Federated States of Micronesia

Department of Transportation,
Communication and Infrastructure

Chuuk International Airport

FINAL Master Plan

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CHUUK

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PLANNING ARCHITECTURE ENGINEERING INTERIORS

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FIGURES

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ACRONYMS

ACHP	Advisory Council on Historic Preservation
AFIS	Aeronautical/Aerodrome Flight Information Service
AGL	Above Ground Level
AIP	Airport Improvement Program
ALP	Airport Layout Plan
AMP	Airport Master Plan
AOA	Airport Operation Area
ARC	Airport Reference Code
ARFF	Aircraft Rescue and Fire Fighting
ARP	Airport Reference Point
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CIP	Capital Improvement Program
CTAF	Common Traffic Advisory Frequency
DME	Distance Measuring Equipment
DOI	United States Department of Interior
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EMAS	Engineered Materials Arresting System
ESA	Endangered Species Act
FAA	United States Federal Aviation Administration
FAR	Federal Aviation Regulations
FSM	Federated States of Micronesia
ICAO	International Civil Aviation Organization
IFR	Instrument Flight Rule
MIRL	Medium Intensity Runway Lights
MTOW	Maximum Takeoff Design Weight
NAVAIDS	Navigational Aids
NDB	Non-directional Beacon
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NOAA	National Oceanic and Atmospheric Association
NPIAS	National Plan of Integrated Airport Systems
NRHP	National Register of Historic Places
OFA	Object Free Area

OC	Obstruction Survey
PCI	Pavement Condition Index
PAPI	Precision Approach Path Indicator
PCC	Portland Cement Concrete
PVC	Poor Visibility and Ceiling
REILs	Runway End Identifier Lights
ROM	Rough Order of Magnitude
RPZ	Runway Protection Zone
RSA	Runway Safety Area
SOE	State Owned Enterprise
SHPO	State Historic Preservation Officer
TKK	Chuuk International Airport
USDA	United States Department of Agriculture
VASI	Visual Approach Slope Indicator
VFR	Visual Flight Rule
VISAIDS	Visual Aids
VOR	Omnidirectional Range

CHAPTER 1: INTRODUCTION

1.1 PURPOSE OF THE MASTER PLAN

The Federated States of Micronesia (FSM) initiated this study in order to develop a Chuuk (Truk) International Airport Master Plan and to identify needed improvements to the airfield and terminal facilities. These facility improvements are in response to future growth in aviation activities and expected growth of tourism affecting Chuuk.

The Master Plan establishes a developmental approach to respond to current conditions and includes appropriate conceptual and schematic plans to assist the Federated States of Micronesia (FSM) with initiating and carrying out technically sound programs for the short and long term development of Chuuk International Airport. Principal planning considerations are:

- To enhance the safety of aircraft operations
- To be reflective of community and regional goals, needs, and plans
- To ensure that future development is environmentally compatible
- To establish a schedule of development priorities and a program to meet the needs of the proposed improvements in the master plan
- To develop a plan that is responsive to air transportation demands
- To develop an orderly plan for use of the airport
- To coordinate this master plan with local, regional, state, and federal agencies
- To develop active and productive public involvement throughout the planning process.

1.2 SCOPE OF THE MASTER PLAN

The airport master plan can be thought of as a flight map into the future. The FAA methodology will be followed for the core elements of the master plan, as this has been a reliable method to identify existing and forecasted conditions, and to identify the various facility upgrades that will be needed to address the specific needs of the airport. In addition to a map, the master plan can be used, successfully, as a funding document. In other words, funding agencies, whether they be government, commercial, private, etc. tend to require that the projects they are being asked to fund be studied, planned, etc., and approved by an official, responsible authority. Thus, the master plan, when done well and approved by the FAA, can additionally serve the airport by providing formal justification to various funding agencies and can facilitate the funding of the important capital improvements called for in the document.

1.3 SCOPE OF PROJECT WORK – CORE ELEMENTS

The following tasks represent the core elements of the master plan. These are the typical elements called for in all FAA funded master plans and master plan updates:

1.3.1 Existing Conditions/Inventory

This inventory is a collection and assessment of all relevant information, historical and current, to form the factual baseline for an informed judgment about the airport and its environment and to evaluate existing facilities and equipment.

1.3.2 Aviation Forecasts

Utilizing the most current information available, a reasonable aviation forecast will be developed for the planning horizon time period (twenty years) with milestones at five and ten years. The bases of forecasts will be customized to reflect the unique nature of the FSM's projected growth rather than the population/business growth oriented model usually used for mainland US airports. FAA approval for this unique modeling/forecasting effort will be obtained.

1.3.3 Airport Operations

Aviation forecasts for Chuuk will consider numerous factors, and ultimately will be primarily expressed in passenger counts to the island. Once the forecasting methodology and anticipated rates of growth have been reviewed and approved by the FSM and FAA, this data needs to be converted into peak hour demand in order for the FAA formulae to be used accurately for the purpose of determining capacity of airside, landside and terminal facilities. Converting forecast data into peak hour operations will involve estimates of airline aircraft mix both current and future. Discussions will be held with the various airlines to arrive at the best estimate going forward regarding their future aircraft mix.

1.3.4 Demand/Capacity Analysis

This is a key element of the master plan process. Essentially, existing and anticipated levels of activity (demand) will be assessed in light of the facility's ability to handle (their capacity) the demand. Three separate analyses will be done:

- Airside demand/capacity

- Landside/access demand capacity
- Terminal facility demand capacity

These analyses are useful tools that give an indication of which facilities will need upgrading to serve the level of activity, and when those facilities need to come on line.

FAA has mathematical models and formulae to guide the efforts for airside capacity and terminal capacity. The landside demand/capacity analysis is less well defined, but this will be supplemented with accepted standards for roadway/access capacity, etc. to provide an accurate overall picture of the airport's needs, now and future.

In addition, there will be a discussion of the potential feasibility of lengthening the existing runway at the airport.

1.3.5 Land Use Planning

Review of present airport land use, identification of airport property, and alternate development schemes for aviation related developments on and near airport property will be done within this task. Holding "think-tank" sessions with airport officials and stakeholders will be encouraged to get the best conceptual ideas going forward.

1.3.6 Utilities

Existing utilities serving the airport will be inventoried and an overall utility plan will be developed for planning purposes. Needs for future upgrades will be identified for all appropriate utilities. Fuel farms and fuel distribution networks to apron areas will be included in this effort.

1.3.7 Environmental Impact

For the various land use ideas and for various facility upgrades, environmental impacts will be discussed and rough mitigation guidelines provided to ensure development goes forward in an environmentally responsible manner.

1.3.8 Capital Improvement Program/Facility Requirements Plan

A plan, in spreadsheet format, will be developed to provide a comprehensive plan over the twenty-year planning horizon, with milestones at five and ten years. This will indicate the suggested capital improvements, and when they are anticipated. Rough Order of Magnitude (ROM) budget estimates will be provided for each suggested capital improvement project.

1.3.9 Airport Layout Plan Drawing Set

The Airport Layout Plan (ALP) will be expanded to illustrate existing and future developments. The new FAA criteria for ALPs will be followed, and the various airspace drawings required per the FAA advisory circulars will be provided here.

1.4 FEDERAL AND LOCAL APPROVAL

The preparation of this plan is based upon guidelines established by the U.S. Department of Transportation, FAA Advisory Circular AC150/5070, Airport Master Plans. Preparation of airport layout plans and identification of significant planning data were guided by FAA Advisory Circular AC150/5360-9, Planning and Design of Airport Terminal Facilities at Non-hub Locations.

The work for this Master Plan is supported by AIP Grant Project No.3-64-0000-01 and the Federated States of Micronesia in accordance with the terms and conditions of a Grant Agreement under the Airport and Airway Improvement Act as amended by the Airport and Airways Safety Expansion Act of 1987, and the regulations of the FAA.

CHAPTER 2: EXISTING CONDITIONS

2.1 GENERAL BACKGROUND

This project is located at Chuuk (formerly Truk) International Airport (TKK). The airport is situated on the Island of Weno (formerly Moen), which houses the capital of the State of Chuuk. Weno is also the largest city in the Federated States of Micronesia. The FSM is a sovereign nation in free association with the United States. The islands of the Federated States of Micronesia are located about 2500 miles southwest of Hawaii, which are approximately three-quarters of the way to Indonesia.

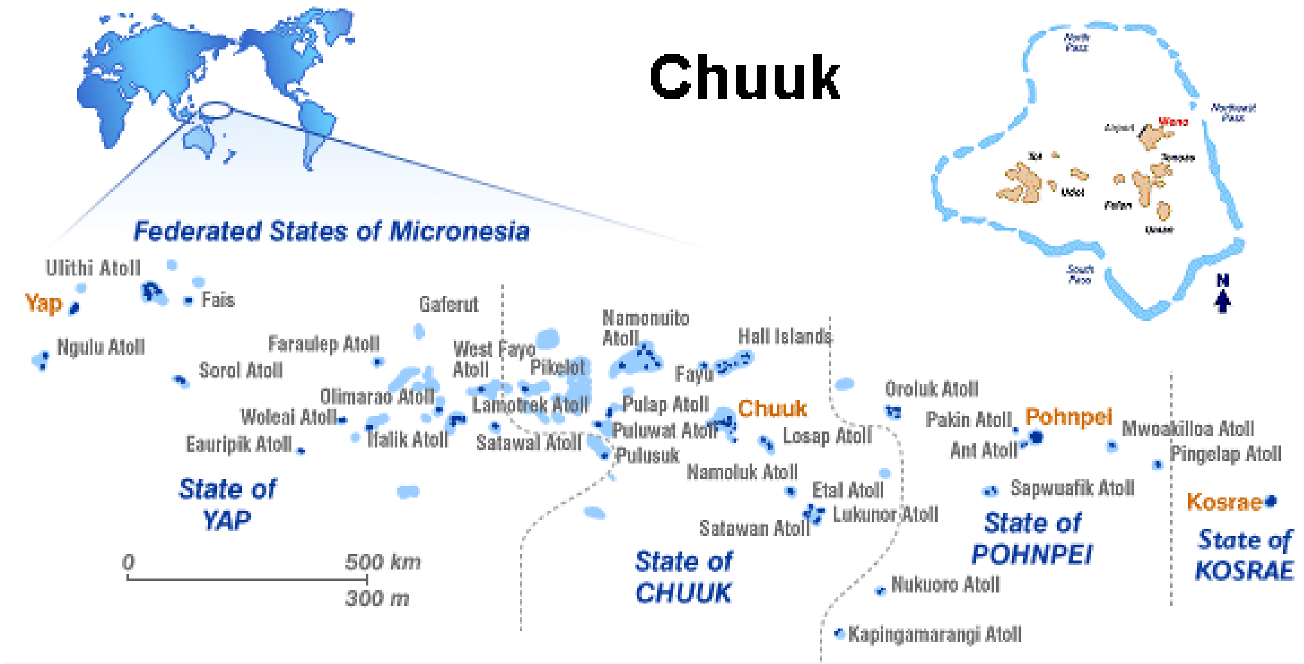


Figure 2-1. Map of the Federated States of Micronesia

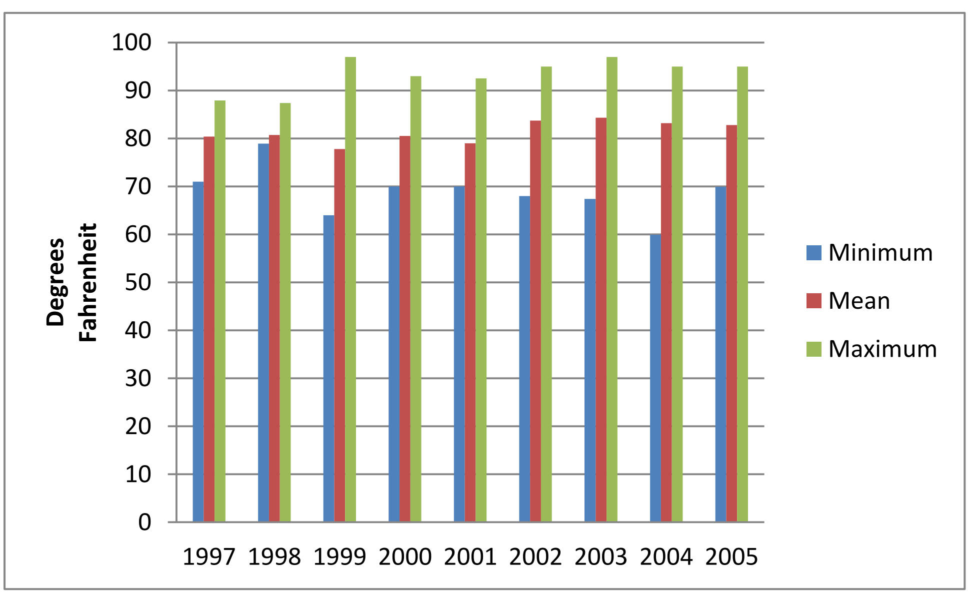
Chuuk has the second largest area of all the island groupings with a total land area of 49.2 square miles. There are seven major island groupings in the State of Chuuk. Chuuk is known for its famous lagoon with its underwater fleet of over 60 Japanese ships that were sunk in the lagoon during World War II. The lagoon was declared a national monument by the United States.

Figure 2-2. Map of Chuuk – Truk Lagoon

2.1.1 Climate and Wind Conditions

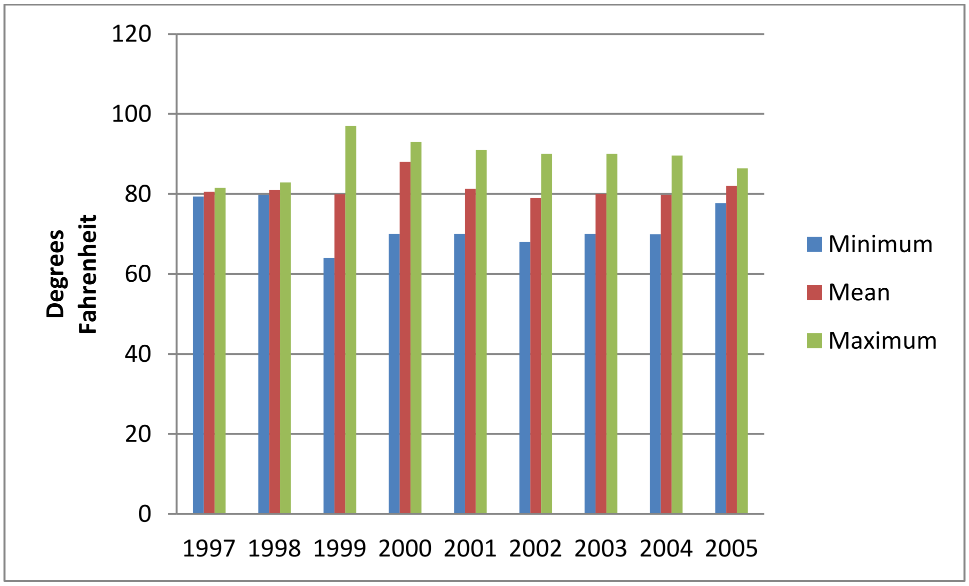
Chuuk, like all the other states in the Federated States of Micronesia, has a pleasant tropical climate. Chuuk has both a dry season and a wet season. The dry season typically occurs between December and April, and the wet season usually spans from April to December. The rainiest season is from mid-summer to mid-fall. The north-eastern trade winds occur from November to June. Because of Chuuk's location, it is prone to typhoons. Typhoons sometimes form east of the State of Chuuk and move in a westerly direction, exposing both Chuuk and Yap to the path of destruction.

Table 2-1. FSM Temperature



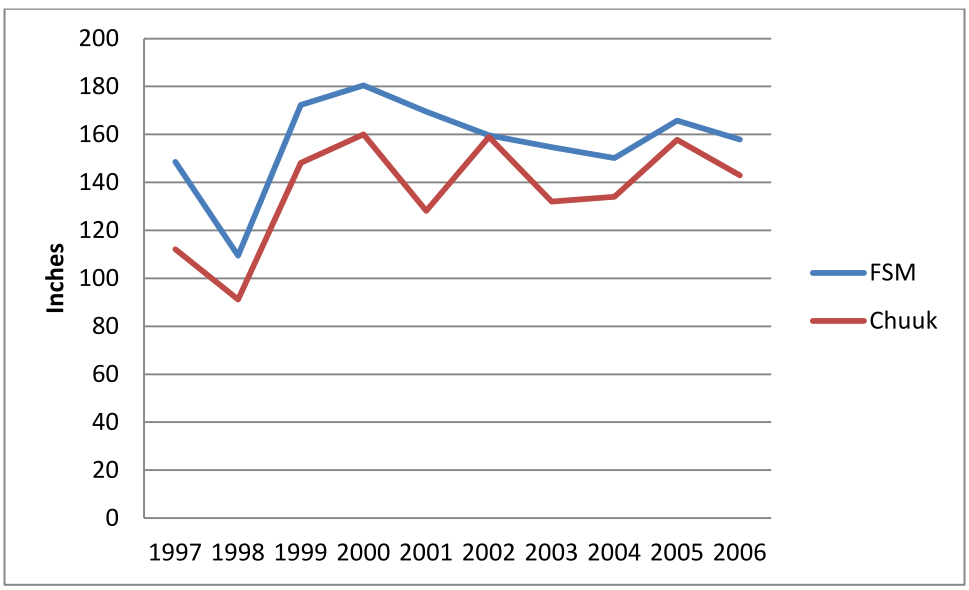
Source: FSM Office of Statistics. 2008

Table 2-2. Chuuk Temperature



Source: FSM Office of Statistics, 2008

Table 2-3. Average Rainfall



Source: FSM Office of Statistics, 2008

2.1.2 Land Formation and Topography

Chuuk consists of the higher volcanic islands inside Chuuk Lagoon, and the lower, smaller coral atolls and islands outside the Lagoon. The high islands in the Chuuk Lagoon were formed mainly of extrusive volcanic rocks, the most common being basalts and basaltic. Atolls outside Chuuk

Lagoon are typically circular reefs of organic limestone that are partly, intermittently, or completely covered by water. The bases of the reefs and lagoons rest on volcanic mountains which are usually submerged several thousand feet below sea level. The airport is built on top of coral fill over the existing reef.

2.1.3 Socio-Economic Conditions

a) Population:

Chuuk is the most populous of the FSM states with a population of 53,826 (2005 census estimate). The population of Chuuk State increased from 31,596 in 1973 to 53,319 in 1994 and to 53,595 persons in 2000. Between 1994 and 2000, the population grew by only about 0.1 percent per year. This is much less than the growth rates of over 3% in the 70s and early 80s as well as the rate of 2.3% between the previous two census years (1989 and 1994). In the last census period (2000), the population of Weno decreased from 16,121 to 14,722, i.e., a decrease of close to 9%. This population decrease is the result of emigration, primarily to Guam, Hawaii, and other parts of the U.S. Among the reasons for this exodus is the limited opportunity for employment in Chuuk.

According to the 2000 census, Chuuk has the highest population density in the FSM with 1,089 persons per square mile. The population of Chuuk is young, with 40.1% of the population under the age of 15 and 61.7% of the population under the age of 25. The median age in Chuuk is 18.9 years of age.

b) Local Economy:

The islands of Chuuk are fringed with mangroves that support an abundant and diverse marine life. The fertile high islands contain native trees and plants including breadfruit, coconuts, mango, banana, and taro that, in association with fish, have supported a subsistence lifestyle for the Chuukese for many years.

Economic development in FSM is constrained by its remote and dispersed island geography and fragile environment. Chuuk State continues to be fiscally challenged, and as of 2007, it has accumulated a State debt in excess of $40 million. As a result, Chuuk is heavily dependent on funding provided by the United States under the terms of the Compact of Free Association and other external aid.

2.1.4 Land Ownership

Most land and aquatic areas are privately owned and acquired through inheritance, gift or, recently, by purchase. The Chuukese value land not just for its economic value, but also for the social status and political power derived from land ownership. In Chuuk, only two percent of the land is publicly owned, however, competition for land has become acute, as increasing numbers of outer-islanders migrate to the capital of Weno for socio-economic and educational purposes.

Due to fractional ownership by families, or clans, and the uncertainty of boundaries and titles, landownership is often disputed and difficult to establish. Additionally, leasing land is equally difficult as all owners tend to assert interest in a specific parcel of land.

The land at Chuuk airport was purchased about four years ago and is considered to be state property.

2.2 EXISTING LAND USE

All land located on airport property is used for airport operations. The property was purchased by the state government about four years ago. The airport is surrounded by the lagoon on the west, east, and north sides. The land surrounding TKK is classified as urban mixed use and is fully developed.

2.3 CHUUK INTERNATIONAL AIRPORT (TKK)

Chuuk International Airport is located on a northwestern strip of the Island of Weno, just north of Mt. Tanaachau in Iras. TKK is owned and operated by the Chuuk State Government as a Division of the State Department of Transportation and Public Works. The airport is at an elevation of 10 feet mean sea level (MSL). The airport reference point (ARP) is N07°27.71’, E151°50.58’. The entire airfield was constructed on existing coral fill over the reef and extensions into relatively deeper water between 1978 and 1982. It was designed with a paved runway together with connecting taxiway to the terminal apron to be used for commercial service operations. Beyond the end of the runway the existing lagoon surface is over 100 feet deep at the northeast corner and over 40 feet deep in places off the west end.

2.3.1 Critical Design Aircraft

The design aircraft for Chuuk International Airport is the Boeing 737-800 series aircraft. It is currently the only scheduled commercial service aircraft flying into Chuuk.

2.3.2 Airport Reference Code

The airport reference code (ARC) is a system established by the FAA to relate airport design criteria to the operational and physical characteristics of the aircraft currently operating and/or forecast to operate at the airport. The ARC has two components relating to the airport design aircraft. The first component, depicted by a letter, is the aircraft approach category and correlates to the aircraft approach speed (an operational characteristic). The second component, depicted by a Roman numeral, is the aircraft design group and relates to aircraft wingspan and tail height (physical characteristics). Generally, aircraft approach speed applies to runways and runway facilities and aircraft wingspan or tail height applies to taxiway and taxi lane separation criteria. The existing ARC for Chuuk International Airport is D-III. The Airport Reference code is discussed in greater detail in Chapter 5 - Facility Requirements.

