MP 96**950–2415 **Tel: (670) 322–7814 FAX: (670) 322-6044** E-mail: **efcosai**pan.com

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INNER APPROACH SURFACE PLAN

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PAGAN AIRSTRIP MASTER PLAN

In
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COCONUT TREE
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JAPANESE AIRPLANE

AIRPLANE

BANDERA PENINSULA

MANGO TREE

Suite 301 Bank of Hawaii Building Marina Heights **Business Park** P.O. Box 502415 Saipan, **MP 96**950–2415 **Tel: (670) 322–7814 FAX: (670) 322-6044** E-mail: **efcosai**pan.com

MACHINE GUN

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CHAPTER 10
DEVELOPMENT PROGRAM & FINANCIAL PLAN

10.1 General

This chapter presents the airport development program and identifies the proposed phasing for implementation of the Master Plan recommendations. The program was designed to expand the existing runway, to improve airport safety and capacity, and to provide a planning guide for airport development.

10.2 Stages of Activity

The primary objective of the Master Plan is to present a development plan for the activation of the Pagan Airstrip to serve civil and other air transportation needs. The Master Plan attempts to establish a realistic schedule for the implementation of the proposed development, particularly focusing on the short-term capital improvement program, as it is the priority objective of CPA to reconstruct the airstrip to bring it to a safe and usable state.

The general schedule of recommended improvements is comprised of two categories: Essential Improvements and Optional Improvements. Essential Improvements includes site preparation such as the removal of the lava flow, extension of the runway, and the construction of minimal landside facilities. These improvements will bring the current runway to a safe and usable state which complies with FAA standards.

Optional Improvements include several additional enhancements which may be planned and implemented either in the immediate or future stages of airport development. Additional enhancements include a future airport traffic control center, service and hangar areas, boundary fence, lighting, access roads, as described in Chapter 7.

10.3 Summary of Developments

This phase involves the following action stages:

- survey and design
- land acquisition
- site preparation
- airport construction

10.3.1 Survey of Development

The survey and design effort must be undertaken prior to the field actions. Three types of surveys are required: 1) topographic surveys, to confirm drainage and ground slopes, and 2) soil surveys to establish the character and condition of the airfield, 3) environmental and historical surveys, necessary for permitting, to assess the impacts of construction activities, if any, and options for mitigation.

10.3.2 Land Acquisition

Land acquisition of the airport property must be accomplished. Presently, all land in Pagan is public land. It is necessary for the Department of Public Lands to appropriate the proposed property as well as airport environs that affect the safe landing and take-off of aircrafts to the control of Commonwealth Ports Authority. The western end of the airstrip is located by the lagoon, and the dropoff to the beach area needs to be stabilized with rip rap.

The Airport Layout Plan shows a tentative property boundary currently considered by CPA and Department of Public Lands. However, critical areas that affect the operation of the airport primarily lie outside the western end of the tentative property line. As discussed in Chapter 8, the recommended airport layout, shown in the Airport Layout Plan, indicates the Runway Protection Zone extending over the shoreline and body of water outside the currently considered property boundary line. Financial feasibility does not justify removing the lava to shift the runway so that all airport functions are included within the tentative property line, it is recommended that the property line be revised to include all the areas on the western end of the airstrip to be appropriated for CPA and designated for use by the airstrip.

It is also suggested that the entire Bandera Peninsula and some real estate in the airstrip approach environ be reserved and appropriated under the control of CPA for future harbor developments. In addition, the peak of the Bandera Peninsula may need to be cut to ensure safe approach to the runway.

10.3.3. Site Preparation & Airport Construction

Site preparation involves the removal of the lava flow to extend the runway by about 1,500 feet. As described in Chapter 5 Existing Conditions, the lava flow from the 1981 eruption covering the runway is of a type known as aa, a slow-moving flow that solidifies in loose, sharp, and brittle chunks. It is different from another type of lava called pahoehoe, which is smooth and liquid, and cools into a solid mass. The removal of the lava flow will be feasible by deploying heavy construction equipment, such as bulldozers.