2.3.3 Runway

Chuuk International Airport has a single runway, 4-22. The runway is 6006 feet long and 150 feet wide. The runway is paved with asphaltic concrete (A/C), grooved, and currently in serviceable condition. There are retaining walls located off the ends of each runway to protect it from erosion. The runway has a weight bearing capacity of 118,000 pounds for single wheel aircraft, and 176,000 pounds for duel-wheel aircraft. Chuuk International Airport has a flexible PCN value of 62/F/C/X/T and a rigid PCN value of 64/R/B/X/T.

2.3.4 Taxiway

There is a stub taxiway that leads from the runway to the apron area. It is 90 feet wide, and located toward the western end of the runway. The taxiway leads south to the terminal apron.

2.3.5 Apron

There is one aircraft parking apron located in the front of the terminal departure area. The length of the existing bituminous paved apron is 512 feet and parallel to the runway centerline, and the width is 250 feet and parallel to the taxiway centerline. There are two Portland Cement Concrete (PCC) hardstands within the apron. The hardstands are 105 feet long parallel to the runway centerline and 105 feet wide parallel to the taxiway centerline. A fuel hydrant with an underground pipe is installed in both hardstands.

2.3.6 Airport Lighting, Visual Navigation Aids

The runway uses Medium Intensity Runway Lights (MIRL); the runway is labeled with precision markings and each end of the runway is equipped with runway end identifier lights (REILs). For approach purposes, the runway also has a Precision Approach Path Indicator (PAPI) at each end. There is also a non-directional beacon (NDB) for navigational purposes located slightly southeast of the approach end of Runway 4, which will be moved near the new ARFF facility once it is completed. Chuuk is an uncontrolled airport with no air traffic control tower. Runway lighting can be activated by the pilot via the CTAF frequency. The airport is furnished with a lighted rotating beacon that flashes green and white to indicate that TKK is a land airport.

2.4 AIRCRAFT OPERATIONS

a) Scheduled Air Carriers

Continental Micronesia provides air service for Chuuk's main island of Weno utilizing a Boeing 737-800 aircraft. Chuuk is serviced via Continental's "island hopper" flight that flies between Guam, Micronesia, Majuro and Honolulu. This "island hopper" lands in Chuuk three times per week from each direction (total of six times per week). In addition to Continental's "island hopper" route, there is further service between Guam and Chuuk one extra day, allowing Chuuk to be serviced once a day every day of the week. See Table 2-4 through Table 2-7 for Flight Timetables.

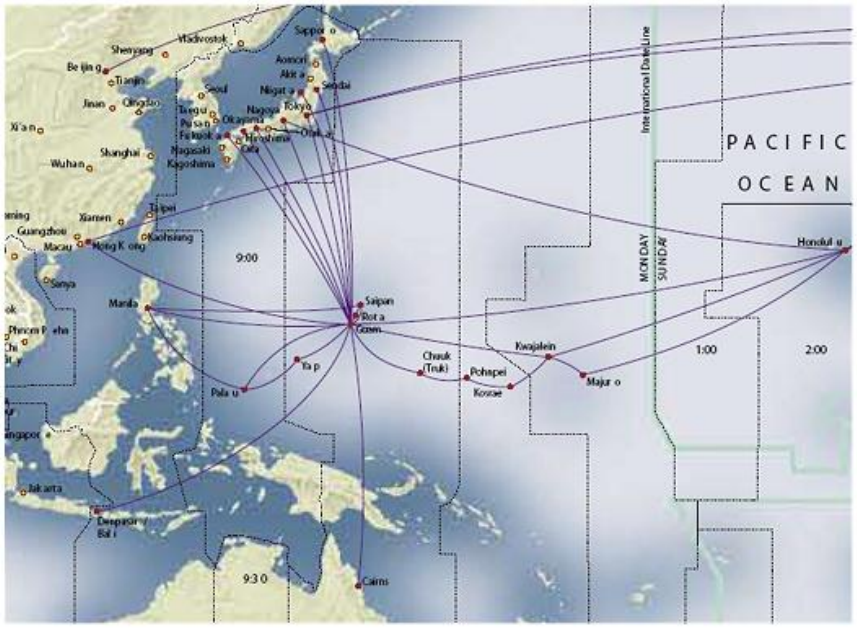


Figure 2-3. Continental Micronesia Route Map

Table 2-4. Continental Timetable

Flight Number	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
956	A 10:00am		A 10:00am		A10:00am		
	D10:45am		D10:45am		D10:45am		
957		A 3:11pm		A 3:11pm		A 3:11pm	
		D 3:50pm		D 3:50pm		D 3:50pm	
958							A9:30pm
							D10:15pm
959	A 1:40am						
	D2:25am						

b) Commuter Airlines:

The only commuter airline flying to Chuuk is Caroline Islands Airlines (CIA). CIA went out of business in the summer of 2008, but has since returned, operating infrequently. CIA had once a week round trip flights between Houk (in Pattiw) and Weno, Onoun (in Namonweito) and Weno, and Ta (in the Mortlocks) and Weno. The flight to and from Ta originates in Pohnpei, so it is possible to fly between Chuuk and Pohnpei by means of two different airlines. The CIA aircraft was a small, propeller driven (approximately 10 seats, depending on configuration) plane that was comparatively slow.

c) Cargo Carriers:

Continental Micronesia is the main cargo carrier that services Chuuk and all of its flights are scheduled to transport cargo to and from Chuuk. In the past, Asia Pacific Airlines occasionally provided air freight services to Chuuk on an as-needed/on-demand basis, but has not flown into TKK in several years.

d) General Aviation and Business Jets:

General Aviation at Chuuk International Airport represents a small percentage of the overall aviation activity and there are presently no single-engine aircraft based at the airport. If and when these activities occur, they originate principally from single engine aircraft based in Guam.

e) Other Services Including Military Operations:

Chuuk International Airport is also without other services, such as aircraft flight schools or helicopter sight-seeing services. Although previously there were military operations at the airport, there have been no military operations using Chuuk International Airport for the past few years.

2.5 AVIATION RELATED FACILITIES

2.5.1 Passenger Terminal

The Chuuk International Airport terminal is located to the south of the runway close to the approach end of Runway 4. The terminal was renovated approximately 5 years ago and the design, construction, and funding was all provided by the Chinese government. The terminal is a two story building with airport operations on the first floor and airport management on the second floor. The terminal is divided into two sections with departures on the east end of the building and arrivals on the west end. The Terminal is approximately 22,000 square feet.

2.5.2 Aircraft Rescue and Fire Fighting (ARFF) Facility

Currently there is no ARFF facility at Chuuk International Airport. Construction of a new ARFF facility has started on the west side of the airport property next to the terminal building and is expected to be completed by the spring of 2011. The fire rescue vehicles are housed in a temporary ARFF structure.

2.5.3 Fuel Farm

The aircraft are serviced by an underground fuel system consisting of pipes, valves and hydrants. There is one fuel hydrant in each of the two Portland Cement Concrete parking aprons. There is a fuel storage area with tanks, processing facilities and pumps located off the southeast corner of the apron. The Micronesian petroleum corporation maintains this facility.

2.5.4 Parking

Parking for the TKK is located directly outside the terminal building. There are approximately 40 stalls with the two closest stalls reserved for government officials. The parking area is used by both the public and airport employees.

2.6 EXISTING UTILITIES

2.6.1 Water Supply

Water supply services on Weno Island and the airport are provided by the Chuuk Public Utilities Corporation (CPUC), a State-owned enterprise (SOE) of the Chuuk State Government. The public's water supply is inadequate in terms of both quantity and quality. In almost all cases the water in Chuuk is undrinkable.

2.6.2 Sewer System

The urban areas on Weno and the airport are connected to a sewer system which is run by CPUC. Outside the urban centers, the population relies on water catchments or wells and different forms of septic tank systems. Standard water and dry composting toilets are used, particularly in remote villages and outer islands.

2.6.3 Electrical Power

Chuuk Public Utilities Corporation (CPUC) is a government-owned corporation that provides power to Chuuk International Airport. The power generation system on Weno is on the verge of collapse. Rolling blackouts on half of the island of Weno occur daily in addition to island-wide blackouts when CPUC does not have funds to purchase diesel fuel to operate the generators.

2.6.4 Communications

FSM Telecommunications Corporation is the only telecommunication company that services all of the states of the FSM with telephone, internet, and cable TV. TKK main terminal has telephone and internet provided by the FSM Telecommunications Corp.

2.6.5 Roadways

In Chuuk, as in most small island states--even on the high islands--most of the settlement and infrastructure is concentrated on the narrow coastal plains. There is one main roadway on the island of Weno, which circles the island and leads directly to the airport. The roadway surface has completely deteriorated and is almost impossible to navigate. The U.S. Department of Interior is providing funds for road improvements.

Chuuk International Airport is located just north of the main road of Weno. The road runs along the perimeter of the island. Because of the airport’s location, there is access from both directions. The main road feeds into the parking and terminal area. Construction is underway on a concrete service road located within the AOA area and adjacent to the airfield security fence.

CHAPTER 3: AVIATION FORECAST

3.1 INTRODUCTION

This chapter describes the objectives, methodology, and preliminary findings of future aviation demands at Chuuk International Airport.

3.2 OBJECTIVES

The Master Plan sets forth the short, intermediate and long-range (5-, 10-, and 20-year) development plans for Chuuk International Airport. A primary objective of the Master Plan is to identify the present and future need for a full range of facilities to serve anticipated air carrier, commuter and general aviation demand. To achieve this objective, an aviation forecast has been developed to identify the magnitude of potential future civil aircraft operations. Aggregated demand of commercial aviation activity, including aircraft mix, enplaned passengers, and type of flight operations are of specific interest in this chapter.

This forecast identifies the various drivers of Chuuk's economy and evaluates the potential for major economic growth. The validity of this forecast is dependent upon properly identifying the various drivers to the economy and their relative weight upon the overall forecast. Typically, for a US mainland airport, the significant variables in the determination of demand are population, employment and income of the community being served, as well as the potential for business development. However, in a unique case such as Chuuk's, the traditional determinants of demand may be of lesser significance in comparison to tourism, Chuuk's primary driver of growth.

A reasonable forecast of aviation activity is essential in determining future aviation facilities needs. Forecasts of commercial airline passengers are the basis for sizing and phasing of airside, landside and terminal facilities. The adequacy of existing airfield facilities is assessed using the number and types of current and projected aircraft activity. The adequacy of both air and landside facilities is influenced by the estimated level of activities at peak arrival and departure periods. For example, this level of detail is helpful specifically when evaluating the size of terminal hold-rooms needed to meet future demand.

The validity of any forecast may be affected by numerous variables and is dependent upon the uncertainty of future events. As such, the potential of demand forecasts is dependent on some known and some unforeseeable factors, and these forecasts become more speculative as one looks further into the future. It may be reasonable to predict as much as three to five years out with a relatively high level of confidence, but with less confidence for projections beyond five years, particularly in an air travel and tourism industry subject dynamic fluctuations.

In some instances, it is appropriate to present three different growth scenarios for aviation activity: a constrained (low), base, and an optimized (high) case. It is the former constrained case which is anticipated. The research that has been done to develop this aviation forecast for Chuuk International Airport indicates that only two cases are needed because the constrained case would have no effect on any variation in future airport development, therefore only a base and optimized case are presented.

3.2.1 Base Case

The assumptions made for this “base case” forecasting is summarized as follows:

- That the current rate of tourism will stay constant or increase slightly
- That Chuuk will sustain its current level of airport operations
- The domestic economies of the United States and Japan, specifically, and the global economy, generally, will stabilize
- Chuuk’s basic infrastructure and internet service island-wide will be continually upgraded
- Violence will lessen, providing a safe atmosphere for visitors
- Efforts to beautify urban areas of Weno will continue

3.2.2 Optimized Case

The assumptions made for this “base case” forecasting is summarized as follows:

- That tourism from Guam based military personnel on rest and recreation tours will increase and remain steady
- Employment opportunities for Chuukese on Guam due to US military buildup will increase
- Chuuk’s basic infrastructure and internet service island-wide will be continually upgraded
- Public safety will increase, providing a safe atmosphere for visitors
- Efforts to beautify urban areas of Weno will continue
- Dive operations and sites in Chuuk will be promoted internationally
- Live-aboard dive operations will be developed

3.3 METHODOLOGY

Forecasting for a typical system or master plan for a business-oriented US mainland airport is based on economic growth factors, population growth, income, employment, domestic and business oriented enplanements and international travel. However, these forecasting tools, which include those published in the applicable FAA Advisory Circulars, do not apply all that well to the FSM. The Federated States of Micronesia has a unique passenger and travel profile. The factors that affect the FSM economic growth are based more on travel and tourism. Therefore, the economic forecast and growth trends for the Master Plan are weighted more toward tourism, travel, and the world events and natural disasters that drive these factors.

3.3.1 Forecast Resources

Several sources served as bases for the evaluation of future demand:

- FSM Division of Statistics, 2008 Yearbook
- 2000 FSM Census Report
- Continental Airlines
- Interview with Chuuk Airport Manager
- Interview with Chuuk International Airport Staff
- FAA Terminal Area Forecast
- International Visitor Arrivals Report for October 2007 to December 2008
- 2005 Household and Income Survey Report, FSM Census Report
- Asian Development Bank - Asian Development Outlook 2009: Rebalancing Asia's Growth
- Asian Development Bank - Country Operations Business Plan Federated States of Micronesia 2007–2009
- United States of America, Department of the Interior - Insular Areas Energy Assessment Report 2006

3.4 COMMERCIAL AVIATION TRENDS

Commercial aviation into Chuuk over the last nine years has decreased by 36%, with a loss of 129 flights from 1997 (360 flights) to 2005 (231 flights). The Federated States of Micronesia continues to be serviced by only one major carrier: Continental Micronesia. Continental Micronesia has flights from Guam through Chuuk going to Hawaii on Mondays, Wednesdays and Fridays. Continental also has flights from Hawaii to Guam through Chuuk on Tuesdays, Thursdays and Saturdays. There is also a turn-around flight from Guam to Chuuk and on to Pohnpei on Sunday evenings.

Continental Micronesia currently uses a Boeing 737-800 series aircraft. This is the only regularly scheduled aircraft flying in to TKK.

3.5 CORPORATE, COMMUTER, MILITARY AND GENERAL AVIATION TRENDS

The only commuter airline flying to Chuuk is Caroline Islands Airlines (CIA). CIA went out of business in the summer of 2008, but has since returned, operating infrequently. CIA had once a week round trip flights between Houk (in Pattiw) and Weno, Onoun (in Namonweito) and Weno, and Ta (in the Mortlocks) and Weno. The flight to and from Ta originates in Pohnpei, so it is possible to fly between Chuuk and Pohnpei by means of two different airlines. The CIA aircraft was a small, (approximately 10 seats, depending on configuration) propeller driven plane that was comparatively slow.

Continental Micronesia is the main cargo carrier that services Chuuk and all of its flights are scheduled to transport cargo to and from Chuuk. In the past, Asia Pacific Airlines occasionally provided air freight services to Chuuk on an as-needed/on-demand basis, but has not flown into TKK in several years.

Historically, general aviation at Chuuk International Airport represents a small percentage of the overall aviation activity and there are presently no single-engine aircraft based at the airport. If and when these activities occur, they originate principally from single engine aircraft based in Guam. There has been no general aviation activity at TKK in the past several years.

3.6 FOREIGN TOURISM TRENDS

Between 1999 and 2008, Chuuk has averaged 4,970 tourists and visitors a year. The visitor and tourism industry in Chuuk is steadily recovering from a low of 3,092 visitors in 2001, most likely caused by the events of September 11, 2001. Since then the number of visitors has increased every year with a high of 6,339 visitors in 2008.

Table 3-1. Tourism and Visitors by Region of Citizenship to Chuuk: 1999 to 2008

Tourism& Visitors Only	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
* International & Interstate Visitor Arrivals	4,109	6,116	3,092	4,810	4,234	4,990	4,884	4,984	6,140	6,339
Australia	125	223	114	152	199	374	447	441	510	1,734
Canada	45	57	53	82	63	40	76	58	153	203
China	125	212	9	33	24	46	23	24	34	20
Europe	497	465	291	416	447	393	523	492	940	772
Japan	889	2,379	766	1,645	976	1,574	928	1,137	1,744	1,082
New Zealand	33	12	9	24	43	38	46	35	38	124
Other Asia	144	209	128	124	209	221	252	159	291	198
Pacific Islands	69	79	87	131	113	137	174	158	133	115
Philippines	139	192	98	78	77	73	92	76	70	43
USA	2,017	2,250	1,524	2,108	2,068	2,081	2,297	2,391	2,202	2,001

Source: International Visitor Arrivals Report for 1999 to December 2008

*Note: Columns do not sum to the total due to the inclusions of not stated cases in the total.

The majority of visitors to Chuuk over the years have predominantly come from the United States and Japan. Between 1999 and 2007, nearly 50 percent of the total travelers have come from the U.S. But in 2008, while the number of American traveling to Chuuk stayed consistent (2,000 visitors), the number of visitors from Australia more than tripled from 2007 (510) to 2008 (1,734). This upward trend in the number of visitors from Australia is continuing.

Visitors and tourists are drawn to Chuuk for the unique diving opportunities it offers. While its volcanic origins have brought about an abundance of marine life and fauna to Chuuk Lagoon, what really elevates it from other average dive sites are the 48 shipwrecks which are scattered across the seabed of the lagoon. These shipwrecks are a result of a fierce battle Operation Hailstone, which took place during the Second World War in February 1944. During this two day battle, the US Naval forces launched a major assault on the Japanese Fleet which had made its base in Chuuk Lagoon, and by the end of the assault, three cruisers, six destroyers, three other warships and over 30 merchant ships had been sunk. Theses wrecks are all protected from deep sea currents by a reef system that has kept them in pristine condition. Chuuk Lagoon is arguably one of the finest locations for scuba diving to be found anywhere in the world.

The United States Military is closing its bases in Japan with the plan of relocating some 8,500 Marines and 3,000 Air Force personnel to Guam. Along with the military personnel, it is expected that some 35,000 dependents will accompany the servicemen to Guam. The transition of military personnel is expected to be complete by 2014. The relocation to Guam is expected to increase the total population of Guam by 46,000 people.

With Chuuk being only 633 miles or 550 Nautical miles from Guam, there is an opportunity to attract new visitors to Chuuk. While the number of visitors per year is limited by the number of flights to Weno, the opportunity offered by Chuuk Lagoon and its historical significance, especially military importance, should attract more visitors as the redeployment of US military troops to Guam is finalized.

Hindering the growth of tourism and the visitor industry is the reliance on a single carrier operating high priced flights in a remote geographical location. A coach ticket on Continental Airlines from the United States (Los Angeles, California) is currently anywhere from two to four thousand dollars. The same ticket to Chuuk leaving from Tokyo, Japan costs between one thousand four hundred to two thousand dollars. With Japan and the United States being the two largest groups of visitors to the State of Chuuk, prices like these have a direct impact on their ability to attract visitors.

Table 3-2. Cost of Airfare to Chuuk

Flights	Price (US Dollars)
Los Angles, California (LAX) to Chuuk (TKK)	$2,405 to $5,560
Tokyo, Japan (NRT) to Chuuk (TKK)	$1,084-3,283 to $6,993
Honolulu, Hawaii (HNL) to Chuuk (TKK)	$1,805 to $2,800
Chuuk (TKK) to Pohnpei (PNI)	$583 to $600
Chuuk (TKK) to Guam (GUM)	$727 to $800

Note: Fares taken from Continental.com + Kayak December 2010

These prices make it difficult to promote tourism in Chuuk, considering that with more than 63 percent of income-earners reported income of less than $1,000 in the 2000 census. These prices also affect domestic travel: a ticket to Pohnpei (the capital of the FSM and closest island) costs $567 according to Continental's web site. With the migration of Chuukese to the United States and Guam, the number of people wishing to return home for visits or wanting to leave Chuuk to visit family members is rising, but these numbers are not reflected in passenger counts because the cost of airfare is out of the reach of the average Chuukese.

Many of the hotels and other facilities in Chuuk offer a standard of accommodation that is unattractive to international travelers. Chuuk lacks the infrastructure and amenities to attract the average vacationer looking for relaxation. While these factors do hinder tourism, Chuuk does offer a unique opportunity to divers. Its lagoon is home to approximately 100 sunken Japanese vessels and planes from World War II. It can also attract eco-tourism, offering an untouched environment to those looking for it.

3.7 SOCIO-ECONOMIC REVIEW

The propensity to travel, by air or any other transportation mode generally correlates closely with three principal statistically significant variables – population, employment, and income. An evaluation of the forecast population and income of Chuuk's residents can help establish trends useful in the forecasting of commercial and general aviation activity.

3.7.1 Local Demographic Characteristics

a) Population:

Historically, Chuuk's population has continued to remain the most consistent of all the states in the Federated States of Micronesia. The population of Chuuk has remained approximately 50 percent of the total population of the FSM.

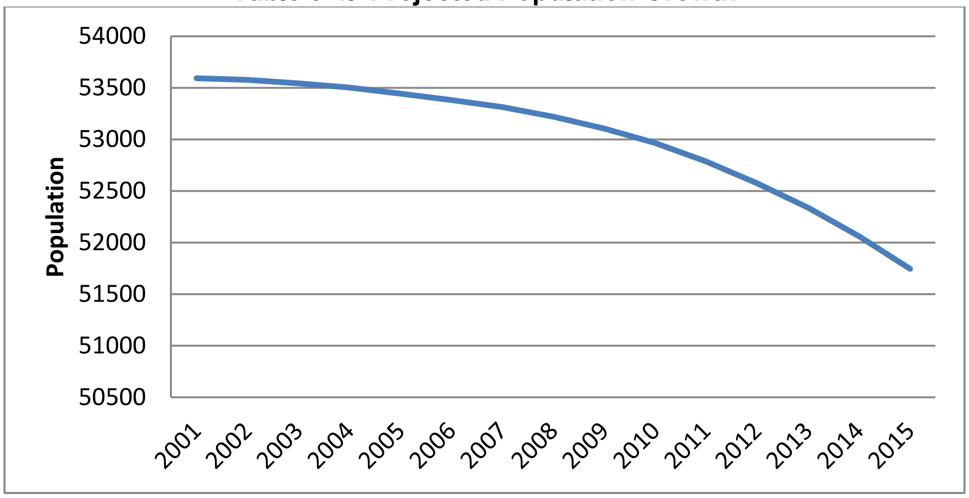
Table 3-3. Population of Chuuk Distribution: 1930 to 2008

State	1930	1958	1967	1973	1980	1989	1994	2000	2008 projected
Total	29,727	39,284	50,172	62,731	73,159	95,551	105,506	107,008	108,100
Yap	6,486	5,540	6,761	7,870	8,099	10,431	11,178	11,241	11,700
Chuuk	15,200	20,124	25,107	31,609	37,488	47,616	53,319	53,595	53,300
Pohnpei	7,051	11,253	15,044	19,263	22,081	30,669	33,692	34,486	34,900
Kosrae	990	2,367	3,260	3,989	5,491	6,835	7,317	7,686	8,200

FSM Office of Statistics, 2008

However, over the years Chuuk's population had been growing at a rate of approximately 2.4 percent, between 1994 and the year 2000, the population grew only by 0.1 percent. The 2008 projection shows that the population in Chuuk has begun to decrease. In 2000 the population was 53,595; the 2008 population is projected to be around 53,300, i.e., a loss of 295 people during these eight years. This decline in population, while minimal, shows a trend that is expected to continue. The FSM Office of Statistics projects the total population of Chuuk to be around 51,744 in the year 2015, a decrease of 2.7% from the year 2008.

Table 3-4. Projected Population Growth



FSM Office of Statistics, 2008

The majority of the decline in population reflects outward migration to neighboring U.S. territories, Hawaii, and the U.S mainland under the migration provisions of the Compact which allows citizens of the FSM to travel freely and work in the U.S. without a visa. As the money allotted by the Compact decreases annually, Chuukese will continue their migration to seek employment opportunities and better rates of pay in the U.S. and in Guam, resulting in continued negative rates of population growth.

b) <u>Employment</u>:

According to the 2000 census there were 31,587 persons aged 15 and older available for the work force. Of those available to work, there were 18,192 in the work force, with 11,979 employed and 6,213 unemployed. Of those employed, 4,546 were in formal employment and 7,433 were in subsistence farming or fishing jobs. There were 13,395 people over the age of 15 that were not available for the work force for various reasons. The number of persons and percentage of the work force in subsistence farming and fishing has increased substantially during the last ten years. The percentage of unemployed has also increased. These employment numbers do not take into consideration the large number of Chuuk citizens that have immigrated to Guam, Saipan, Hawaii and the U.S. mainland since the 2000 census.

Lack of employment opportunities is the main reason for the reduction in population. In an attempt to reduce the state's debt, the government (the largest employer in Chuuk) has been downsizing. Employees who have not lost their jobs have had their hours decreased from an 80-hour pay period, down to a 64-hour pay period. In the last ten years employment growth rate is down -4.5 percent, -3.7 percent by the government alone. (See Table s 3 – 5 and 3 - 15).

Table 3-5. Employment Growth Rates by Sector

	Government	Private	Total
FY 1995 - FY 2007	-3.70%	-0.80%	-4.50%

FSM Office of Statistics, 2008

With strict laws limiting the ability to develop the private sector, there has also been negative growth in that area of -0.8 percent.

c) Income:

Government employment is the largest source of income in Chuuk. Commercial fishing provides the biggest export commodity. Tourism is a major source of revenue with the World War II shipwrecks the most important tourist attraction.

Chuuk's minimum wage in the public sector is currently $1.25 per hour. There is no set minimum wage for the private sector. The average annual income for Chuuk has increased slightly from $5,443 in1994 to $6,195 in 2000. Low-wage earners increased significantly from 1994 to 2000. More than 63 percent of income-earners reported income of less than $1,000 in the 2000 census. For the previous census, it had been slightly over 50 percent. Income for three-quarters of wage earners in Chuuk was less than $2,000 in 2000.

In 2004, the average wage of those employed in the formal employment sector in Chuuk was $4,912 per year. Persons employed in the private sector had an average wage of $3,105 per year whereas those in public sector enterprises such as utilities and telecommunications, etc. had an average wage of $8,979. State government wages averaged $6,468; Municipal government $4,354; other government agencies $5,744; and non-profit organizations $2,937. (Source: 2006 DOI Energy Assessment)

The large number of low-income wage earners indicates that the resident population of Chuuk will not be able to contribute to any major growth in air traffic. Almost all growth must come from the tourism industry.

3.8 HISTORICAL AVIATION ACTIVITY

3.8.1 Aircraft Operations

With no fixed base operators or general aviation based at Chuuk International Airport, it is safe to assume that the number of departures will match the number of arrivals. Tables 3-9 and 3-10 below show the number of operations by aircraft at TKK. Since 2000, arrivals of commercial aircraft have remained fairly steady, while all other types of aircraft arrivals have declined. The average number of commercial aircraft operations (departures) over the nine-year period is approximately 426.6 flights per year, but has remained constant at 416 flights per year over the past two years. The highest number of commercial aircraft to arrive over the nine-year period was 459 aircraft in 2003.

Table 3-6. Continental Airlines Aircraft Operations 2000-2008

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008
Arrival	414	420	408	459	452	436	419	417	416
Departure	412	420	410	459	452	436	419	416	416

Source: Continental Airlines

Freighter, military, private, and other classifications of aircraft have almost completely diminished after the year 2001. In 2005, there was only one private aircraft arrival, while all the other classifications had no arrivals.

Table 3-7. Non Commercial Aircraft Operations

Year	1998	1999	2000	2001	2002	2003	2004	2005
Freighter	19	14	27	50	30	42	16	0
Military	17	21	11	28	35	5	0	0
Private	6	13	14	5	7	9	4	1
Other	0	1	2	2	0	1	1	0
Total	**42**	**49**	**54**	**85**	**72**	**57**	**21**	**1**

Source: 2008 FSM Statistical Yearbook

3.8.2 Based Aircraft and Aircraft Mix

There are no based aircraft at Chuuk International Airport. The only type of aircraft currently operating in Chuuk on a regular schedule is Continental Micronesia's Boeing 737-800 series. The only other aircraft reported to use the airport, according to the airport manager, is Caroline Island Air which flies a small 10-seat commuter aircraft.

3.8.3 Enplaned Passengers

With only one commercial carrier in Chuuk, the total number of enplaned passengers is obtained from the Continental Micronesia flight. Table 3-8 below shows the number of enplaned passengers departing from TKK.

Table 3-8. Enplaned Passengers per Year 2000 to 2008

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008
Departures	20,772	20,061	20,061	20,061	20,061	20,061	20,061	20,061	20,061

Source: Continental Airlines

The number of passengers departing Chuuk has averaged 20,140 passengers per year over a nine year period. Since 2001, according to the data provided by Continental Airlines, the number of passengers departing Chuuk is exactly the same at 20,061 passengers per year. Table 3-9 below shows departing passenger data provided by the airport manager at Chuuk International Airport for 2005 through 2008.

Table 3-9. Enplaned Passengers per Year 2005-2008

Year	2005	2006	2007	2008
Departures	15,622	13,187	19,776	17,281

Source: Chuuk International Airport

These annual passenger numbers provided by the airport manger are significantly lower than the ones provided by Continental Airlines. It is unclear why there is such a difference between the data, but for forecasting purposes the numbers provided by Continental Airlines will be used.

3.8.4 Aircraft Load Factors

Aircraft load factors essentially equate to the average number of passengers per flight. To arrive at a realistic ratio of numbers of passengers per flight, we will need to derive a correlation between aircraft departures and the number of departing passengers, using historic data for visitor/transit passengers, as well as historic data for the number of aircraft departures.

Continental Airlines uses a Boeing 737-800 series aircraft which has a total capacity of 155 passengers. There are 14 First/Business Class seats and 141 economy seats. With Chuuk International Airport being just one of four stops on Continental's "island hopper flight," not all of the 155 seats final destination is Chuuk.

Table 3-10. Average Number of Passengers per Flight Departing Chuuk: 2000 to 2008

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008
Flights	412	420	410	459	452	436	419	416	415
Departures	20,772	20,061	20,061	20,061	20,061	20,061	20,061	20,061	20,061
Average*	50	48	49	44	44	46	48	48	48

Source: Continental Airlines
*Average number was rounded to the closest whole number

Over the past ten years the average passenger per flight has been 47 passengers. Over the past three years (2006-2008) there has been an average of 48 passengers per flight. Overall the number of passengers has stayed pretty consistent, fluctuating only two to three people per year.

3.8.5 Air Cargo

The air freight data from a ten year time span shows that the average amount of air freight brought into Chuuk is approximately 250 tons per year. The most inbound air freight was recorded at approximately 566 tons in 2007, while the least amount was 29 tons in 1998. Over the ten year period between 1998 and 2008 the inbound cargo to Chuuk increased by 1950 percent. Outbound air freight has been significantly less over the years. The average outbound freight over the ten year span was approximately 590 tons per year.

Table 3-11. Inbound and Outbound Airfreight by Tonnage (000) Chuuk: 1998 to 2007

Year	Inbound	Outbound	Difference
1998	29	459	-429
1999	36	573	-537
2000	235	512	-277
2001	234	714	-291
2002*	250	725	-475
2003*	209	626	-417
2004*	306	597	-291
2005*	310	572	-262
2006	320	528	-208
2007	566	597	-31

Source: FSM Office of Statistics, 2008
Note: 2002 to 2005 do not include airmail

3.9 AVIATION FORECAST

Using demographic indicators of population, employment and income, the data shows that Chuuk is losing population, and its unemployment rate is increasing. The unemployment rate will continue to increase as a result of the state government reducing personnel in an attempt to reduce the government's budget as it is currently over 40 million dollars in debt. These combined factors indicate that there will be no internal growth in the area of aviation.

Expansion of the aviation industry into TKK from outside the FSM would depend heavily on the tourism industry. Over the past decade there has been a slow and steady growth in the industry. Its position as one of the world's best dive locations ensures that Chuuk will be able to attract dive enthusiasts. Historically the majority of visitors to Chuuk originated from Japan and the United States, over the past decade there has been an increase in visitors from Australia. It is important for Chuuk to maintain this increase, continuing to attract visitors from a third region. An area of travel that does have a potential for growth is former residents who've migrated to the U.S. or Guam returning home to visit family and friends, and family leaving Chuuk to visit loved ones who have moved outside the FSM.

Perhaps the greatest impact on aviation growth will be the US military buildup on Guam, adding an additional 45,000 people to the western pacific, and the world class wreck diving offered in Truk Lagoon. It is assumed that soldiers and their families will take advantage of Chuuk's close geographic location for R and R. This hypothesis is based on the principle that Chuuk State will continue to upgrade their basic infrastructure and be able to provide service men and women a safe environment in which to vacation. With Palau and Yap also offering unique vacation opportunities, the failure to address these significant issues will cause Chuuk to lose out on this new tourism potential.

The forecast for Chuuk International Airport is one percent increase for the base case and a two percent increase for the optimized case.

TKK is served by only one air carrier; even with a moderated increase of aviation demand it would be restrained by the fact that there is only one flight per day that makes up to six stops on its route through Micronesia. Travelers to Chuuk need to compete for seats with passengers traveling to the Marshall Islands, Kosrae, Pohnpei, and Guam. Having just one way to reach Chuuk which is intertwined with other destinations, stifles any chance for more travelers, cargo and mail reaching Weno.

3.9.1 Aircraft Operation Forecast

a) Commercial Airlines:

Continental Airlines is the only commercial airline that flies into Chuuk International Airport. It is expected to remain so because there is a lack of demand for more carriers into the western pacific. Continental Micronesia currently uses a Boeing 737-800 series aircraft. This is the only regularly scheduled aircraft into TKK. It is expected that even with a slight growth in other areas the number of operations flown by Continental will remain the same at about 416 a year.

b) Corporate, Commuter, Cargo, Military and General Aviation:

Other than commercial aircraft, there are no other flights into Weno, except for infrequent flights by Caroline Island Air which flies between TKK and the outer islands of Chuuk. It is expected that this will continue to be the case over the forecasted period.

3.9.2 Based Aircraft Forecast

There are no based aircraft at Chuuk International Airport and there is no expectation that any aircraft will be based at TKK during the forecasted period.

3.9.3 Critical Aircraft Forecast

Continental Micronesia currently uses a Boeing 737-800 series aircraft. This is the only regularly scheduled aircraft in to TKK and is projected to be the only schedule aircraft to meet the requirements for critical design aircraft. The critical design aircraft is discussed in greater detail in Chapter 4 Demand Capacity Analysis.

3.9.4 Enplaned Passenger Forecast

Forecasts of enplaned passengers for TKK are set forth in Table 3-12. The table shows a projected growth rate over the forecasted period. It is assumed that Continental will still be the only commercial air carrier at Chuuk and that the level of aircraft operated by Continental into Chuuk will remain the same at approximately 416 flights per year, as there has been no indication that either will increase.

Table 3-12. Forecast of Enplaned Passengers

Year	Base Case	Optimized
2010	20,609	20,813
2015	21,660	22,979
2020	22,765	25,371
2025	23,926	28,012
2030	25,147	30,927

Table 3-13 shows the forecast growth for passengers per flight for departing aircraft. The number of aircraft operations by Continental Airlines at Chuuk is expected to stay constant at 416 operations per year. The number of passengers per flight was derived from taking the projected number of flights by the forecast of enplaned passengers.

Table 3-13. Forecast Aircraft Passengers per Flight

Year	Passengers	
	Base	Optimized
2010	*56	57
2015	59	63
2020	62	60
2025	66	70
2030	69	85

*Numbers rounded to the nearest whole number

3.9.5 Air Cargo Forecast

The average amount of inbound cargo being flown into TKK over the past ten years has been 350 tons, while the outbound average over that same time period has been 590 tons. Over the past two years (2006, 2007), outbound cargo has been 320 and 566 tons respectfully, while inbound cargo has been 528 (2006) and 597 (2007) tons. Continental Airlines is the only air carrier that is flying cargo into Chuuk at this time. With its limited space and no expectation of an increase in exportable items, and the majority of cargo being shipped in by boat, it is safe to assume that the amount of cargo being shipped will not vary significantly over time.

Table 3-14. Forecast of Air Cargo by Tonnage (000)

Year	Base Case		Optimized Case	
	Inbound	Outbound	Inbound	Outbound
2010	583	601	615	634
2015	613	663	646	699
2020	644	732	679	772
2025	677	808	714	853
2030	712	893	751	941

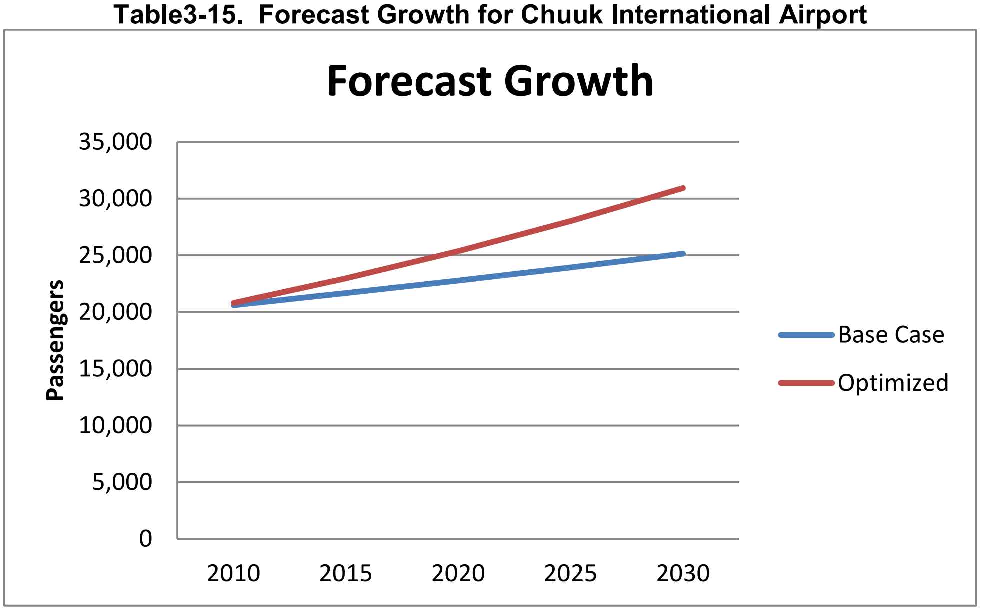
3.9.6 Peak Hour Activity Forecast

An additional measure of airport activity is hourly peaking. Hourly peaking can be defined in different ways. The typical approach is to develop "design hour" flows of passengers and aircraft. The design hour is the estimate of the peak hour of the average day of the busiest month. Chuuk International has only one scheduled air carrier and currently only one flight per day, six days a week, which basically makes the hour when Continental arrives, the peak hour. So, for Chuuk the peak operations are normally two operations per hour. While CIA does operate in Chuuk there may be a rare occasion when Continental Micronesia and a CIA flight might arrive or depart during the same hour. This is would be extremely rare, and will remain so for many years due to restrictions applied to the airspace surrounding this region of the Pacific.

3.9.7 Aviation Forecast Summary

Over the past decade Chuuk has shown a steady increase in the number of visitors. This, along with the U.S. Military buildup in Guam and the increase in visitors from Australia--giving Chuuk a third region along with the United States and Japan from which to draw visitors--creates the expectation that Chuuk International Airport will see a sight growth in aviation activity. Table 3-15 shows the anticipated growth at TKK.

Table3-15. Forecast Growth for Chuuk International Airport



The "base case" is shown with a one percent per year growth rate, while the "optimized case" indicates a two percent growth rate.

Subsequent chapters will utilize the "base case" growth rate as this applies to passenger counts, numbers of flight operations, peak hour conditions, and other parameters that will be useful in determining when facility improvements are needed.

CHAPTER 4: DEMAND CAPACITY ANALYSIS

AIRPORT CAPACITY: AIRSIDE

Airport capacity can be calculated using the procedures in FAA Advisory Circular 150/5060-5. The title of this Advisory Circular is "Airport Capacity and Delay." The Advisory Circular is over 20 years old, but the procedures, methodology and principles included therein are reasonably appropriate for today's aircraft and operations. However, because this manual is primarily applicable to high volume/high operations airports that are approaching capacity, and plan to increase their capacity, or develop an entirely new airport, it is not appropriate for calculating annual capacity at Chuuk International Airport since their demand is so far below even the most restricted IFR capacity.

The FAA methodology for capacity analysis involves a step-by-step process that addresses three components of the airfield's capacity which are determined using the method in FAA AC 150/5060-5, including the hourly capacity of the runways, the annual service volume, and the annual aircraft delay.

Hourly Capacity of Runways: This basic measure of capacity is related to peak hour activity, and regulates the maximum number of aircraft operations that can take place in one hour.

Annual Service Volume: This number refers to the annual capacity or maximum level of aircraft operations that can occur at an airport during one year. This volume can be used as a reference in planning the runway system.

Annual Aircraft Delay: This number is a measure of the total delays incurred by all aircraft on the airfield in one year.

4.1 FACTORS AFFECTING CAPACITY

Airfield capacity is defined as the number of aircraft operations that an airfield configuration can process or accommodate during a specified interval of time when there is a continuous demand for service (i.e., an aircraft is always waiting to depart or land). The capacity of an airport is affected by several factors including the runway/taxiway system (airfield layout), meteorological conditions, aircraft mix, touch and go operations, and percent age of arrivals. These items are described below.

4.1.1 Runway/Taxiway System Capacity

The capacity of the runway/taxiway system is a primary determinant of the level of activity that can take place at the airport. An airport is assumed to reach capacity when the average delay for an arrival or departure exceeds a certain predetermined level. TKK has one runway (4-22) and a single stub taxiway. The layout of both the runway and taxiway are constrained to the current configuration by the lack of available land and Chuuk's geographical terrain.

4.1.2 Meteorological Condition

Aircraft operating parameters are dependent upon the weather conditions, such as the cloud ceiling height and visibility range on and near the airfield, and more importantly wind, because aircraft land and takeoff into the wind. As weather conditions deteriorate, pilots must rely on instruments to define their position both vertically and horizontally. Capacity is lowered during such conditions because aircraft are spaced further apart when they cannot see each other. Also, some airports, such as Chuuk International Airport, may have limitations with respect to their instrument approach capability which impacts capacity during bad weather. The FAA defines three general weather categories, based upon the height of the clouds above ground level and the visibility:

- Visual Flight Rule (VFR): Cloud ceiling is greater than 1,000 feet above ground level (AGL) and the visibility is at least three statute miles. All airports are able to operate under these conditions.

- Instrument Flight Rule (IFR): Cloud ceiling is at least 500 feet AGL but less than 1,000 feet AGL and/or the visibility is less than three statute miles but more than one statute mile. Aircraft operations are limited if the aircraft and the airport are not equipped with the proper instrument facilities.

- Poor Visibility and Ceiling (PVC): Cloud ceiling is less than 500 feet AGL and/or the visibility is less than one statute mile. Most airports, even those with precision instrument capabilities, have limited operations during these conditions.

This factor is important in determining the percent of time that aircraft operations are conducted under VFR and IFR conditions or below visibility minimums, as the capacity of the airport differs under VFR versus IFR conditions.