The site preparation and construction activities are summarized below.

ESSENTIAL IMPROVEMENTS: Runway Improvements:

- Remove lava flow
- Level and finish runway and safety area
- Repair existing runway surface and drainage system
- Replace windsock
- Construct riprap along dropoff at the west end
- Remove trees within Runway Obstacle Free Zone (ROFA) and remove or trim trees outside ROFZ to provide for 7:1 transitional slope clearance.
- Install end and side runway markings
- Mobilization/Demobilization
- Engineering

Land Side Improvements:

- Terminal building pavilion
- Fuel storage facility

OPTIONAL IMPROVEMENTS:

- Boundary fence: A fence may be installed around the perimeter of the airstrip in order to keep feral animals out.
- Access road: Repairs to the existing trail may be undertaken along with future developments of Pagan Island. Long-term repairs will require reworking the shoulder and drainage ditches and culverts. Immediate repairs should be made only to seriously damaged sections of the existing trail.
- Lighting

10.3.4 Construction Cost Estimate

The estimated construction cost in Table 10-A includes the following cost considerations:

- Any construction project on Pagan would require the importation of heavy equipment, fuel, supplies, and personnel. The estimated cost of bringing in heavy equipment alone is currently

$7,200 - $8,000 per day. This estimate includes the use of a tugboat and barge carrying one (1) bulldozer; two (2)10-ton dump trucks; one (1) 10-ton roller compactor; one (1) road grader; (1) payloader and (1) excavator.

• Labor is estimated as a total of 12 workers, working 8 hours daily, for 6 days a week, for four months.

Item Total Costs 1. Clear lava flow 2,000 ft x 200 ft inclusive of safety areas, 12ft height average. $2,880,000.00 2. Level and finish runway by compacting to finish surface grade after removal of lava flow to design elevation including all safety area. $400,500.00 3. Repair of existing runway by filling low areas and compacting. $75,000.00 4. Wind sock, complete (no light) $5,000.00 5. Riprap at west end $35,000.00 6. Removal of iron wood tree $20,000.00 7. Side and end R/W marking $10,000.00 8. Mobilization/Demobilization $900,000.00 9. Engineering $587,000.00

Total cost $4,912,500.00

• TABLE 10-A: DEVELOPMENT SUMMARY AND COST ESTIMATE

10.4 Financial Plan

This section outlines the steps that need to be taken to implement the Master Plan program. It will discuss airport development revenue

 sources, the relationship between airport revenues and expenditures, airport management, and marketing of the facility.

10.4.1 User Charges

The Commonwealth Ports Authority currently charges $4.50 per passenger facility fee of which $4.39 is paid to the Commonwealth Ports Authority,

Based on the projected passenger arrival only about $1,000.00 per year is expected.

The Commonwealth Ports Authority currently charges $1.33/1,000lbs for Rota and Tinian for landing fees.

At the projected air travel of 2 flights per month for the next 5 years with each flight weighing at 1,800lbs, the expected revenue is $65.00/year.

10.4.4 Other Sources

It is clear that development of the Pagan Airfield cannot be supported by its operational revenue generations. Funding through the AIP and or local – legislation/executive branch appropriations must be sought. There are currently no definitive plans to develop new infrastructure for Pagan or in the Northern Islands. CNMI is experiencing extreme

economic difficulty making it unlikely for any funds to be made available, specifically, for the improvement to the Pagan Airstrip. Nonetheless, the Mayor of the Northern Islands is pursuing obtaining allocation on future CIP and other fundings for the improvement work. FAA funding is expected to be the primary resource for developing and maintain the Pagan Airstrip. However, there is no certainty of funds actually becoming available.

It is highly unlikely that private funds can be identified. It is also highly unlikely that a bond could be floated specifically for the development of the Pagan Airfield as the expected operational revenue is not adequate.