4.1.3 Aircraft Mix Index

The operational fleet at an airport influences an airfield's capacity based upon differing aircraft requirements. Various separations are set by the FAA for a number of safety reasons. For example, an airfield's capacity is influenced by the time needed for the aircraft to clear the runway either on arrival or departure. As aircraft size and weight increases, so does the time needed for it to slow to a safe taxiing speed or to achieve the needed speed for takeoff. Therefore, a larger aircraft generally requires more runway occupancy time than a smaller aircraft would. Thus, as additional larger aircraft enter an airport's operating fleet, the capacity for that airfield will be lowered.

There are four categories of aircraft used for capacity determinations under the FAA criteria. These aircraft classifications are based upon the maximum certificated takeoff weight, the number of engines, and the wake turbulence classifications.

Table 4-1. Aircraft Classifications

Aircraft Class	Maximum Certificated Takeoff Weight (lbs)	Number of Engines	Wake Turbulence Classifications
A	12,500 or less	Single	Small
B	12,500 or less	Multi	Small
C	12,500 – 300,000	Multi	Large
D	Over 300,000	Multi	Heavy

Source: FAA AC 5360-5, Change 2, "Airport Capacity and Delay."

The aircraft mix at Chuuk International Airport contains class A, B and C aircraft. The mix index is the mathematical expression of the aircraft mix, and is the percent of C aircraft plus three (3) times the percent of D aircraft [%(C+3D)]. The mix index for Chuuk International Airport is 100 percent.

4.1.4 Percentage of Arrivals and Percentage of Touch and Goes

The percentage of aircraft arrivals is a factor of the ratio of landing operations to the total operations of the airport. This percentage is considered because aircraft approaching an airport for landing require more runway occupancy time than an aircraft departing the airfield. The percentage of touch and goes is the ratio of landings with an immediate takeoff to total operations. There are currently no touch and goes at TKK. Arrivals and departures at the airport are equal, thus arrivals comprise 50 percent of the total operations.

4.2 AIRFIELD CAPACITY ANALYSIS

4.2.1 Runway/Taxiway

Chuuk International Airport was designed with a single paved runway together with a connecting taxiway to the terminal apron to be used for commercial service operations (Airport Classification, ARC, D-III). The capacity of TKK's single runway configuration was evaluated within the parameters of US FAA Advisory Circular, AC 150/5060-5 together with the National Plan of Integrated Airport Systems service level criteria and has been determined to be adequate for the foreseeable future.

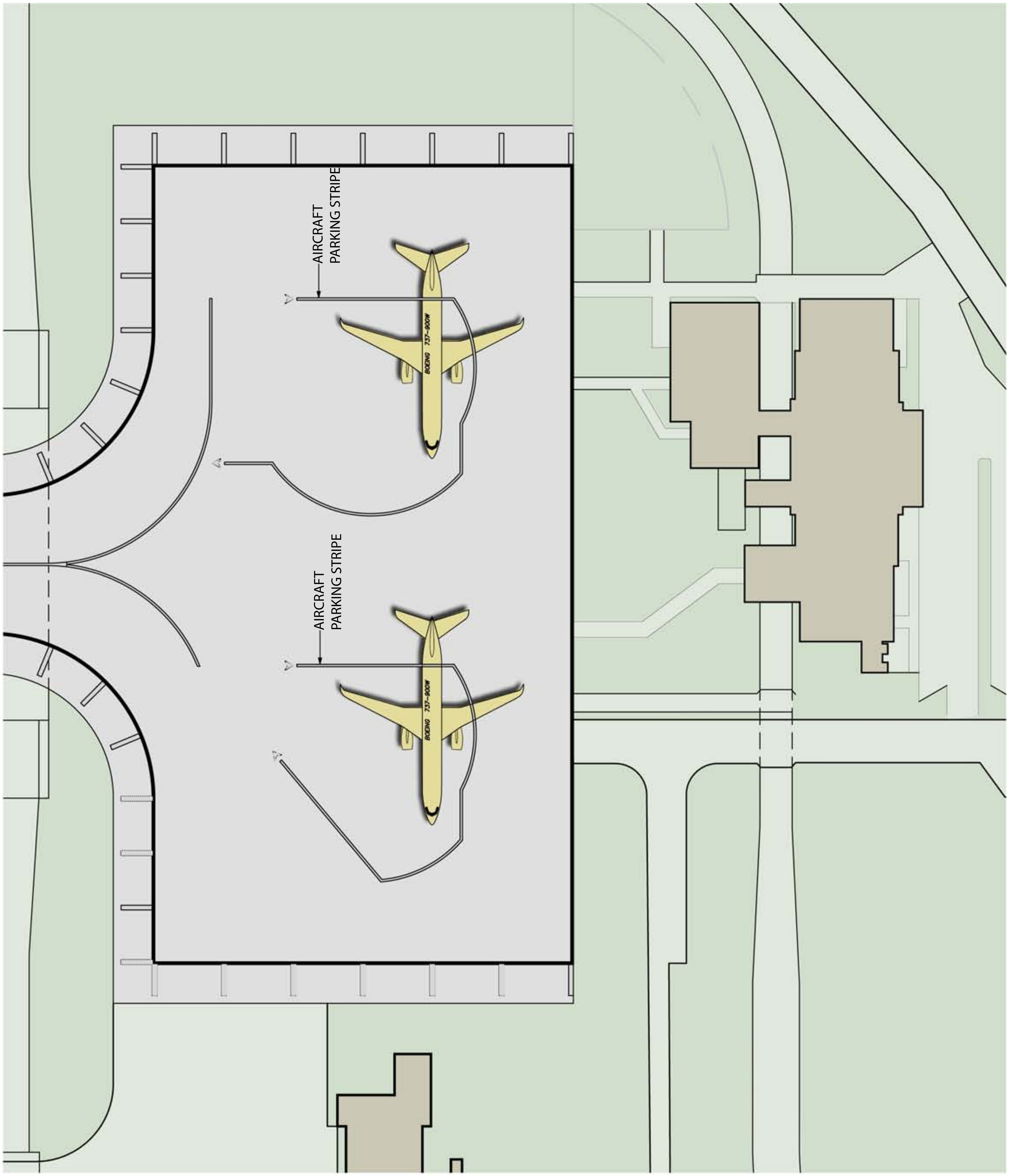
It is noted that Chuuk International Airport is very limited in available real estate property. Construction of a parallel taxiway would not be feasible due to the required separation standard distance from the runway centerline to the parallel taxiway centerline for the critical/design aircraft (B737-800). The one air carrier, Index III flight per day is managed through the prior notification process for arriving and departing aircraft at TKK. Ground Communication Facilities under airfield jurisdiction, required operating procedures, the Common Traffic Advisory Facility (CTAF), observation from airport ground vehicles and the Aircraft Rescue and Fire Fighting Station assure the runway is clear.

The runway capacity is assured and adequate for the foreseeable future, subject to the above capability of airport management.

4.2.2 Apron Parking Area

An aircraft parking apron is usually located adjacent to the passenger terminal. The loading and unloading of passengers, baggage, cargo, and mail as well as the fueling, servicing, and light maintenance of the aircraft take place at the aircraft parking apron. Adequate depth for the apron should be preserved for maneuvering and parking of both current and future aircraft and for apron activities.

The length of the existing apron is 512 feet and parallel to the runway centerline, and the width is 250 feet and parallel to the taxiway centerline. There are two concrete hardstands within the apron. The hardstands are 105 feet long parallel to the runway centerline and 105 feet wide parallel to the taxiway centerline. The parking apron is capable of allowing two 737-800 size aircraft to park at the apron; this configuration meets the current and future needs of TKK.



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CHUUK INTERNATIONAL AIRPORT
FEDERATED STATES OF MICRONESIA

FIGURE 4-1. APRON PARKING PLAN

4.3 AIRPORT CAPACITY: LANDSIDE

"Landside" refers to the terminal area facilities that are used primarily for passenger movements. This area includes the terminal/administrative buildings, the ARFF facility, general aviation facilities, parking and access roads. The following subsections address the abilities of these landside facilities to accommodate existing demand, and to identify the requirements needed to handle future projections.

FAA's AC 150/5360-7, "Planning and Design Considerations for Airport Building Development," describes a methodology for translating forecasted passenger activity into design peak hour demands. The procedure utilizes historic and projected passenger levels and aircraft movements to develop a hypothetical design day activity table from which passenger peaking activity can be analyzed. The circular also provides "average" peaking charts and rules-of-thumb for rough estimating of various peak (high level of activity) hour demand activities.

Airport terminals and related vehicle access and parking are planned, sized, and designed to accommodate peak passenger demands of the forecasted period. But planning for absolute peak demands (the greatest demands anticipated) will result in impractically oversized and under-utilized facilities except on rare occasions.

In the case of Chuuk International Airport, the use of AC 150/5360's methodology for finding peak hour design is unnecessary as there is only one flight a day into Chuuk. This flight, Continental's "island hopper" is the only current aircraft flying into TKK. This aircraft is a 737-800 series, which has a total capacity of 155 passengers. Since this is not a direct flight making two stops when flying westbound and two stops on its east bound route, it is highly unlikely that all of the 155 passengers' final destinations will be Chuuk.

Based upon observations of peak hour operations, the landside and access facilities should accommodate both existing and forecasted demand through the planning horizon. However, there is a correlation between the capacity of landside/access facilities and airline arrivals/departures. It is important to emphasize the role of airport management in taking a proactive role in establishing operational time slots for airlines' arrivals/departures as necessary. Operational control emanating from airport management is crucial in regulating the arrivals/departures throughout the day to avoid congestion and situations that could overwhelm the terminal and landside capacity. A good example would be to avoid having more than two aircraft at a time proceeding with arrival/departure operations simultaneously; this scenario would overtax TKK facilities.

4.3.1 Air Rescue/Firefighting Station

Requirements for aircraft rescue and firefighting (ARFF) services at an airport are established under Federal Aviation Regulations (FAR) Part 139. An airport's ARFF Index determines the minimum ARFF equipment and extinguishing agents to comply with FAR Part 139.315. The Index is determined by a combination of factors including aircraft length and an average of five daily departures by the largest air carrier aircraft using the airport over a recent consecutive three month period. In the case of TKK, where there are less than five (5) daily departures of the largest air carrier aircraft using the airport, § 139.319 (c) is applicable:

"…the certificate holder may reduce the rescue and firefighting to a lower level corresponding to the Index group of the longest air carrier aircraft being operated…"

In the case of TKK, the longest air carrier aircraft operating at the airport is the B 737-800, which is 129.6 feet long. Thus, according to § 139.315 (b), TKK is currently an Index C airport. A new state of the art ARFF Station is currently under construction and will meet all requirements for an Index C airport.

4.3.2 Commuter, General Aviation, and Business Jet

Currently there is no general aviation based out of Chuuk International Airport and none is expected over the forecasted period.

4.3.3 Parking

There are approximately fifty vehicle parking spaces in the lot. During several flight arrivals and departures in November 2009 the use of the lot was observed. The use varied widely but at the highest peak observed there were 41 passenger cars and five vans in the lot. The existing parking lot meets the airports needs, but needs to be upgraded with new lighting and pavement.

4.3.4 Airport Access Road

The terminal roadway system includes the roadway serving the terminal building and associated parking areas, and the service roads which provide access to terminal support facilities, to the airfield and other nonpublic areas.

There is no traditional airport access road leading to the airport. All roads leading to the airport parking lot and both secure access gates are public roads and lead to other properties. The public enters the airport parking lot through the main entrance from the major public road. This road is currently in very poor condition but is undergoing upgrading.

A secondary entrance into the parking lot is from the opposite side, through an entrance from the second lane of parking. This road is in poor condition and may not be incorporated into the road project noted above.

Access to the aviation fuel storage area on the airport is through a gate adjacent to the main entrance to the public parking lot. Access to the airport secure area is through a gate on the west side of the terminal. This gate is reached using the road that serves the secondary entrance into the parking lot. At the present time much of this road is unpaved and subject to rutting, potholes, mud and debris. This presents a serious potential for tracking rocks and other objects onto the paved airfield pavements. This debris can result in damage to aircraft and engines causing Foreign Object Debris (FOD). If this road is not included in the road project discussed above it is recommended that it be declared an access road, made eligible for FAA funding under this category, and paved as soon as possible.

4.4 AIRPORT CAPACITY: TERMINAL

The overall size/square footage of the terminal is appropriate and of proper scale given the passenger peak hour operations and frequency of flights into and out of Chuuk. Most congestion at airport terminals occurs at processing stations such as security checkpoints and check-in counters. Capacity analysis of airport terminals aims at minimizing congestion related passenger delay in the terminals. Following is a review of the terminal's capacity.

4.4.1 Existing Terminal Area Facilities

The existing terminal facilities are located in a two story building south of the runway, with the first floor used for airport operations and the second floor for airport management. The first floor is approximately 17,240 square feet, with the west end of the terminal used for arrivals and the east end used for departures. The terminal was recently renovated, enclosing and air conditioning the majority of the facility.

4.4.2 Arrival Area and Hold Room Area

There is no arrival area at Chuuk Airport. Arriving passengers go straight to immigration from the airplane. The holding area for passengers departing TKK is 2,852 square feet and is fully enclosed and air conditioned. There are bathrooms along the west wall. There are windows along the north and east walls, along with doors leading to the apron. Adjacent to the hold room is the VIP lounge; the lounge is approximately 675 square feet, including a private unisex bathroom. Both the hold room and lounge are adequate, meeting the capacity demands of TKK.

4.4.3 Ticketing Area

The only carrier, Continental Airlines, has a check-in area, which includes two lines for their general ticketing and one line for elite passengers. The Continental office is located to the right of the check-in area along the same east facing wall. Both the Continental office and the check in area are sufficient to meet the needs of the airport.

Currently the lines for the ticketing area run from west to east towards the center of the terminal. When flights are crowded, these lines back into the entrance way of the terminal and into the security bag inspection area. To help reduce the traffic in this area it is recommended that the lines be changed from a straight line to a snaking curvilinear line. This will provide more space for the ticketing passengers and free up the congestion in the entrance way of the terminal.

4.4.4 Customs and Baggage Claim Area

The baggage and customs area share a large enclosed room which is completely enclosed and air conditioned. On the west end of the room is the baggage area and to the east end is the customs check point, comprised of two eight-foot long tables where bags are hand checked. The baggage area is made up of two ten-foot long carousels that are manually fed. The area is approximately 2,770 square feet. This manual operation can cause delays in retrieving checked baggage as new luggage cannot be placed on the carousels until the current baggage is retrieved.

The entrance into this section of the terminal for passengers arriving at the airport is in the middle of the room. From this entrance, passengers must turn to the right (west) to retrieve their baggage. Once they have recovered their baggage then they must turn 180 degrees to the east and cross the room to the custom’s check point. In the present situation, a passenger retrieving their luggage must jostle with the others passengers waiting to get their baggage, and then proceed through the passengers entering the room to go through customs. This layout also causes the customs line to back into the entrance way causing even more confusion and a log jam of people.

One problem with the baggage area is that the baggage pick-up is too small. Two ten-foot manual carousels do not meet the needs of the airport during crowed flights. The carousels need to be expanded by five feet on each side. This is possible by removing the door located on the baggage loading area wall next to the southernmost carousel, and making it part of the carousel. There is another door that allows access to the outside through the adjacent office. On the northernmost carousel, part of the wall would need to be removed to make the additional space. These adjustments will allow for more baggage to be processed at one time lessening the backlog of people near the entrance way.

The two custom counters on the east end of the room are adequate and meet the requirements for the airport. The counters should be moved back five feet to allow more room so passengers will not be as crowded.

4.4.5 Immigration Check Points

a) Departure Area:

The Immigration check point for passengers departing the airport is located immediately behind the check-in area and departure counter. There are two booths running north to south, used for Immigration purposes. Theses booths line up directly with the security check point, which is located approximately five feet away.

It is recommended that the Immigration booths be rotated from north to south to west to east. This change will move the booths closer to the center of the terminal where there is more open space. It will also reduce the backlog of passengers waiting to be processed from spilling into the entrance area and into the people waiting to check in. It will also allow additional room between the immigration area and the security check point. By making this change, more room will be created for passengers waiting to check in, waiting to go through immigration, and for those waiting to go through the security check point.

b) Arrival Area:

Passengers arriving at TKK enter the terminal on the northwest end of the building. The entrance leads to the immigration check point. The check point is open air with jalousie windows on both the east and west sides, approximately 910 square feet. At the doorway, an immigration officer directs passengers into three lines each about ten-feet long. These short lines can cause the lines to back out the doorway causing travelers to wait outside the terminal and open to the elements.

To maximize the use of this current area it is recommended that the current location of the immigration booths be moved back approximately five feet to the end of the room, right before the entrance way into the baggage/customs area. It is also recommended that the three straight lines be changed to one curvilinear line. These adjustments will allow for the utmost use of space and let more passengers into the building. While these changes will improve the room's occupancy, the addition of an awning to the outside of the building should be looked into to protect the remaining passengers from the elements.

4.6 TERMINAL RECOMMENDATION

It is recommended that a terminal study should be done to look at the layout of the terminal building. The current layout of the terminal with all operations pushed to the west and an east end of the buildings creates an unnecessary backlog of passengers. By moving certain operations and utilizing the center of the terminal, arriving and departing passengers will have more room, allowing for the terminal to become free flowing. Figure 4-1 shows the existing terminal layout, while Figure 4-2 shows proposed changes to the terminal area.

CHUUK INTERNATIONAL AIRPORT TERMINAL PLAN

FEDERATED STATES OF MICRONESIA

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SCALE: 1/16"=1'-0"

PROJECT #081-10015-008

EXISTING TERMINAL PLAN

FIGURE 4-2

CHUUK INTERNATIONAL AIRPORT
TERMINAL PLAN

FEDERATED STATES OF MICRONESIA

LEO A DALY

SCALE: 1/16"=1'-0"

PROJECT #081-10015-008

PROPOSED TERMINAL IMPROVEMENT PLAN

FIGURE 4-3

CHAPTER 5: FACILITY REQUIREMENTS

5.1 DESIGN STANDARD ISSUES

Airport design standards are spelled out in several FAA publications. Design standards for civil airports are set forth in the FAA's Airport Design Advisory Circular. These standards have been applied in the determination of facilities requirements for Chuuk International Airport. These circulars also recognize that each airport is unique and that some adjustments need to be made to best fit each airport's needs.

5.2 AIRSIDE FACILITIES

"Airside" relates principally to the airfield facilities, which include the runways, taxiways, runway approach surfaces, runway protection zones and navigational aids (NAVAIDS). The following subsections address the ability of airside facilities to accommodate existing and future traffic loads, and to identify the requirements needed to handle future traffic.

5.2.1 Critical Design Aircraft

FAA AC 150/5325-4B provides guidance for determining the potential range of critical design airplanes through establishing a "substantial use threshold" of 500 or more annual itinerant operations at the airport (landings and takeoffs are considered as separate operations). If an aircraft were to meet this substantial use threshold, it would be eligible for consideration as a design aircraft. The critical design aircraft for this study is the Boeing 737-800 series. The Boeing 737-800 series aircraft is the only scheduled aircraft that flies into Chuuk and with more than 250 arrivals and departures meets the FAA criteria for critical design aircraft. Continental Airlines, the one scheduled air service provider--has talked about the possibility of changing from the 737 aircraft to a 757 aircraft. If this change were to happen it would switch the critical design aircraft from the 737 to the 757.

Table 5-1. Critical Design Aircraft

Aircraft	Approach Speed (Knots)	Maximum Takeoff Weight (LB)	Maximum Landing Weight (LB)	Wing-span (Feet)	Length (Feet)	Max Tail Height (Feet)
Boeing 737-800	142	174,200	146,300	112.6	129.5	41.4
Boeing 757-300	143	273,000	224,000	124.8	178.6	44.8

Source: Boeing

5.2.2 Airport Reference Code

The FAA Advisory Circular 150/5300-13, *Airport Design*, has established a coding system to relate airport design criteria to the operational and physical characteristics of aircraft expected to use the airport. This code, the airport reference code (ARC), has two components. The first component, depicted by a letter, is the aircraft approach speed (operational characteristic); the second component, depicted by a Roman numeral, is the airplane design group and relates to aircraft wingspan (physical characteristic). Generally, aircraft approach speed applies to runways and runway-related facilities, while aircraft wingspan primarily relates to separation criteria involving taxiways, taxi lanes, and landside facilities. Aircraft in lower ARC would be accommodated by a higher ARC (e.g., A-I or a B-II fits into a C-III).

According to AC 150/5300-13, an aircraft's approach category is based upon 1.3 times its stall speed in landing configuration at that aircraft's maximum certificated weight. The five approach categories used in airport planning are as follows:

- ***Category A:*** Speed less than 91 knots.
- ***Category B:*** Speed 91 knots or more, but less than 121 knots.
- ***Category C:*** Speed 121 knots or more, but less than 141 knots.
- ***Category D:*** Speed 141 knots or more, but less than 166 knots.
- ***Category E:*** Speed greater than 166 knots.

Based on the critical design aircraft's tail height and wingspan, the airplane design group for Chuuk is Airplane Design Group III.

Table 5-2. Airplane Design Groups

Airplane Design Groups (ADG)		
Group #	**Tail Height (ft)**	**Wingspan (ft)**
I	<20	<49
II	20 - <30	49 - <79
III	30 - <45	79 - <118
IV	45 - <60	118 - <171
V	60 - <66	171 - <214
VI	66 - <80	214 - <262

Source: FAA AC 150/5300-13 Airport Design

The design aircraft (737-800) would give the airport an existing airport reference code (ARC) of D-III. The ARC is not anticipated to change throughout the planning period, however there is a possibility that Continental Airlines, the only commercial carrier into TKK, is looking into the possibility of using a Boeing 757 for its route through Micronesia. If Continental was to change aircraft, the ARC would change to C-IV.

Table 5-3 Design Standards For ARC C-III/C-IV

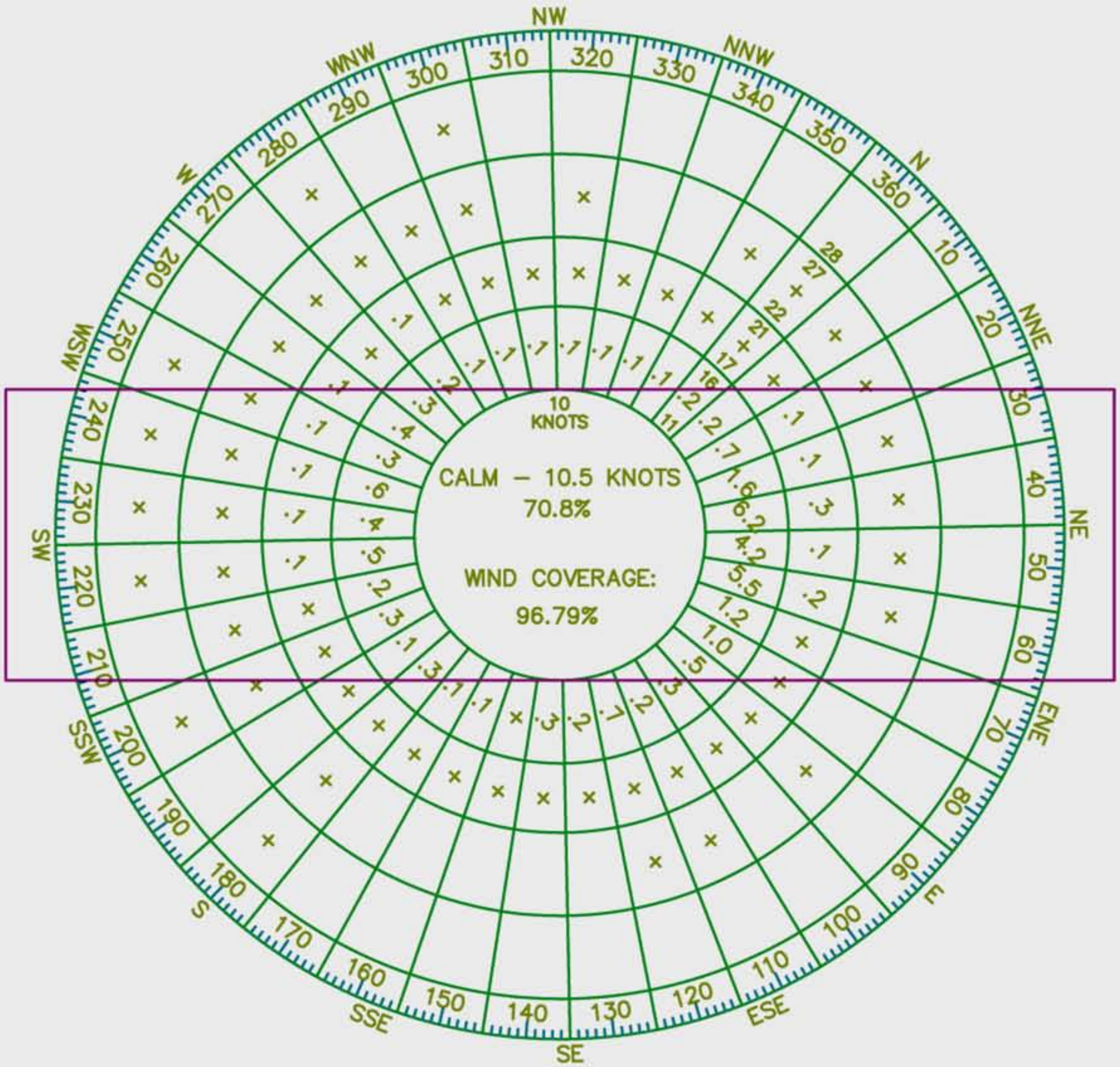
Design Standards	Airport Reference Code	
	D-III	C-IV
Runway Width	100 ft.	150 ft.
Runway Shoulder Width	20 ft.	25 ft.
Runway Blast Pad Width	140 ft.	200 ft.
Runway Blast Pad Length	200 ft.	200 ft.
Runway Safety Area Width	500 ft.	500 ft.
Runway Safety Area Length Beyond Runway End	1,000 ft.	1,000 ft.
Obstacle Free Zone Width	400 ft.	400 ft.
Obstacle Free Zone Length Beyond Runway End	200 ft.	200 ft.
Runway Object Free Area Width	800 ft.	800 ft.
Object Free Area Length Beyond Runway End	1,000 ft.	1,000 ft.
Taxiway Width	50 ft.	75 ft.
Taxiway Shoulder Width	20 ft.	25 ft.
Taxiway Safety Area Width	118 ft.	171 ft.
Taxiway Object Free Area Width	186 ft.	259 ft.

Source: FAA AC 150/5300-13 Airport Design

5.3 RUNWAY REQUIREMENTS

5.3.1 Wind Analysis

A factor influencing runway orientation and number of runways is wind. Ideally a runway should be aligned with the prevailing wind. Wind conditions affect all airplanes in varying degrees. The most desirable runway orientation based on wind is the one which has the largest wind coverage and minimum crosswind components. Wind coverage is that percent of time crosswind components are below an acceptable velocity. Wind coverage is calculated using a wind rose, which graphically depicts wind data collected from the National Oceanographic and Atmospheric Administration (NOAA). The wind rose is essentially a compass rose with graduated concentric circles representing wind speed. Each box in the wind rose represents a compass direction and, when filled, indicates the percentage of time wind travels in that direction at that speed. The desirable wind coverage for an airport is 95 percent, based on the total number of weather observations. Chuuk International Airport exceeds the desired wind coverage with 97.9 percent coverage (Data taken between 1999-2008).



CHUUK WIND DATA

1999 - 2008

CALM	4.1%
0-3 KNOTS	01%
4-6 KNOTS	14.5%
7-10.5 KNOTS	52.2%
	70.8%

RUNWAY 4-22 - 97.97% COVERAGE AT 16 KNOTS

SOURCE: NOAA NATIONAL DATA CENTERS
U.S. DEPARTMENT OF COMMERCE

CHUUK WIND ROSE
STATION NUMBER 91334
FILE NAME AN91334A.PRN
NAME CHUUK, PI
ANNUAL SUMMARY
1999 - 2008

CEILING/VISIBILITY:	ALL
PRESENT WEATHER:	ALL
HOURS:	ALL

5.3.2 Runway Length Analysis

Runway length is a crucial consideration in airport planning and design. Aircraft need specified runway lengths to operate safely under varying conditions of wind, temperature, takeoff weight, and surface conditions. Chuuk International Airport has a single runway, Runway 4-22 which is 6006 feet. The design aircraft 737-800 series needs a runway at maximum takeoff weight (174,200 lbs.) of 7,500 feet during VFR conditions.

The runway length required is based on standards presented in FAA AC 150/5300-13, *Airport Design*, Chapter 3 and FAA AC 150/5325-4A, *Runway Length Requirements for Airport Design*. The recommended length for a primary runway at an airport is determined by considering either the family of airplanes having similar performance characteristics, or a specific aircraft requiring the longest runway. This need is based on the aircraft or family of aircraft that use the airport on a regular basis, where regular basis is typically defined as a minimum 500 itinerant operations per year. Additional factors considered include critical aircraft approach speed, its maximum certificated takeoff weight, useful load and length of haul, the airport's field elevation above sea level, the mean daily maximum temperature at the airfield, and typical runway surface conditions, such as wet and slippery.

The current critical design aircraft for TKK is the Boeing B-737-800. It is the design aircraft based on current operations and determinations based on application of the Federal Aviation Administration-National Plan of Integrated Airports System Plan (NPIAS) and grant funding priority under the Airport Improvement Program as amended. The above parameters are within programming planning criteria even though this location may have less than 500 total annual operations and less than a minimum of 2500 enplanements. This location is grand fathered based on prior grants and being programmed within the NPIAS.

5.3.3 Aircraft Landing and Takeoff Calculations

Aircraft Performance is calculated from guidance in US FAA Advisory Circular AC 150/5325-4B, "Runway Length Requirements for Airport Design" for the Boeing B 737-800 Aircraft. The Advisory Circular Guidance for runway design is not to be used for flight operations. Flight operations must be conducted in accordance with applicable aircraft flight manuals.

Table 5-4 - Airport and Aircraft Data

Airport and Aircraft Data		
Airport Elevation - Sea Level	Zero Wind	Maximum Temp - 86˚F(Standard Day + 27˚F)
Auto Spoilers Operating	Anti-Skid Operating	Maximum Differences in Runway Elevation – 2 ft (Pacific Supplement)

Table 5-5 - Aircraft Landing and Takeoff Calculations

Boeing B-737-800	
Max. Landing Design Weight	146,000 lbs.
Max. Takeoff Design Weight	174,200 lbs.
Landing Length - 30˚ Flaps	Wet Runway 6,200 feet, Dry Runway 5,800 feet
Takeoff Length	8,100 feet

The FAR Landing and Takeoff Runway Length Requirements for landing aircraft indicate a dry runway requirement of 5800 feet and wet runway requirement of 6200 feet and a 8100 foot takeoff requirement for a maximum takeoff design weight (MTOW) of 174,000 lbs. The Advisory Circular guidance is for airport runway design and is not to be used for flight operations. Flight operations must be operated in accordance with the applicable aircraft manual.

5.3.4 User Aircraft Landing and Takeoff Recommendations-System Operation Data

Commercial Air Carrier Service for Chuuk International Airport is provided by Continental Micronesia Airlines. The data in Table 5-6, Runway Landing Length-Airline User Planning Data, includes the landing distances for various aircraft operational configurations and runway conditions. Local and area weather may cause variation in the airport environs and impact aeronautical operations. The scenarios in Table 5-6 include ground operational changes based on a dry runway with light rain, with moderate rain or heavy rain causing a wet runway surface resulting in poor braking action. The data in the table specifies the Runway Condition and Braking Action associated with Normal and Non Normal Landing Conditions.

Table 5-6 - Runway Landing Length – Airline User Planning Data

Runway Landing Length – Airline User Planning Data				
Runway Conditions	Normal Landing	Non Normal Landing	Landing	Non Normal Landing
Braking Action (BA)	Configuration	Configuration	Configuration	Configuration
	Flap 40 degree	One-Engine Inoperative	Anti Skid Inoperative	One Engine Inoperative
	Braking Maximum V Ref 40 knots	Flaps 1 to 15 degrees	Flap 1 to 40 degrees	Hydraulics A/B System Inoperative
	Landing Distance	Landing Distance	Landing Distance	Landing Distance
New, Dry, Clean, Normal (BA)	3,298 feet	3,338 feet	5,302 feet	4,956 feet
Island, Day, Intermittent Rain, Good (BA)	4,618 feet	4,730 feet	5,922 feet	6,158 feet
Moderate Rain, Fair (BA)	6,235 feet	6,814 feet	7,524 feet	8,550 feet
Heavy Rain, Poor (BA)	8,758 feet	9,354 feet	10,100 feet	11,058 feet

Two major impacts to planning aeronautical facilities and aircraft operations in Micronesia are the distances between airports and changes in the weather. The Weather Forecast Office (WFO-Guam) provides routine daily forecasts for the FSM. Heavy weather alerts and Tsunami forecasting are also part of their services.

Normal operations are conducted in light to moderate rain. All runways are grooved to increase braking action. The non normal and anti skid inoperative landing distance in moderate rain covers a range of 6,235 to 7,524 feet. For planning purposes the landing length for the design aircraft Boeing B 737-800 at maximum design landing weight on a dry runway is 5800 feet and for the wet runway is 6,200 feet. A runway landing length between 6235 and 6814 feet, fair breaking action in moderate rain (wet runway) is an applicable planning parameter for a normal and/or non normal landing with one engine inoperative. Based on consideration of available land area, a cost analysis and using the balanced runway concept, a 6,500 foot landing runway length would be acceptable in the initial 5 year planning time period. This allows the air carrier to plan for enroute landing weights at those airports with lesser loads and variable operational cycles.

The following landing runway length for a Current (5 year), Intermediate (6 to 10 year), and Long Term (10 to 20 year) plan for Chuuk International Airports is based on the design aircraft operational requirements and to meet forecast utilization and needs.

Table 5-7. Recommended Runway Length

Runway Length			
	0 to 5 years	6 to 10 years	10 to 20 years
Chuuk International Airport	6,500 feet	6,500 feet	6,500 feet

All of the FSM runways are somewhat “challenged” in terms of overall runway length, which is an increasingly important topic of discussion with the airlines that serve these airports. Unfortunately, for many of the FSM airports, the physical terrain is somewhat prohibitive, economically, in terms of runway extensions. The depth of the lagoon at both ends of the runway at Chuuk International Airport makes expansion of the runway economically unfeasible. The northeast lagoon at the end of the runway is over 100 feet deep, while on the west end, the lagoon’s depth is over 40 feet. These constraints limit the runway to its current length of 6,006 feet.

5.3.5 Runway Width

Runway width is a dimensional standard that is based upon the physical characteristics of the aircraft using the Airport. The most important physical characteristic is the wingspan. The FAA Advisory Circular 150/5300-13, “Airport Design,” recommends a runway width for a Design Group III aircraft of 100 feet, unless the airport is used by aircraft exceeding 150,000 pounds, in which case the runway width should be increased to 150 feet. Presently, Runway 4-22 is 150 feet wide. Thus, a runway widening is not necessary.

5.3.6 Pavement Strength

Aircraft weight characteristics also affect the design of an airport. Pavement design of the runways, taxiways, and aprons is based on a design aircraft. The design aircraft is different from the critical aircraft described previously. The design aircraft is determined by landing gear configuration (i.e., single wheel, double tandem, etc.), and the known or forecast number of operations of aircraft with the heaviest maximum gross takeoff weights. The dual wheel main gear, 174,200 pound maximum takeoff weight Boeing 737-800 series is expected to be the most demanding aircraft to frequent TKK. The current strength rating on Runway 4-22 is 115,000 pounds single wheel loading (SWL) and 176,000 pounds for double wheel loading (DWL). There is no data for a dual tandem wheel loading (DTWL).

The International Civil Aviation Agency, (ICAO), standard for reporting airfield pavement strength is the Pavement Classification Number, (PCN). The United States FAA is presently transitioning airport pavement strength reporting into this international system. The information and guidance for determining the PCN is provided in FAA Advisory Circular AC 150-5335-2B.

Two approaches may be used to calculate the airport PCN. These are the “using” aircraft method or the “technical” evaluation method. Briefly, the “using” aircraft method determines the Aircraft Classification Number (ACN), of the most critical aircraft using the airport. See the Advisory Circular for more information on the definition and determination of the aircraft ACN. Generally this aircraft ACN number is then published as the airport PCN. The “technical” method allows evaluation of a range of aircraft including those that might use the airport in an emergency situation or for expansion of air services to the community. This method provides a PCN value that considers the aircraft wheels and the pavement structure that must support the aircraft loads.

The “technical” evaluation method was used to prepare TTK’s PCN values. Chuuk International Airport has a flexible PCN value of 62/F/C/X/T and a rigid PCN value of 64/R/B/X/T. These values will permit reasonable unrestricted use by any civilian or military aircraft that might chose to operate at the airport. Requests to permit aircraft requiring higher PCN values might be considered favorably on an individual basis.

5.3.7 Runway Grades

The FAA Advisory Circular 150/5300-13, “Airport Design”, allows a maximum longitudinal grade of 2.0% for A and B type runways and 1.5% for C and D runways. Gradient changes shall be such that any two points five feet above the runway centerline shall be mutually visible for the complete length of the runway. The effective gradient of the existing runway is 0.00% according to the Airport Layout Plan.

5.3.8 Runway Blast Pad

Runway Blast Pads for ARC D-III airports are required to be 140 feet wide, except when serving Group III aircraft with a maximum takeoff weight greater than 150,000 pounds, for these aircraft the width of the blast pad is required to be 200 feet wide, which is the same required width for ARC C-IV airports. The required length for runway blast pads for both ARC D-III and C-IV is 200 feet. The existing blast pads on runway 4-22 are 200 feet in width and length meeting the requirements set forth in AC 150/5300-13.

5.4 SAFETY AREA STANDARDS

The FAA has established several safety surfaces to protect aircraft operational areas and keep them free from obstructions that could affect their safe operation. These include the runway safety area (RSA), object free area (OFA) and runway protection zone (RPZ). The dimensions of these safety areas are dependent upon the critical aircraft ARC and approach visibility minimums. The entire RSA is required to be on airport property. If necessary design standards push the RSA beyond the airport property line, then fee simple acquisition will need to be undertaken. The OFA and RPZ can extend beyond airport bounds as long as obstructions do not exist in these areas. It is not required that the RPZ be under airport ownership, but it is strongly recommended

5.4.1 Runway Safety Area (RSA)

RSA standards are defined in AC 150/5300-13 section 305 and construction standards are found in AC 150/5370-10 P-152. According to AC 150/5300-13 section 503, the RSA must be centered on the same line as the center of the runway and the RSA must be cleared, graded and have no hazardous surface variations. Any object that is constructed higher than 3 inches above grade should be constructed on frangible supports. Any other objects must be constructed no higher than 3 inches above grade. For ARC D-III airports the RSA length must be 1,000 feet beyond the runway end, and its required width is 500 feet; these requirements are also the design standards for an ARC C-IV airport.

Table 5-8. Runway Safety Area

Runway	Required Length	Actual Length	Required Width	Actual Width
4	1,000 ft.	200 ft.	500 ft	500 ft.
22		206 ft.		500 ft.

Source: FAA AC 150/5300-13 Table 3-3

The current RSA are non-standard, falling well short of the dimensions mandated by AC 150/5300-13. Beyond the end of the runway the existing lagoon surface is over 100 feet deep at the northeast corner and over 40 feet deep in places off the west end, the airports location limits the length of the runway and the RSA. An Airport Certificate holder in accordance with US Federal Aviation Administration (FAA), Federal Aviation Regulation (FAR) Part 139, Section 139.309, Safety Areas, must maintain for each runway and taxiway that is available for air carrier use, a Safety Area of at least the dimensions that; (1) Existed on December 31,1987 if no reconstruction or significant expansion of the runway or taxiway was begun after January 1,1988 or (2) were authorized at the time construction, reconstruction or expansion began after January 1, 1988. TKK's RSA is grandfathered in based on the description above.

A Runway Safety Area (RSA) Inventory was completed in September 2000 by the Federal Aviation Administration for airports certificated under Federal Aviation Regulation (FAR) Part 139 using guidance included in FAA Order 5200.8, Runway Safety Area Program. The purpose was to identify airports which could provide the standard runway safety area 1000 feet long with a 150 foot extended runway width within the 500 foot wide safety area. Those runway ends which could not meet the standard due to natural obstacles, property limitations, environmental constraints and local developments required the evaluation for alternatives to conform to the safety requirements expected from the 1,000 foot long and 500 foot wide RSA standard.

The following four factors were utilized to categorize the existing runway environment as to the capability to provide a standard RSA.

1. The existing RSA met standards in accordance with US FAA Advisory Circular AC 150/5300 13, Airport Design.
2. The existing RSA does not meet criteria but is practical to improve to meet current standards.
3. The exiting RSA can be improved but still will not meet current standards.
4. The existing RSA does not meet current standards and is not practical to improve.

At locations with natural obstacles, environmental constraints, local development and/or property limitations to providing the standard 1000 foot safety area at each end of the existing runway or a planned runway extension, the FAA has accepted the use EMAS subject to an economic or cost benefit evaluation. A 600 foot long EMAS installation is considered by FAA to be equivalent to a full Runway Safety Area (RSA) built to the dimensional standards in US Federal Aviation Administration (FAA) Advisory Circular AC 150/5300-13, Airport Design.

The installation of Engineered Materials Arresting Systems (EMAS) was evaluated in detail for use at locations described in Factors (3) and (4). An evaluation process is included in Section 9 of US Order 5200.9, Financial Feasibility and Equivalency of Runway Safety Area improvements and Engineered Material Arresting Systems. Initially the EMAS program did not include operational data to indicate the arresting capabilities of EMAS for specific aircraft. Two major concerns were raised: Should runways be reduced in length to accommodate EMAS and should EMAS be installed on a runway which did not provide an acceptable length for the critical/design aircraft to operate at Maximum Takeoff Weight (MTOW) Installation of EMAS on a runway that is not adequate for MTOW operations may limit an airport's future development.

For Chuuk International Airport the use of EMAS could potentially reduce the length of useable runway. With the runway length already below the critical design aircraft MTOW it is not recommended that EMAS be used.

5.4.2 Object Free Area (OFA)

The runway OFA is "a two-dimensional ground area, surrounding runways, taxiways, and taxi lanes, which is clear of objects except for objects whose location is fixed by function (i.e., airfield lighting)." The OFA is centered on the runway, extending out in accordance to the critical aircraft design category utilizing the runway. For ARC C-III aircraft, the FAA calls for the OFA to be 800 feet wide (centered on the runway), extending 1,000 feet beyond each runway end. Runway 4-22 currently meets OFA standards.

5.4.3 Approach Surfaces and Runway Protection Zones

The approach surface and the runway protection zone are important elements in the design of runways that help insure the safe operations of aircraft. A brief description of these two areas is as follows:

- The approach surface is an imaginary inclined plane beginning at the end of the primary surface, and extending outward to distances up to 10 miles, depending on runway use. The approach surface governs the height of objects on or near the airport. Objects should not extend above the approach surface. If they do, they are classified as obstructions and must either be marked, lowered or removed.

- The runway protection zone (RPZ) is an area at ground level that provides for the unobstructed passage of landing aircraft through the above airspace. The runway protection zone begins at the end of the primary surface, and has a size which varies with the designated use of the runway.

Federal Aviation Regulation Part 77 indicates that the approach surface should be kept free of obstructions to permit the unrestricted flight of aircraft in the vicinity of the airport. As the approach to a runway becomes more precise, the approach surface increases in size, and the required approach slope becomes more restrictive. The existing and ultimate Part 77 surfaces for the runway are listed below in Table 5-9.