There may be grants that the Mayor of the Northern Islands together with the Commonwealth Ports Authority may be able to secure under an economic development scenario.

10.4.5 Projected Airport Revenue and Expenditures

The ideal and ultimate goal of any airport should be the capability of supporting its own operation and development through airport user fees. Unfortunately, very few general aviation airports do this. Oftentimes, the high cost of maintaining the airports cannot be met by the revenue received from user fees, which are set at reasonable rates to the users. Yet, these airports continue to be subsidized because the communities recognize their value and necessity to the area.

Revenues:

As shown in section under 10.4.1 the projected revenue cannot support the development of the Pagan Airfield.

Funding for its improvement and operation needs to come from other sources.

However, it is noted that the island of Pagan has potential for tourism, fishing and agricultural production. These industries cannot be realized, however, unless transportation to and from Pagan is improved.

It is noted that the islands of Tinian and Rota, called the First and Second Senatorial Districts, respectively, have each dedicated a certain amount of their funds towards specific development projects at each of their respective airports. The Northern Islands fall under the Third Senatorial District along with the island of Saipan, and there may be local funds available to support the development of the Pagan airstrip.

Operating expenses:
For the most part, operating expenses at general aviation airports fall into four main categories: administration, maintenance, utilities, and supplies and miscellaneous. There will be no staff employed at Pagan Airstrip. Utilities such gas, electricity and lighting, sewage treatment, and phones will not be provided. Supplies for day-to-day operation at the airstrip will not be needed. Therefore, the primary category of operating expenses for the airstrip will be the maintenance of the runway and related equipment, such as mowing and runway markings and visual aids, as well as the upkeep of airport-owned facilities such as the terminal building.
The expense to maintain the airfield is nominal. Maintenance can perhaps be performed as a community effort as was done by the residents of Pagan in the 1960s.

CHAPTER 11
BIOLOGICAL RECOURCES

11.1 Vegetation and Habitat Resources

A. Overview of Pagan's Vegetation

The pictures to the left of the narrative are a pictorial view of the runway on Pagan. They are not specifically referenced in the narrative.

The most recent and best general overview of vegetation in the Northern Islands can be found in Mueller-Dombois and Fosberg (1998). Their extensive literature review brings the current understanding of the Northern Islands vegetation into focus and rather than attempting to paraphrase the information, the following description of each islands' vegetation was taken directly from Mueller-Dombois and Fosberg (1998):

"Pagan is the largest of the Northern Mariana Islands, with an area of 48 km^2. The island has the form of a panhandle and is composed of two high, volcanic centers connected by a wide, low isthmus. The more northern of these, Mt. Pagan, 570 meters in elevation, was active not long before 1950, and minor activity, such as warm springs and emissions of steam and hot gases, could still be observed in 1950. The topography then was very diverse, much of it steep and rough.

The surface was made up of relatively fresh lava flows
and beds of ash and coarser pyroclastic material. Photo 11-A: Pagan Airfield in the background looking west.
Slightly elevated reef limestone of limited extent was
found on the eastern and northern coasts.
 Plant collections have been made on Pagan by Marche, Kanehira, Hosokawa, Anderson, Bonham, Fosberg, Moore, and Raulerson. A catalogue of the vascular flora has been prepared on the basis of these by Fosberg (1958). A small fossil flora has also been found and was reported by Fosberg and Corwin (1958). The geology was thoroughly studied in 1954 by Corwin et al. (1957). Notes on the vegetation were made in connection with the geological study by Bonham. Fosberg was able to make records and photographs during a short stop in 1950. After Fosberg's (1958) report, a destructive eruption took place (1980). The vegetation of Pagan in 1950 gave a general impression of semiaridity; indeed, large areas would be classed physiognomically as deserts. This is probably not so much a reflection of climatic dryness as of the extreme porous substrates and of the pioneer nature of the vegetation occupying the surfaces of recent volcanic ejecta. In the very few low, wet areas, such as to the west and south-west of the Freshwater Lake, or Inner Lake, there were luxurious thickets of broad-leafed trees; in places bordering the lake, the conditions were somewhat marshy. Luxuriant patches of woods also occurred in hanging valleys on the west side of the south end of the island. A mixed-scrub forest of low stature formed thickets and patches up to several hectares in extent on the plains north and south of Mt. Pagan, in places extending up the lower slopes of the volcano. Scrub forest also occurred on steep slopes on the west shore of the isthmus and in the numerous ravines throughout the island. It varies in height from 3 to 8 meters and in density from open parkland to dense, tangled thicket. The understory was sparse, but in denser areas, the low, tangled branches of the trees seriously obstructed movement. The effects of the 1980 eruptions on this vegetation are not yet on record, but Ohba (1994) reports that the extensive 1980 lava field and ash deposits are still devoid of almost any vegetation.
 The loose volcanic ash that covered large areas,