The runway protection zone is the most critical safety area under the approach path and should be kept clear of all obstructions. No structure should be permitted within the runway protection zone. It is therefore desirable that the airport owner acquire adequate property interests in the runway protection zone to insure compliance with the above. The required size of the runway protection zone is shown in Table 5-9.

Table 5-9. Runway Protection Zone

Runway Protection Zone			
	Runway End	4	22
	Approach Category	C	C
	Visibility Minimums	Greater Than 1 Mile	Greater Than 1 Mile
RPZ	Length – L	1,700 feet	1,700 feet
	Inner Width – W1	500 feet	500 feet
	Outer Width – W2	1,010 feet	1,010 feet
	Acres	29.5	29.5
Approach	Length	10,000 feet	10,000 feet
	Inner Width	500 feet	500 feet
	Outer Width	4,000 feet	4,000 feet
	Slope (H=Horiz., V+vert.)	34:1	34:1

Source: FAA AC 150/5300-13

5.5 TAXIWAYS REQUIREMENTS

FAA Advisory Circular AC 150/5300-13 provides taxiway and taxi lane criteria for pavement width, shoulder width and safety area width. The criteria also provide dimensions for the distance from the taxiway or taxilane centerline to any object. The dimensions for taxiways and taxi lanes serving Group III and Group IV aircraft are:

Table 5-10. Taxiway Requirements

Criteria	Required Width (Feet)		Centerline To Edge (Feet)	
	Group III Aircraft	Group IV Aircraft	Group III Aircraft	Group IV Aircraft
Pavement width	50	75	25	37.5
Shoulder width	20	25	45	62.5
Safety area width	118	171	59	85.5
Taxiway Object free area width	186	259	93	129.5
Taxilane Object free area width	162	225	81	112.5

Source: FAA AC 150/5300-13 Airport Design

There is one stub taxiway located towards the eastern end of the runway. The existing taxiway is 90 feet wide with 25-foot shoulders on all sides. There are two fillets with a radius of 125 feet between the runway and the taxiway and two fillets with a radius of 100 feet between the taxiway and the apron. The required width for ARC D-III taxiway is 50 feet, except for Group III airplanes with a wheel base greater than or equal to 60 feet, the standard taxiway width for these aircraft is 60 feet. This stub taxiway is sufficient for current and future operations at Chuuk International Airport.

a) <u>Taxiway Safety Areas</u>.

The taxiway safety area is centered on the taxiway centerline and is 118 feet wide for Group III aircraft and 171 feet wide for Group IV aircraft. Group III aircraft are aircraft having wingspans from 79 feet (24m) up to but not including 118 feet (36m). Group IV aircraft are those having wingspans from 118 feet (36m) up to but not including 171 feet (52m). The Boeing 737-800 aircraft is a group III aircraft and the B-757 is a group IV aircraft. The largest width is available at the Chuuk taxiway. Except for the twelve foot wide paved shoulders the entire safety area is unpaved. Plants grow on this surface and require constant mowing. The surface becomes soft during periods of heavy rain that extend over several days. Ruts have occurred when vehicles traverse this area during such times.

b) Taxiway Obstacle Free Areas.

There are two criteria that might apply to this taxiway. The taxiway object free area criteria require larger clearances than the taxi lane criteria. Taxi lane criteria are intended to apply to areas where the pilots are aware of limitations and are exercising greater care in maneuvering the aircraft. At Chuuk the plan will use the taxiway criteria dimensions since that width exists at this airport. The taxiway object free area width is 186 feet for Group III aircraft and 259 feet for Group IV aircraft. There are no objects within this area.

5.6 APRON REQUIREMENTS

The length of the existing bituminous paved apron is 512 feet and parallel to the runway centerline, and the width is 250 feet and parallel to the taxiway centerline. There are two Portland Cement Concrete (PCC) hardstands within the apron. The hardstands are 105 feet long parallel to the runway centerline and 105 feet wide parallel to the taxiway centerline. The apron has full safety and object free area clearances on three sides, but there are some small structures close to the edge of the apron on the terminal building side. There is a vehicle road from the apron to the terminal for use by the airline baggage and cargo vehicles. A fuel hydrant with an underground pipe is installed in both hardstands. Both hardstands are in use at this time.

a) Apron Safety Areas.

Except on the terminal building side there are no obstacles within 92 feet of the other three edges of the apron. When the ARFF building is completed this should be verified, as some items may be located on the concrete apron in front of the building. This means that assuming the aircraft centerline is at least 37.5 feet inside the edge of the apron, Category III and IV taxiway safety area criteria are met. Except for the twenty-five foot wide paved shoulders, the entire safety area is unpaved. Plants grow on this surface and require constant mowing. The surface becomes soft during periods of heavy rain that extend over several days. Ruts have occurred when vehicles traverse this area during these times. Vehicles crossing this area may track mud and objects onto the pavement.

b) Apron Object Free Areas

There are two criteria that might apply to the apron. The taxiway obstacle free criteria require larger clearances than the taxi lane criteria. Taxi lane criteria are intended to apply to areas where the pilots are aware of limitations and are exercising greater care in maneuvering the aircraft. Taxi lane criterion applies to the apron. The taxi lane obstacle free dimension width from the centerline used by the aircraft on the apron is 81 feet for Group III aircraft and 112.5 feet for Group IV aircraft. As noted above, when the ARFF building is completed this clearance dimension should be verified.

c) Apron Wingtip Clearances.

These criteria may be used for specific aircraft in specific locations. At Chuuk these criteria apply to the clearances from the aircraft to the objects on the apron. The required wingtip clearance for Group III aircraft is 21 feet and 27 feet for Group IV. This clearance is available at this airport.

5.7 PAVEMENT CONDITION INDEX

Proper maintenance of airfield pavements is considered an important part of airport safety and economic operation of airports. The Federal Aviation Administration (FAA) has also recognized the significant benefit of having some formal requirement for a pavement maintenance program at all airports and has encouraged airports to have such a program in place. The advantage of using a formal pavement maintenance program with regularly scheduled maintenance activity ensures that the cost of pavement maintenance is reduced and pavement performance optimized.

The MicroPAVER™ procedure describes the pavement condition by assigning a value from 0 – 100 to the represent the pavement condition. This value is known as the Pavement Condition Index (PCI) of the pavement. A brand new pavement is assigned a PCI of 100 at the time of completion. A major project, such as an overlay, is also assigned a PCI of 100. As each subsequent pavement survey is made, the information is used to compute a new PCI. Each individual airport can create its own standards, but the US Air Force guidelines recommend that localized preventive work should be continuous at all times. When the PCI declines to 70 global preventive maintenance work should be undertaken to inhibit further rapid deterioration. In the event the pavement declines to a PCI of 50, major rehabilitation projects should be undertaken.

Two maintenance surveys were conducted using MicroPAVER™, the first in 2010, the second in 2011, the runway PCI was calculated as 98 in 2010 and 95 in 2011.

5.8 AIRFIELD MARKINGS

Guidance for marking airfield pavements is set forth in AC 150/5340-1F, Marking of Paved Areas and Airports. As stated in the AC, "…runway and taxiway markings are essential for the safe and efficient use of airports, and their effectiveness is dependent upon proper maintenance to maintain an acceptable level of conspicuity."

a) Runway Markings:

The runway at Chuuk International Airport is presently marked as a precision instrument runway conforming to FAA and ICAO criteria. The markings were installed in December 2009. The basic elements comprising this type of marking are as follows:

- Marking colors (runway marking is white)
- Runway centerline marking
- Designation marking (runway end identity)
- Threshold marking
- Fixed distance marking (to inform pilot of remaining available pavement)
- Holding position markings (for taxiway/runway intersections)
- Touchdown zone markings (an aiming point usually 1,000 feet from the landing threshold)
- Side stripes (edge of runway)

Blast pads, stop ways, and paved safety areas must also be appropriately marked in accordance with the AC. It is emphasized that frequent maintenance is essential in assuring that pavement markings are clearly visible.

b) Taxiway Markings:

The current stub taxiway shall continue to be appropriately marked in accordance with the FAA Advisory Circular. These markings include:

- Marking colors (taxiway marking is yellow)
- Taxiway centerline marking
- Taxiway edge marking
- Holding position markings (at runway intersection)

The taxiway markings conform to current FAA criteria. The holding line marking and approach stripes were painted to the latest FAA criteria in December 2009.

c) Apron Markings:

The apron is presently marked with stripes to direct aircraft into and out of the two parking positions. The apron also has edge markings and shoulder markings that were repainted in December 2009.

5.9 AIRFIELD LIGHTING

Guidance for airfield lighting is set forth in FAA AC's 150/5340-4C, -19, and -24. These AC's refer to runway and taxiway edge lighting, runway and taxiway centerline lighting, and touchdown zone lighting. Airfield lighting is necessary to operate the airport during periods of darkness and low visibility due to inclement weather conditions.

The existing runway has Medium Intensity Runway Lighting (MIRL). An airport beacon (white/green) signifying a lighted land airport, and a lighted wind indicator/segmented circle are also part of the airfield lighting system. Runway lighting can be activated by the pilot via the CTAF frequency.

Under the TKK current capital improvement project, the airfield lighting is being updated to meet all design requirements.

5.10 AIRFIELD SIGNAGE

The Standard for Airport Sign Systems, AC 150/5340-18B is the guidance for signage on airports. There are three basic color-coded sign types that provide information to the pilots on the airfield. The three types are as follows:

- Mandatory instruction signs (intersections and critical areas)
- Information signs
- Runway distance remaining signs

Under TKK current capital improvement project the airfield signage is being updated to meet all design requirements.

5.11 AIRSPACE AND NAVIGATION AIDS

Enroute and terminal navigational aids help increase the overall airport and airway systems for VFR pilots, IFR pilots and the general public through increases in communications and in controlled aircraft separations. Typical enroute instrument aids include Nondirectional Radio Beacons (NDB), Very High Frequency Omnidirectional Range (VOR), and Distance Measuring Equipment (DME). Typical terminal area visual aids include Visual Approach Slope Indicators (VASI), Precision Approach Path Indicators (PAPI) and Runway End Indicator Lights (REIL).

The lack of visual and navigational aids at an airfield can limit the airport's ability to accommodate aircraft operations during periods of darkness and poor visibility associated with inclement weather. For this reason, an analysis of both visual aids (VISAIDS) and electronic navigational aids (NAVAIDS) is an important part of an airport's expansion planning.

a) Visual Aids (VISAIDS) to Navigation:

The current visual aids at Chuuk International Airport include:

- Runway End Identifier Lights (REIL) for both runways 4 and 22
- Precision Approach Path Indicators (PAPI) for both runways 4 and 22

These visual aids are connected to the airfield lighting circuit and can be activated by pilots in the area via an air to ground interface by utilizing the CTAF frequency. The full complement of airfield lighting and visual aids can be activated without need for on duty ground personnel. This level of airfield lighting and VISAIDS allows night flight operations.

b) Electronic Navigation Aids (NAVAIDS):

Chuuk International Airport is currently served with a single Non-Directional-Beacon (NDB) which is coupled with Distance Measuring Equipment (DME). There has been much discussion among airlines flying in this region, and FAA, regarding the desire to have additional navigational aids, specifically to provide better help with precision instrument approaches in the event of inclement weather.

CHAPTER 6: LAND USE PLAN

6.1 INTRODUCTION

The primary objective of the Airport Land Use Plan is to provide a review of the current land use and to develop guidelines for the future land use at and surrounding Chuuk International Airport. The Master Plan contains forecasts of aviation demand to help define the physical requirements for airport development over the next 20 years.

Unlike most airport master plans that look at airport compatible land use and ways to minimize the number of people exposed to frequent and/or high levels of airport noise or high cumulative noise levels, this chapter does not analyze the effect of noise level to the surrounding land use. With the limited number of scheduled and unscheduled operations per day at Chuuk International Airport, the noise level produced at the airport is negligible.

This chapter will examine the physical setting, existing land use, potential aviation related uses for airport lands and discuss the potential need to expand airport property. It will also focus on preserving the airport airspace to minimize the risk of potential aircraft accidents in the vicinity of the Airport by avoiding the development of land uses and land use conditions, which pose hazards to aircraft in flight.

6.2 PHYSICAL SETTING/ EXISTING LAND USE

Chuuk International Airport is located on a northwestern strip of the Island of Weno, just north of Mt. Tanaachau in the village of Iras. TKK is owned and operated by the Chuuk State Government as a Division of the State Department of Transportation and Public Works. Chuuk International Airport was constructed on existing coral fill over the reef and extensions. The surrounding area can best be defined as urban mixed use with a combination of residential, commercial, industrial, office, institutional, or other land uses near the airport. Chuuk State does not have any land use zoning or ordinances restricting the type of land use near or around the airport.

FIGURE 6-1. Aerial of Chuuk International Airport

6.3 POTENTIAL AVIATION RELATED USES FOR AIRPORTS LANDS

The following narrative discusses the various aviation related land use planned facilities, for airside, landside, and terminal that should be considered going forward. This discussion does not include the numerous FAA ACIP funded projects already completed, or in the construction phase, for Chuuk International Airport. These newly completed facilities, and those currently under construction, include:

- ARFF Facility and new ARFF Trucks
- Runway/Taxiway/Apron seal coat
- Airfield Lighting and Signage
- New Airport Perimeter Fence
- Airport Perimeter Road

The above mentioned facilities are either completed or being constructed. Additional facilities/upgrades are needed to ensure safety of operations and to ensure that forecasted aviation activity is supported going forward into the twenty year planning horizon. Following here is a summary of proposed aviation related land use facilities segregated into three areas: airside, terminal, and landside.

6.3.1 Airside

a) FAA/Chuuk State Electrical Vault/Engine Generator

Presently, the airport's electrical service is provided through an electrical vault located outside of the AOA. This vault contains both the Chuuk State equipment as well as the FAA electrical equipment and engine generator. Typically, it is preferable to have an airport's electrical vaults and switchgear located within the AOA for security and access reasons. The land use plan for Chuuk International recommends that this facility, which is old and in need of upgrading, be relocated within the AOA and co-located with the FAA vault for maintenance, serviceability, as well as limiting the footprint these facilities have given the scarcity of real estate on and near the airport area. The recommended location for the vault is within the AOA, adjacent to the ARFF facility. See Figure 6-2 Chuuk International Airport Land Use Plan Long Term.

b) Airport Workshop

Presently, there is no place for the airport maintenance staff to work on the various types of equipment needed to keep an international airport up and running. An enclosed workshop is recommended for the airport to help ensure that the equipment needed on a day to day basis is properly maintained and kept out of the (very corrosive) elements. The recommended location for the workshop is within the AOA area, in the ARFF compound. See Figure 6-2 Chuuk International Airport Land Use Plan Long Term.

c) AOA Access/Central Security Facility

The Land Use Plan Long Term, Figure 6-2, shows the recommended location of this combined AOA access and security facility located on the southern edge of the aircraft apron at the end of the public roadway entering the AOA area. This is an ideal location for both guard shack/entry control to the AOA as well as the conjoined facility for administration support.

d) Obstructions

An Obstruction Survey (OC) is being done for this airport. This will provide detailed information on all obstructions on and around the airport environment. Wherever practical, for example vegetation, these obstructions should be eliminated and/or mitigated. This will help to set the stage for GPS precision approach facilities as a beta site project for the airport, as is presently being done successfully on Guam in an FAA/Continental Airlines beta site project. In addition, it is recommended that the FSM National Government pursue legislation to prohibit any construction in the airport area that would create obstructions that could negatively impact air safety and/or the establishment of minima criteria for instrument let down procedures.

e) Runway Extension

Presently the useable runway length at Chuuk International is 6,000 feet. While this runway length is adequate to serve the B 737-800 aircraft currently flown by Continental Air Micronesia, the airline has requested additional runway length at FSM airports, wherever practical, given terrain and cost considerations. This request for additional runway length is based upon the desire for additional safety margins and the desire for higher payloads (cargo/fuel) that would result from a modest runway extension. The FSM system plan, which will become a stand-alone submittal for system wide assessment/recommendations of the overall aviation system in FSM, is in process. The system plan has assessed the runway lengths in FSM and will make the recommendation that for airfields where terrain and financial practicality allow, the optimal runway length, with the exception of Pohnpei International Airport, should be 6,500 feet. Unfortunately, the reef ledges off of both ends of the runway are relatively deep and the cost to extend the runway makes this proposition financially impractical.

f) Runway Safety Area

RSA standards are defined in AC 150/5300-13 section 305 and construction standards are found in AC 150/5370-10 P-152. According to AC 150/5300-13 section 503, the RSA must be centered on the same line as the center of the runway and the RSA must be cleared, graded and have no hazardous surface variations. For ARC D-III airports the RSA length must be 1,000 feet beyond the runway end, and its required width is 500 feet. The RSAs need to be lengthened to meet FAA requirements, the existing RSA are currently only 200 ft in length. FAA and ICAO have made standardizing RSAs to these dimensions a priority. The terrain and physical characteristics of Chuuk International Airport are such that an abbreviated, non-standard RSA has been accepted by FAA and ICAO and due to the financial impracticality involved with the extension of the runway and/or RSA, this situation will remain.

g) Shoreline Revetment/Protection

The airfield is protected by shoreline revetment, a combination of cast concrete dolos, large boulders and graded material. The goal of this revetment system is to protect the airfield area from erosion due to storm surf, tidal flows, etc. In the past decades, it has been observed that storm intensities have increased along with a rise in the base sea level elevations. It is prudent, at this time, to recommend an upgrade to this shoreline revetment system in order to further protect the airfield in light of the increased storm severity and rising ocean levels.

h) Drainage Canal

Presently, there is an open swale parallel to and south of the runway, that serves as a catchment for rainfall runoff from the runway and RSA areas. From this open swale, runoff flows to the ocean. This canal is a combination of concrete lined, in areas proximate to the terminal building, and unlined in areas away from the terminal. Typically, this is a workable situation as the unlined swale will function reasonably well and percolation of runoff water into the soil is not a problem and in some cases could be a plus. However, in the case of Chuuk, vegetation grows at an alarming rate and the unlined swales produce a maintenance nightmare. This point is somewhat difficult to communicate without being at the airport and seeing firsthand how quickly the vegetation takes over and secondly how difficult it is to clean/maintain the swale. It is recommended that the entire length of the unlined swale be lined with either rip-rap (cobble/grout) or by concrete.

6.3.2 Landside

Chuuk International Airport is physically constrained on all sides. The airside is bounded by the ocean on the north, west, and east, and the airport terminal and landside areas are bounded by the public highway that runs parallel to the runway. On the south, the AOA is defined by a perimeter fence adjacent to a public access road.

Due to these constraints, there are significant limitations to how, and where, the airport could feasibly increase its limited land area. Working with the airport management team, and exploring this issue in the field, there is fortunately one area that does lend itself to a modest increase in useable AOA space. This area is located to the south of the existing ARFF, which is presently defined by a perimeter fence and a public roadway. This area is actually airport property, all the way south to the existing canal.

It is recommended that this area be utilized for the airport, and developed in the following manner:

- Construct a new public access road adjacent to the existing canal, turning and connecting to the existing access road which provides access to the National Weather Service facility.
- Construct an airport perimeter fence along the boundary of this new road, thus enlarging the AOA area considerably.
- Provide public access to the ARFF parking area, and provide AOA access/control at the western edge of the ARFF facility.

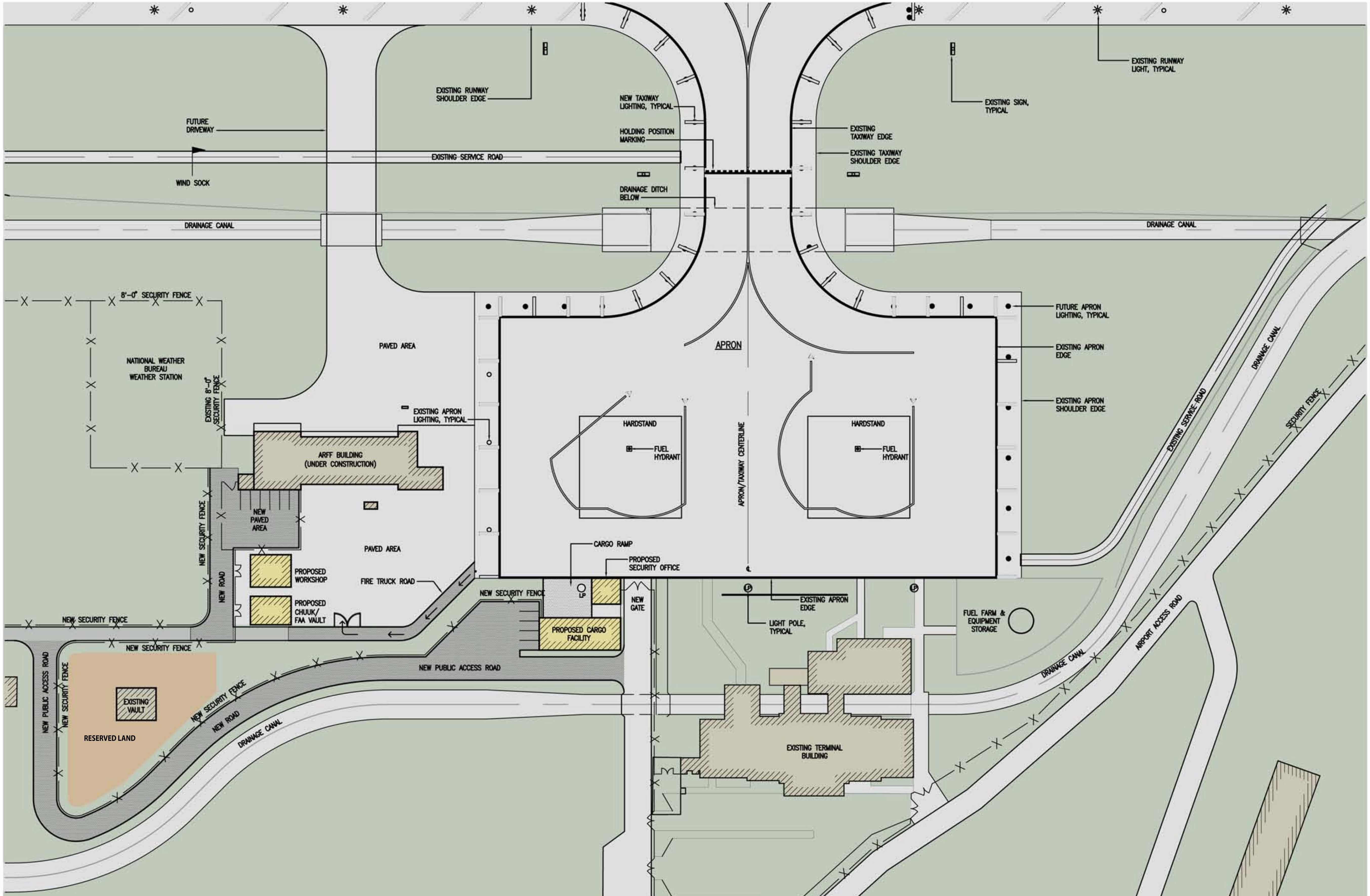
This will free up some much needed real estate for the airport's present and future use, and will also allow for facilities to be located in this area. See Figure 6-4 Chuuk International Airport Land Use Plan, Long Term. Specific elements of landside proposed improvements are now discussed here.

a) <u>New Mixed Use Cargo Facility</u>

The new public access road ties into the existing road which accesses the AOA and is an ideal location for a mixed use cargo facility. Presently, cargo storage is limited within the terminal building, and Continental needs more space for storage of outgoing cargo. A dedicated cargo ramp which has airside/AOA access is sited adjacent to the cargo facility, as is a public parking area, located outside the AOA.

b) <u>ARFF Truck Apron/Back Side Access Road</u>

It is important that the ARFF trucks have drive-through capability into and out of the ARFF structure. In other words, the trucks should be able to transit from the aircraft apron area then directly into the back side of the ARFF bays. The long term land use plan shows an access road for the ARFF trucks that will accomplish this. See Figure 6-2 Chuuk International Airport Long Term Land Use Plan. For the interim, the ARFF trucks will access the back side of the ARFF structure by using the existing public road which is outside of the AOA.