especially on the western side, was vegetated largely by an almost pure stand of Miscanthus floridulus. This formed a coarse, harsh, blade like grassland 1 to 3 meters in height and very dense in places. On the steepest slopes and above 250 meters in elevation, this grass tended to be shorter, and the clumps more widely spaced. Above 450 m it was sparse to absent.

Lava flows may be virtually bare, as on the northeast side of Mt. Pagan. But they can support scattered clumps of Miscanthus and trees of Casuarina, as on the eastern and southeastern sides of Mt. Pagan and the central upland of the southern part of the island. As on many of the flows and lava cliffs, they can even be covered by almost pure forests of Casuarina. Casuarina and the fern Nephrolepis hirsutula are among the earliest invaders on new lava. These two species were found well established on a fresh, black `a`ã flow in the depression at the western base of Mt. Pagan in 1950. This flow has been dated by Tanaka- date (1940) as having occurred in 1925. In 1950 it showed no sign of visible weathering.

Photo 11-B: Towards the left of photo is lava flow across runway.

On plains of ash soil, the vegetation is generally grassland with scattered trees or clumps of trees. The trees may be Pandanus tectorius, Casuarina equisetifolia, or any of a number of broad-leafed species. Many of these areas were under cultivation before WW II but were weedy in 1950; they had rows of Casuarina and other trees planted by the Japanese as windbreaks. Jatropha gossypifolia, a fleshy-stemmed shrub introduced by the Japanese in the late 1930's, had spread, and it dominated large areas in the central part of the island.

Clumps of trees of various kinds marked the sites of houses. On the gently sloping north-western part of the island was a large coconut plantation. Smaller ones were located in many parts of the island, both on plains and on talus cones. Coconut trees were also common in ravine mouths and on steep slopes near the sea. The large plantations were of relatively recent dates, but there was no way of knowing the ages of the smaller clumps of coconuts that were mixed with other vegetation in various parts of the island. Some may very well have dated from pre-European times.

A small, slightly raised coral reef on the east coast was the only known

locality on the island for Pemphis acidula, Capparis cordifolia, and several other plants of rough limestone habitats. However, Pemphis-Capparis scrub may also occur on similar reefs on the north end of the island.

The vegetation on steep slopes, rough ground, and relatively fresh lava was little disturbed by human activities. The sword grass has been burned over large areas, but such burning does not seem to be much of a deterrent to Miscanthus. In favorable places the grass, after being burned in 1954, grew to waist height within six weeks. Such burning, however, tends to eliminate associated species and keeps Casuarina from gaining a foothold. As noted above, the area of more gentle ash slopes, plains, and talus cones has been very much altered by humans. The cultivated areas were abandoned after WWII and allowed to grow into weed fields. Some of these were gradually reoccupied up to the time of the 1980 eruption. The coconut plantations had changed little before the eruption, except they had become choked with weeds and young coconut seedlings.

The above account was mostly written before the 1980 eruption. Since that time, there have been few species additions. Large tracts of

vegetation were completely eliminated in 1980 by lava and ash blanket deposits.