LONGTERM PLAN

100 0 100 200

SCALE: 1" = 100'–0"

CHUUK INTERNATIONAL AIRPORT
AIRPORT LAYOUT PLAN

FEDERATED STATES OF MICRONESIA
CHUUK STATE

LEO A DALY
PLANNING ARCHITECTURE ENGINEERING INTERIORS
EST. 1915
1357 Kapiolani Boulevard, Suite 1230
Honolulu, Hawaii 96814 USA
Tel 808-521-8889 Fax 808-521-3757

Job No. 081-10015-008
Date NOVEMBER 2010

LAND USE PLAN
LONG TERM

FIGURE 6-2

c) Private Landowner and Sand Quarry Business

Located on the southwestern corner of the airport, just south of the AOA and perimeter fence, is a single family home and a sand quarry. This area is very close to the AOA and it is recommended that the airport consider an acquisition of this property to ensure a margin of safety in terms of both proximity to aircraft operations, and to limit the dust and airborne particulates that may have impact on operations.

6.3.3 Terminal

The terminal building at Chuuk International Airport is in reasonably good shape and, given good overall maintenance, will be able to remain in service for a good number of years. As discussed in Chapter 4 Demand Capacity Analysis, the overall size/square footage of the terminal is appropriate and of proper scale given the passenger peak hour operations and frequency of flights into and out of Chuuk.

There are, however, some issues with the terminal's layout and internal use of space that, fortunately, can be improved via fairly inexpensive modifications. Figure 4-2 (Chapter 4 Demand Capacity) Chuuk International Airport Terminal Plan, gives an illustrative view of these recommended improvements, summarized here:

- Arrivals/Immigration: Presently, the arrivals and immigration function are in need of improvement as the queuing area for arriving passengers is limited. Figure 4-2 shows an expanded area for immigration/queue that will resolve this issue.
- Ticket Lobby/Check In Area: Presently, this area becomes congested during check in as the many functions of check in, payment of departure tax, etc are laid out in a manner that produces congestion. See Figure 4-2 which shows a rework of the area to increase ticketing areas, baggage make up areas, and better passenger flow between check in and payment of departure tax. Airline office areas are also reworked in this area.
- Passport/Immigration: Presently there is congestion around the immigration booth which could be mitigated by the arrangement shown on Figure 4-2.
- Security Screening: expanding this area will improve passenger throughput.

These modifications are reasonably low in cost and high in value, and it is recommended that they be implemented to improve the overall function of the terminal.

6.4 COMPATIBLE LAND USE

When looking at airport compatible land use, the major concern is that developments on, near or around the airport comply with accepted restrictions on location, height, and activities that provide for safe aircraft movement and airport operations. Particular areas near airports are vulnerable to various levels of accident potential. Identifying and protecting these specific areas through effective land use controls is essential for the safe and efficient operation of an airport.

Planning techniques are valuable tools in developing comprehensive land use around an airport. An effective planning technique is the use of zoning to protect the airport area. Two such techniques are Airport Overlay Zoning and Airport Development Zoning. An Airport Overlay Zone is a zone that promotes compatible land uses for specific distances around airports, and may apply additional conditions or restrictions to a specified area while retaining the existing zoning classification. This zone can be highly effective in addressing a number of potential incompatibilities with airports and airport operations. The Airport Overlay Zone can be used to limit the height of objects surrounding an airport, or restrict uses producing conditions that may be hazardous to air navigation (e.g., smoke and glare).

The Airport Development Zone is a zoning district that identifies outright and conditionally permitted uses on airport property. The zone should include areas used or needed for airport operations, areas needed for anticipated facility growth, airport-related industry and commercial operations and airport-related industrial, commercial or recreational activities.

Another effective tool is the use of local ordinances. Local ordinances give state authorities the jurisdictions to address potential land use incompatibilities through site plan review procedures and building code standards. In establishing zoning and ordinances, the authority to do so lies with the state government the airport needs to work closely with the State Planning and Land Use office to create and enforce zoning procedures.

Safety issues are a primary area of concern with compatible land uses. Areas around the airport should be free of development that could pose a hazard to pilots operating aircraft in the airport environments. Four primary characteristics of land use that reflect safety related issues are:

- High Concentrations of People
- Height Obstructions
- Visual Obstructions

- Wildlife and Bird Attractants

Chuuk International Airport has or is currently addressing these four primary areas of concern.

6.4.1 High Concentrations of People

High concentrations of people can be defined as the number of people within a particular land area and is often measured by the number of people per unit of area. Density may be categorized as high, medium, or low depending on the number of people that a development contains. TKK is located in the village of Iras. This area can best be classified as urban mixed use; the area surrounding the airport is heavily populated, and there are hotels, apartment buildings, residential houses, and stores on the southern end of the airport's property. As mentioned above it is important for airport management to work closely with the state government to enforce and establish new zoning and regulations to protect the airport from current and future incompliant land use.

Another helpful tool, especially in areas with a high concentration of people, is land acquisition. Land acquisition can be used to remove, lower or control existing land uses. As a preventive tool, acquisitions can take place to acquire property and easements prior to the development of a conflicting land use. Acquisition typically has two forms; fee simple acquisition or acquisition of easements. Each of these methods is discussed below.

- **Fee simple** acquisition is the process by which the airport purchases property from the existing property owner in its entirety, including the property and structures or facilities on the property, as well as the air and mineral rights. It should be noted that if land is purchased using U.S. FAA funds that the procedures in AC 150/5100-17 Change 3 must be followed.

- **Easement** may be used as an effective method of land use control to reduce incompatible land uses in the airport environs. One major advantage of easements is that they are usually permanent agreements, whereas zoning ordinances can be changed, thus impacting or changing the affect on the airport.

Land acquisition for Chuuk International Airport is a highly unlikely option, as the airport lacks the resources to purchase or lease land around the airport. Also land in Chuuk is extremely limited and valuable, and is rarely for sale. In many case the actual owners of the surrounding area is debatable as there are no official land records. Even with the TKK ability to acquire land, it is an important tool the airport should keep in mind if non- compatible land does become available.

6.4.2 Height and Visual Obstructions

An Obstruction Survey is currently under way at Chuuk International Airport in order to update the existing FAA/NOAA database on terrain at and near the airport environment. This data is routinely used to determine the minimum descent altitude (minimums) for published instrument approaches into the airport. NOAA (US Federal Agency) was previously responsible for data collection and providing obstruction surveys to the FAA. Under new guidelines, the FAA has taken responsibility for the new obstruction surveys and has developed guidelines for the survey. These guidelines include the need for aerial photography (photogrammetry) along with land based survey efforts.

Height restrictions are necessary to ensure that objects will not impair flight safety or decrease the operational capability of the airport. Federal Aviation Regulation (FAR) Part 77 defines a series of imaginary surfaces surrounding airports. Any objects or structure which would penetrate any of these imaginary surfaces is considered by the FAA to be an obstruction to air navigation. While an obstruction to air navigation may not necessarily be a hazard to air navigation, the FAA presumes it to be and treats is as such until an FAA aeronautical study has determined that it does not have a substantial adverse effect upon the safe and efficient use of navigable airspace by aircraft.

Federal Aviation Regulations (FAR) Part 77 imaginary surfaces to determine height restrictions for natural and man-made objects are as follows:

a) *Primary Surface*: A surface longitudinally centered along the runway, extending 200 feet beyond each end of the paved runway and having a total width of 250 feet.

b) *Horizontal Surface*: A horizontal plane 150 feet above the established airport elevation, the perimeter of which is constructed by scribing an arc 5,000 feet out from the center of each end of the primary surface and connecting the arcs with tangents.

c) *Conical Surface*: A surface extending outward and upward from the periphery of the horizontal surface at a slope of 20 to 1 for a horizontal distance of 4,000 feet.

d) *Approach Surface*: A surface longitudinally centered on the extended runway centerline, extending outward and upward from each end of the primary surface at a slope of 20 to 1 for a length of 5,000 feet. The width of this surface starts the same as the Primary Surface, 250 feet, and flares to 1,250 feet at 5,000 feet.

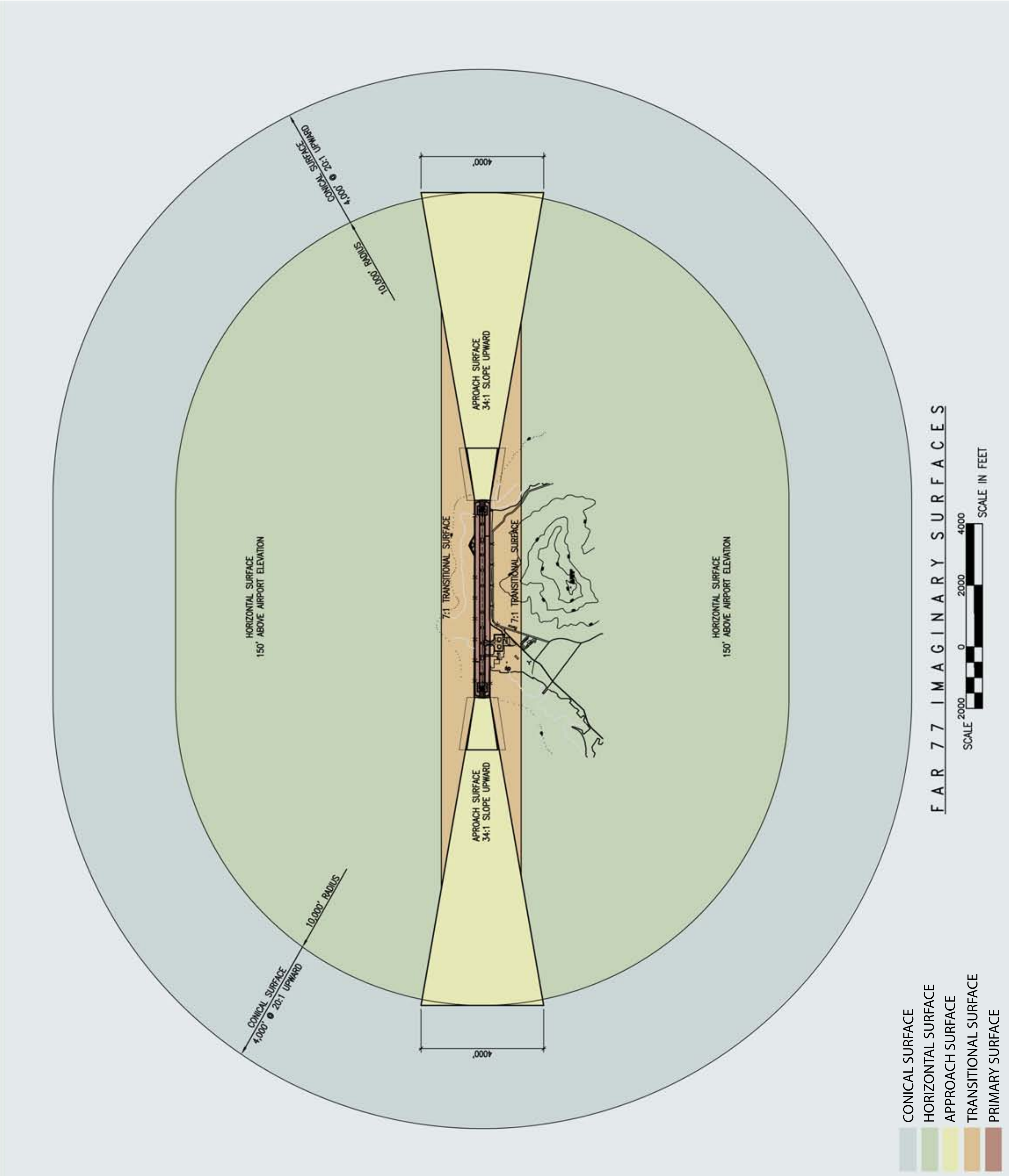
e) *Transitional Surface*: A surface extending outward and upward from the sides of the primary surface and from the sides of the approach surfaces at a slope of 7 to 1.

Figure 6-7 shows the FAR Imaginary Surfaces.

Visual obstructions are obstructions that obscure pilot visibility and should be limited to facilitate safe navigation. Visibility can be obscured by a number of items including: dust, glare, light emissions, smoke, and steam. TKK management needs to make sure that any activities that may cause issues with visibility are regulated and do not occur during aircraft approaches and departures.

6.4.3 Wildlife and Bird Attractants

Bird strikes to aircraft have land been a hazard to aviation safety. This issue is a growing concern for the island airports in the Western Pacific, with several recorded bird strikes within the last year. TKK, with the assistance of the United States Department of Agriculture (USDA), is in the process of developing a Wildlife Hazard Management Plan including a mitigation plan for the airport. Prior to the development of this plan, there will be a data collection phase (for 12 months) to gather actual data on types, quantity, and locations of birds on and near the airport. The Wildlife Hazard Assessment was approved by the FAA in June 2011; a completed Wildlife Management Hazard Plan will be completed by the middle of 2012.



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CHUUK INTERNATIONAL AIRPORT
FEDERATED STATES OF MICRONESIA

FIGURE 6-3. FAR 77 IMAGINARY SURFACES

CHAPTER 7: UTILITIES

A Facilities and Systems Maintenance Plan for Chuuk International Airport was recently completed, which covers existing structures, infrastructure, and supporting systems that are currently in place to facilitate airport operations. This Maintenance Plan identifies tasks, frequency and budget costs for implementation of the Plan to ensure that Chuuk International Airport can continue to safely operate and provide reasonable passenger accommodations at the current level of service.

This Utilities Chapter uses information from the Maintenance Plan to describe existing conditions and recommended routine maintenance. Unlike the Maintenance Plan, this section will also recommend ways to enhance airport operations, as well as proposals to fulfill future needs.

7.1 AIRPORT POWER

The Chuuk International Airport utility description may be divided into several components. Chuuk Public Utilities Corporation (CPUC) serves as the local utility company. CPUC provides energy to different portions of the airport complex independently. CPUC provides separate service and metering for:

1. The Airfield proper.
2. Federal Aviation Administration (FAA) facilities that support Airfield operations.
3. The Main Terminal Building.
4. The Aircraft Rescue and Firefighting Facility (ARFF).

In addition to normal utility (CPUC) supplied power, emerging generator backup power supplies need to be addressed to fully understand the power supply characteristics of the Chuuk International Airport Complex.

7.1.1 Airfield Electrical Systems Responsibilities

Responsibilities for electrical systems associated with airfield operations are divided between the Chuuk State, Federated States of Micronesia (FSM) and the U.S. Federal Aviation Administration (FAA). FAA systems are beyond the scope of work for planning purposes. The FAA is ultimately responsible for all systems.

FAA Electrical Systems Excluded From the Chuuk State Master Plan:

a) Precision Approach Path Indicator (PAPI)

b) Non-Directional Beacon (NDB)
c) Distance Measuring Equipment (DME)
d) Runway End Identifier Lights (REIL)
e) Aeronautical/Aerodrome Flight Information Service (AFIS) Radio and Antenna
f) NDB/DME Antenna Tower
g) FAA Engine – Generator Shelter located adjacent to the Chuuk State Airfield Lighting Vault supporting the PAPI and REIL power supplies including:
    1. Engine-generator set
    2. Automatic transfer / isolation-bypass switches
    3. Daytank
    4. Main Fuel tank

Chuuk State Maintained Electrical Systems:

a) Windsocks – multiple locations on the airfields: all the wind cones are equipped with floodlighting
b) Rotating Beacon – located southwest of the Airfield Lighting Vault
c) Series circuit regulator/constant current transformer for runway, threshold, and taxiway edge lights
d) Edge lighting which is provided for taxiway and the main runway; threshold lights which are provided at both ends of the runway.
e) Illuminated runway distance markers and directional signage are being utilized.
f) Aviation lighting system is energized from three series circuit regulators/constant current transformers. The set of three regulators/transformers are rated 10 kVA, 10 kVA, and 7.5 kVA, 208 volt, 60 Hz, single phase input with 4.8/5.5/6.6 ampere output current steps
g) There exists a fourth series circuit regulator/constant current transformer for airfield lighting that serves as an off-line spare
h) The series circuit for lighting system components that Chuuk State is responsible to maintain (versus FAA responsibility) is housed within the Chuuk State Airfield Lighting Vault that is located as an independent structure southwest from the Main Terminal Building and aircraft parking apron.

7.1.2 Airfield Lighting Vault

The Airfield Lighting Vault houses a generator room and electrical equipment room. The generator room houses a 125 kW/156 kVA Caterpillar generator set and ASCo automatic transfer switch. A CPUC (electric utility) 75 kVA pad mounted transformer is located beneath a roof overhang extending from the Airfield Lighting Vault. The secondary compartment of the transformer includes a 3P500A output circuit breaker, 500:5A current transformers for the electric utility billing meter, and billing meter 16578181 is mounted on the side of the transformer enclosure. The secondary output feeder is routed to the ASCo automatic transfer switch within the generator room and also to the FAA Engine – Generator Structure. The electrical room houses the power supplies and controls for airfield electrical and lighting systems.

7.1.3 Main Terminal Building Electrical Systems

a) Incoming Power Service

Incoming power from CPUC is delivered at 13.8 kV, 3 phase, 3 wire. Primary power (13.8 kV) is delivered to a pole top transformer bank located just inside the airport perimeter fence line at the west corner of the property, near the public roadway. A three 37.5-kVA each pole-top service transformer bank (112.5kVA total capacity) is used to step down from 13.8 kV to the 208Y/120 volts, 3 phase, 4 wire secondary distribution voltage.

A secondary service feeder is routed overhead two pole spans from the transformer bank pole in the direction of the Main Terminal Building, then underground to an out-of-service pad-mounted transformer that is used strictly as a junction box and instrument transformer enclosure for the utility meter that is attached to the exterior of the pad-mounted transformer. The CPUC revenue meter is identified as meter number 17872140.

b) Emergency Power Supply

A SDMO manufactured engine-generator set with weatherproof enclosure is located on a concrete equipment pad adjacent to the out-of-service pad-mounted utility transformer. The engine-generator set is rated 53kw/66kVA, 208Y/120volts, 3 phase, 4 wire. The engine-generator set does not have sufficient capacity to support the entire Main Terminal Building. However, a 15.5 kVA emergency bus loading was observed on the generator set instrumentation during a utility power outage at 11a.m., August 21, 2009.

Output power is routed from the engine-generator set to the Main Service Switchboard for the Main Terminal Building via an underground feeder. There is no centralized automatic transfer switch to alternate between normal utility power and emergency generator power. Instead, there are distributed transfer controls that select between normal power and emergency power buses at each set of branch circuit power panels that energize the facility. There exists a transfer switching master control panel for this purpose in the main electrical room, adjacent to the Main Service Switchboard.

c) Main Service Switchboard

The Main Service Switchboard is manufactured by GGD (Chinese manufactured) and located within a utility room at the southwest corner of the Main Terminal Building. The Main Service Switchboard receives incoming secondary service from the 112.5 kVA capacity pole top transformer bank described above.

The main switchboard has a 3P400A main circuit breaker for the normal utility power input bus. The Main Service Switchboard has a 3P200A main circuit breaker for the emergency power input bus supplied by the SDMO engine-generator set.