Ohba (1994) essentially confirms the picture of devastation with no revegetation since the 1980 eruption, noting Casuarina forest as the most predominate vegetation in the northern part of Mt. Pagan. Ohba adds that the relatively old central volcanoes, with more weathered surfaces, support Pandanus tectorius stands and, above 150 m elevation, an impoverished Elaeocarpus joga forest, which has been degraded by goats. The more severe degradation state is said to be Miscanthus grass cover. On the southern volcano there are remnants of native forest

Photo 11-C: The runway from the western approach.

where the endemic tree genus Guamia was originally found. This species, G. mariannae, is now considered extinct on Pagan due to goat grazing."

The proposed site for the airport runway and support facilities contains no substantial areas of valuable wildlife habitat as the runway has remained "active" since the Japanese era. Over time, it appears that ironwood trees (Casuarina equisetifolia) and coconut palms (Cocos

nuciferus) have encroached toward the runway, however not to the extent where it has jeopardized landings or takeoffs by the aircraft currently frequenting Pagan. Invasion of the runway area by new vegetative growth has likely been minimized by the grazing of a high feral animal population (cattle, goats and pigs) and the manual hand clearing of larger shrubs by island visitors or temporary residents.

B. Jurisdictional Wetlands Under The Clean Water Act

For this discussion, wetlands are considered special aquatic inland habitats as defined by the U.S. Army Corps of Engineers Clean Water

 Act section 404 regulatory program. Wetlands are defined by the Clean Water Act as:

"Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas." (33CFR 328.3).

Within the CNMI, "jurisdictional" wetlands occur primarily on the southern islands of Rota, Tinian and Saipan. With respect to the Northern Islands, only Pagan has inland surface water bodies and due to their “isolated” status, it is not clear whether these lakes would fall under Clean Water Act jurisdiction. Coordination with the U.S. Army Corps of Engineers should occur prior to any work in the immediate vicinity of these lakes. With respect to the general area of the runway there are no jurisdiction wetlands present.

11.2 Invasive Species

Though the actual count is unknown, the number of non-indigenous wildlife and plant species in the CNMI are numerous. However not all exotics become invasive species. For the purposes of this report, an invasive species will be defined as “a species that is 1) non-native (or alien) to the ecosystem under consideration and 2) whose introduction causes or is likely to cause economic or environmental harm or harm to human health (Executive Order 13112).” As can be seen, there is much latitude in determining what defines an invasive species when the criteria includes futuristic and conditional terms such as “is likely”. Identifying invasive species in the CNMI will be based partially on best judgment, historical documentation and current situations and will certainly be open to criticism. Unfortunately, only time will tell

 whether certain species now considered as "harmless" exotics in the CNMI will actually evolve into invasive species.

Most regulatory programs addressing exotic introductions or invasive species issues are managed by the Federal Government. The CNMI Government has not passed legislation addressing invasive species. One of the earliest attempts (1977) to address the problem was Executive Order 11987, which directed Federal agencies and encouraged states, to restrict exotic species introductions into natural ecosystems. In 1990, congress passed the Non-indigenous Aquatic Nuisance Prevention and Control Act (NANPCA) or the "Zebra Mussel Act". Six years later, NANPCA was re-authorized and amended by the National invasive Species Act of 1996. This act directed federal agencies to address introductions and infestations of exotic species. More recently, the US Coast Guard promulgated voluntary guidelines for ballast water management in order to decrease the spread of alien marine species introductions within US waters.

Most of the invasive species found in the CNMI are primarily associated with terrestrial environments and include both plant and animal species. The most invasive species on Saipan and Tinian would likely be the tangantangan tree (Lucaena leucocephalus). Tangantangan was introduced after Saipan was taken by the U.S. military during World War II as an erosion preventative measure. This was necessary due to the denuding of large areas of vegetated habitat, much of it sugar cane fields, during military actions. A shrubby legume, this species is fast growing and provides good

Photo 11-D: View of western end of runway.

ground cover. Because Saipan was intensely seeded, a