7.1.4 ARFF Electrical Systems

a) Incoming Power Service

Incoming power from CPUC is delivered at 13.8 kV, 3 phase via underground ductlines from a riser pole that is a part of the utility overhead primary distribution system across the gravel roadway fronting the ARFF site to a pad-mounted service transformer located within the ARFF compound. A pad-mounted 500 kVA service transformer is used to step down from 13.8 kV to the 208Y/120 volts, 3 phase, 4 wire secondary distribution voltage. CPUC secondary meter for billings is mounted on the exterior wall of the ARFF facility. 1200:5A current transformers are used by the meter to monitor electrical consumption. The current transformers monitor each phase of the secondary feeder cable sets.

b) Emergency Power Supply

Emergency power is supplied by an engine-generator set. The engine-generator set has a standby rating of 420 kW, 208Y/120 volts, 3 phase, 4-wire, 0.8 PF. The output from the engine-generator set is protected by a 3P1600A main circuit breaker that delivers power to the automatic transfer/isolation-bypass switch (ATS/ISO-BP) located within the main electrical room of the ARFF. The generator set is housed in a dedicated generator room. The engine-generator set supports the entire ARFF facility load. A fixed-mounted loadbank is installed in-line with the generator set radiator exhaust cowling. The loadbank is connected via a 3PI600A circuit breaker mounted along with the generator set output main circuit breaker.

c) Main Electrical Secondary Service

The main electrical secondary service is protected by a 3P1600A main circuit breaker. This main circuit breaker receives incoming service feeders from the pad-mounted transformer and sends normal utility power on to the ATS/ISO-BP located within the main electrical room. The secondary feeders from both the service disconnect switch and engine-generator set are fed through an automatic transfer/isolation-bypass switch. The ATS/ISO-BP is rated 4P1600A. Output power from the ATS/ISO-BP is routed to a Main Distribution Panel located adjacent to the ATS/ISO-BP within the main electrical room of the ARFF. The Main Distribution Panel utilizes circuit breakers to energize power panels and other significant loads of the ARFF facility.

7.2 TELECOM

a) Terminal Building

FSM Telecommunications Corporation is the local telephone utility company. There is no telephone EPBAX system utilized for administrative phones. Land line phones are located only at point of use.

b) ARFF Building

Telephone lines are derived directly from FSM Telecommunications Corporation.

7.3 POTABLE WATER / SANITARY SYSTEM / STORM WATER SYSTEM

7.3.1 Potable Water

The lack of an adequate water supply to the population of Weno Island is an issue of the highest priority within Chuuk State. A number of projects to improve water supply service on Weno Island, including the ADB-financed Water Supply and Sanitation Project, have not successfully addressed the island's need for water in terms of both quantity and quality.

a) Terminal Building

The utility company water meter is located along the roadway fronting the airport complex. A domestic water tank and water pump for pressurization of cold water piping to the Main Terminal Building exists at the west end of the facility, across the driveway from the baggage make-up areas.

Standard plumbing for building occupancy in use within the Main Terminal Building, consists of lavatories (7 each), water closets (11 each), and urinals (3 each). Water heating is not provided for general use within the Main Terminal Building. There is no rainwater catchment system used for the Main Terminal Building.

b) ARFF Building

Standard plumbing for building occupancy in use, consists of lavatories (6 each), kitchen/janitor/service sinks (5 each), water closets (3 each), and urinals (1 each). Water heating is provided for lavatories, sinks, and showers (3 each), as well as for the washing machines. A duplex potable water booster pump set is utilized to supply water to the ARFF facility. A rainwater harvesting storage tank and catchment water transfer pump are used to supplement the domestic water supply. A domestic water storage tank is used to ensure continuous supply of water to the ARFF facility.

7.3.2 Sanitary Sewer

Sanitary sewer lines are routed from the Main Terminal Building to a sewage collection piping system routed along the roadway fronting the airport complex. This sanitary sewer is connected to the island-wide sanitary sewer system.

7.3.3 Storm Water System

a) Runway Drainage Systems

Drainage is by sheet flow essentially perpendicular to the centerline of the runway. There are no paved or unpaved drainage ditches within the safety area dimensions. There are no underground drainage systems within the limits of the runway safety areas. The runoff is directed through the shore protection structure on the north and other locations where the shore protection exists. On the south side the drainage is collected by a system of drainage channels parallel to the runway and surrounding the terminal area.

b) Taxiway Drainage Systems

Drainage is by sheet flow. There are no paved or unpaved drainage ditches within the safety area dimensions. The open ditch that directs run-off under and away from the taxiway is outside the safety area requirements. There is a drain channel under the taxiway that conforms to safety area dimensions.

c) Apron Drainage Systems

Drainage is by sheet flow to the north and south sides. There are no paved, or unpaved drainage ditches, nor underground drainage systems within the limits of the apron safety areas.

d) Drainage Systems on Airside of the Terminal Building

The terminal building is lower than the apron edge, but grading diverts runoff away from the buildings. Portions of the vertical difference are accommodated with a retaining wall, and other portions are either graded with grass, or surfaced with paved roads or sidewalks. A drainage ditch separates the various portions of the terminal building. Most of the terminal building is on the far side of the ditch and away from the apron. The only larger portion on the apron side is the departure holding room. Portions of the terminal building span the ditch and are used for passenger processing

7.4 AIRCRAFT FUELING SYSTEM

Aircraft are serviced by an underground fuel system consisting of pipes, valves and hydrants. There is one fuel hydrant in each of the two concrete parking aprons. There is a fuel storage area with tanks, processing facilities and pumps located off the southeast corner of the apron. The FSM Petroleum Corporation maintains this facility. At some time in the future it will be necessary to replace the system.

7.5 SECURITY FENCING AND INTERNAL ACCESS ROADS

A new perimeter security fence was completed in the Fall of 2010 and an internal access road is under construction and should be complete by the end of 2011.

7.6 REMEDIAL WORK REQUIRED

a) Airfield

The out-of-service window air conditioning unit or out-of-service split air conditioning system for the electrical room needs to be replaced or suitably sized additional exhaust fans installed to ensure reasonable ambient temperature. Excessive heat is the primary contributor to accelerated electrical installation degradation.

The unprotected wall opening between the out-of-service window air conditioning unit and fan coil unit needs to be closed. Exposure of electrical equipment to wind driven rain and/or salt laden winds is extremely detrimental to the electrical installation.

The generator and electrical rooms are recommended to have emergency (battery backup) lighting installed. Emergency lighting will allow for cursory inspection, adjustment, and/or trouble-shooting in the event that generator power does not become available when there is a utility company outage.

Occupational Safety and Health Administration (OSHA) advocates a deluge shower and eyewash for maintenance involving hazardous chemicals. The starting batteries of the engine-generator set contain corrosive acid electrolyte fluid and, therefore, fall under this requirement. Installation of the deluge shower/eyewash immediately outside of the door to the generator room is suggested since unrestrained water within the generator room could pose a higher level shock hazard.

b) Main Terminal Building

The out-of-service split air conditioning system within the baggage claim area needs to be repaired to help maintain comfort cooling for arriving passengers.

c) ARFF Facility

As the ARFF facility will be new construction, there should not be a need for any remedial work. As the ARFF facility will be under warrantee, there should be little need for routine maintenance other than janitorial services.

Over the long term, maintenance needs to be performed in accordance with procedures prescribed in the operations and maintenance documentation required by the construction specifications of the ARFF facility.

7.7 FUTURE NEEDS

a) Airport Main Power Vault

It is recommended that the Chuuk State power vault be replaced as the only viable means to address code issues and extended power outage issues. Having reached that recommendation, it then becomes advisable to locate the new vault within the AOA to protect it from public access. Such a location will have the additional benefit of reducing the feeder run lengths from the power vault out to airfield loads, thus increasing reliability with such shorter cable lengths. The maintainability of the new vaults will also be enhanced by its new proximity to other airport facilities with similar maintenance requirements.

Similarly, it is suggested that FAA likewise consider relocating its power vault adjacent to the proposed Chuuk State power vault. Doing so will allow for restoring the cross-connection redundancy between engine-generator sets. Since the FAA is also considering installation of a new non-directional beacon inside of the AOA, it too will reduce feeder lengths for energizing the beacon and thereby enhancing the reliability of that FAA installation. FAA equipment supporting the airfield itself (PAPI, REIL, etc.) will likewise benefit.

The output circuits from both the Chuuk State and FAA power vaults are routed between the ARFF construction site and the east end of the aircraft parking apron. Handholes in that area have been identified as convenient interception points for any circuits that need to be reconnected to the new vaults. Locating these new vaults in this area would thereby minimize construction costs.

b) Landside Fire Hydrants

The new terminal and adjacent buildings are significantly different than when the original ones were installed. It is suggested that multiple fire hydrants be placed on the edge of the vehicle parking lot area, adjacent to and south of the terminal complex. Placing the hydrants in this location would aid the fire department's efforts in handling a fire in the terminal complex.

c) Paving the Western Portion of the Drainage Ditches

The drainage ditch is paved from approximately its midpoint to the eastern end. From that point west the ditches are unpaved. It would be desirable to pave the entire ditch. The paving of the east ditch is four inches thick Portland Cement Concrete with small reinforcing mats. The estimated volume of concrete to completely pave all the ditches is 4,000 cubic yards. This can be built in stages or as one project.

Reasons to pave the ditches are: tall bamboo plants grow rapidly in the ditch. Within a month they get fairly dense and tall. These plants provide shelter for birds and other animals as well as blocking drainage. The density of the bamboo is such that an intruder or even relatively large groups of persons or materials could hide on the airfield inside the security fence. Constant maintenance and clearing are essential. When the airfield was first opened it was possible to drive anywhere on the safety area. Now that the ditch retards water runoff, the safety area is wet more often and rutting is common.

d) Access Roads

The airport should be prepared to take any necessary action to properly connect the airport roads, including the parking lot roads, to the public road being constructed at this time. It is understood that the public road project does take this connection into account in its plans, but should problems arise it may be necessary for the airport to remedy the problems. Of particular concern is the western end road that leads to the AOA, although this road is a public road, and much of the use is by others than the airport. At the present time much of this road is unpaved and subject to rutting, potholes, mud and debris. This presents a serious potential for tracking rocks and other objects onto the paved airfield pavements. This debris can result in damage to aircraft and engines causing Foreign Object Damage (FOD).

f) Terminal

At Chuuk International Airport, the issue of energy consumption and related costs is a major concern. The monthly costs for electricity and diesel fuel for the airport's generators are so great that the airport cannot afford to operate and staff itself appropriately. While this situation is not unique to Chuuk, the recent terminal modifications (enclosing the terminal areas, adding air conditioning, etc.) have increased operational costs and aggravated this situation. It is also recommended that the terminal be more closely studied to develop a strategy aimed at reducing the electrical usage given the fact that the monthly utility bills are simply not affordable for the airport, and this situation is about to get dramatically worse once the ARFF is in service. A green energy study of the terminal is strongly recommended. This study should include the following elements:

- Reduction of air conditioned spaces and more reliance on open air ventilation.
- Increase of roof insulation.
- Use of energy saving lighting units (LED)
- Use of heat resistant window tints.

Figure 7-1 shows short term improvements to help the airport reduce it energy consumptions.

7.8 CONSIDERATIONS AFFECTING EXISTING FACILITIES

The state of the local economy is the main issue affecting the airport's existing facilities. According to state law, 50% of all revenue produced by the airport is to be returned to the airport and used for maintenance and operations. With Chuuk's increasing state debt, however, the revenue allocated to the airport is not always available, or when available, the airport does not receive the full 50% needed to manage and maintain the airport.

ZONE 1
1) Remove all A/C units
2) Remove all windows and replace as appropriate with a metal screen material, operable window, or leave completely open
3) Improve air circulation & ventillation by installing fans in ceilings to draw warm air into the interstitial space between the ceiling and the roof structure above
4) Install automatic timers on light fixtures in Arrivals Lobby

ZONE 2
1) Remove all A/C units
2) Remove all windows and replace as appropriate with a metal screen material, operable window, or leave completely open
3) Install ceiling fans
4) Install motion sensors on light fixtures

ZONE 3
1) Install motion sensors on light fixtures
2) Replace all plumbing fixtures with low-flow type fixtures

ZONE 4
1) Install automatic timers on light fixtures in Arrivals Lobby
2) Install ceiling fans

ZONE 5
1) Install ceiling fans

ZONE 6
1) Remove all A/C units
2) Remove all windows and replace as appropriate with a metal screen material, operable window, or leave completely open
3) Improve air circulation & ventillation by installing fans in ceilings to draw warm air into the interstitial space between the ceiling and the roof structure above
4) Install automatic timers on light fixtures in Departures Lounge

ZONE 7
1) Install Motion Sensors on light fixtures
Note: A/C to remain

ZONE 8
1) Install motion sensors on light switches
2) Replace all plumbing fixtures with low-flow type fixtures

ZONE 9
1) Install Motion Sensors on light fixtures
Note: A/C to remain

ADDITIONAL
Further exploration to determine the feasibility of photovoltaic or wind powered electricity generation

CHUUK INTERNATIONAL AIRPORT
FEDERATED STATES OF MICRONESIA

FEDERATED STATES OF MICRONESIA

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SCALE: 1/16"=1'-0"

PROJECT #081-10015-008

SHORT TERM SUSTAINABILITY IMPROVEMENTS

FIGURE 7-1

CHAPTER 8: ENVIRONMENTAL INVENTORY

8.1 INTRODUCTION

The purpose of considering environmental factors in airport master planning is to identify the potential key environmental impacts of the various airport development alternatives so that those alternatives can, when possible, avoid or minimize impacts on sensitive resources. The environmental review should provide information that will help expedite subsequent environmental processing.

8.2 GENERAL CONDITIONS

The general conditions look at the current state of Chuuk's environment.

8.2.1 History/Culture

Chuuk means mountain in the Chuukese language and was known mainly as Truk (a mispronunciation of Ruk), until 1990. Based on archaeological material found near one of the lagoon islands, people have inhabited Chuuk for about 2,000 years. Chuuk legends refer to the first inhabitants as having come from Kosrae, about 1300 km to the east. The inhabitants were initially coastal dwellers who produced simple undecorated pottery, but about 1500 years ago this disappeared from the archaeological record. Over time settlement patterns changed and people moved to hill slopes and onto mountain tops. The Chuukese from the outer atolls were recognized as great navigators using outrigger sailing canoes to sail to the lagoon and other islands.

The first Europeans, the Spanish, arrived in 1565, 34 years after Magellan passed by on his first voyage. The Chuuk Islands were visited occasionally by 19th-century traders and whalers and were included in the German purchase of parts of Micronesia from Spain in 1899 but were annexed by Japan in 1914 during World War I. Chuuk was ideally situated, half way between the Philippines and Hawaii, and became Japan's principal naval supply station for both merchant and military shipping during World War II. By 1944 there were over 40,000 Japanese civilian personnel living and working on Chuuk. Over 1,000 war and supply ships were moored there and a total of five airfields supported close to 500 aircraft.

In February 1944, Operation Hailstorm, a surprise Allied aerial attack, caught the Japanese by surprise sinking much if not all of the Japanese ships and aircraft to the bottom of Chuuk Lagoon.

These wrecks are the basis of Chuuk's tourism industry today. Following the war Chuuk, along with the rest of Federated States of Micronesia, became a Trust Territory of the US until independence in 1986.

8.2.2 Air Quality

Observations indicate that Chuuk has good air quality, experiencing excellent visibility throughout the year. In the major urban areas the air quality is affected by industry and automobiles, while, in the rural areas there is little to no air pollution. Chuuk's consistent trade winds, remote location, and absence of major air polluting activities, suggest high air quality. The air quality in Weno is good. Sources for air pollution in the area are emissions from cars and dust from the roadway.

8.2.3 Water Quality

According to the US DOI, the State Government's inability to provide adequate funding for the provision of a reliable and safe water supply has meant routine functions such as disinfection of water prior to distribution and routine maintenance are no longer undertaken. Consequently, water supply wells have progressively failed and the water delivered by the Weno Water Supply is not potable.

Septic tank and pit toilets discharge directly into the shallow aquifers that underlie the island and are a major contributor to groundwater contamination. Household wells are generally shallow and intercept contaminated groundwater. As a result, diarrhea, particularly amongst infants, and cholera are common.

8.2.4 Terrestrial Environment

The many islands of Chuuk are fringed with mangroves that support an abundant and diverse biodiversity. The fertile high islands contain native trees and plants including breadfruit, coconuts, mango, banana, and taro that, in association with the marine life, have supported a subsistence lifestyle for the Chuukese for many years

8.2.5 Marine Environment

Chuuk lagoon has a diameter of over 30 miles. Within the lagoon, there are 18 volcanic fringing reef islands and 17 channels that dissect the perimeter reef of the lagoon. The lagoon is the home of many Japanese warships that sank during World War II. The coral reefs are species rich. These reefs are highly beneficial for they provide food and other products that are vital to the people of Chuuk. This biodiversity is still high within the Chuuk reefs but face many man made threats.

8.2.6 Land Use

a) Traffic:

The traffic in Weno, especially in the urban area surrounding the airport, is extremely congested. Traffic is caused by severe deterioration of the roadway.

b) Noise:

The noise level in Weno varies from place to place, but for the most part its noise level is quite low. In the more developed areas, the noise is similar to any small urban area. The majority of the noise is caused by traffic and local business. In rural areas there is barely any noise. There is no real noise from traffic to speak of and local businesses are limited to small family-operated stores.

8.3 POSSIBLE IMPACTS TO ENVIRONMENT

8.3.1 Methodology for Assessing Impacts

This section looks at the environmental impacts of proposed actions, reasonable alternatives to that action, and environmental effects that cannot be avoided should the proposed actions be implemented. It is required that consideration of impacts includes the context, intensity, duration, type and measures to mitigate impacts.

Impacts are considered at their local, national, and regional context as appropriate.

Intensity is a measurement of the severity of an impact. The intensity of an impact may be:

- *Negligible* – when the impact is at its lowest level of detection
- *Minor* – when the impact is low but detectable
- *Moderate* – when the impact is evident and considerable
- *Major* – when the impact is severe

The duration of an impact is a measure of how long the effects of an impact will last. The duration of impacts are categorized as short-term and long- term.

- *Short term* – impacts that last less than a year
- *Long term* – impacts that last longer than a year

Types of impact

- *Adverse* – impacts that change the affected environment in a manner tending away from the natural range of variability
- *Beneficial* – impacts that change the affected environment toward the natural range of variability
- *Direct* – impacts caused by the action and occur at the same time and place
- *Indirect*– impacts caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable
- *Cumulative* – impacts on the environment resulting from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

8.3.2 Potential Impacts

The following section takes a generic look at possible environmental impacts that may result from the proposed capital improvements recommended by this Master Plan. There will be a need, however, to complete coordination with federal, state, and local agencies when the recommended projects are initially designed. Without mitigation or implementation of an environmental management plan, environmental impacts can occur during both construction and operation of major infrastructure projects. Such impacts are widely documented and are summarized in the matrix shown as Table 8-1.

TABLE 8-1. Potential Impacts Caused by Capital Improvement Projects

Construction Activities	Potential Environmental Impact
Surveying and demarcation of work site	• Loss of vegetation and disruption of historical sites • Social impact on to nearby population
Earth moving activities (digging, excavations, cut and fill activities)	• Accidental discovery of archaeological assets, sites or resources • Soil erosion, silt generation and increased runoff • Sediment contamination of nearby water ways (ocean, rivers, and streams) • Turbidity in near-shore and reef environments • Loss of land uses
Contractor mobilization	• Wastes generated at construction camps • Various social impacts
Aggregate extraction	• Removal of corals damages reefs and depletes marine resources • Removal of beach gravels removes shoreline protection, changes littoral drift and accelerates erosion • Dust generated affects air quality • Noise creates negative effect on community
Vehicle Operation (machinery, trucks, etc.)	• Emission of exhaust from vehicles and machinery • Dust generated by heavy vehicles transporting materials • Traffic delays • Noise pollution
Run-off, discharges	• Increased siltation • Water pollution –streams, rivers, ocean • Hazardous effects to marine life
Emergency or accidental spills	• Soil contamination • Potential contamination of water supply sources such as groundwater • Risk to people and animals • Air pollution

8.4 FEDERAL AND STATE LAWS

The Federated States of Micronesia national government is responsible for setting minimum standards and providing technical assistance to the state level agencies responsible for environmental protection. The following is a summary of environmental laws that may have an effect on capital improvement projects at Chuuk International Airport.

8.4.1 Federated States of Micronesia

a) Environmental Protection Act:

“. . . declares that it is the continuing policy of the Federated States of Micronesia, in cooperation with State and municipal governments, and other concerned public and private organizations, to use all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of the Federated States of Micronesia."

b) Environmental Impact Assessment Regulations:

"The purpose of these regulations is to implement Section 13 of the Federated States of Micronesia Environmental Protection Act by establishing standard procedures for preparation of an environmental impact assessment statement prior to taking or funding any major action that may significantly affect the quality of the human environment. The environmental impact assessment (EIA) process is intended to help the general public and government officials make decisions with the understanding of the environmental consequences of their decisions, and take actions consistent with the goal of protecting, restoring, and enhancing the environment."

- Endangered Species Act:

"The Endangered species Act of the Trust Territory of the Pacific Islands was incorporated into the Code of the FSM. Title 23, Chapter 3. Section 303 of the FSM Code states that: "…the indigenous plants and animals of the Trust Territory (FSM) are of esthetic, ecological, historical, recreational, scientific, and economic value and it is the policy of the Government of the Trust Territory (FSM) to foster the well-being of these plants and animals by whatever means necessary to prevent the extinction of any species or subspecies from FSM islands or the water surrounding them."

- Earthmoving Regulations:

All earthmoving activities within the Federated States of Micronesia shall be conducted in accordance with these regulations and in such a way as to prevent erosion and accelerated sedimentation. To accomplish this, all persons engaging in earthmoving activities shall design, implement, and maintain erosion and sedimentation control measures which effectively prevent accelerated erosion and accelerated sedimentation. The erosion and sedimentation control measures must be set forth in a plan, must be available at all times at the site of the project, and must be filed with the Department.

8.4.2 State of Chuuk

According to Chuuk State EPA, Chuuk State environmental laws are the same as the laws passed by the National Government.

8.4.3 United States

United States regulations and laws may be applicable for projects that are funded by United States' grants and loans. Listed below are potential environmental regulations that may affect future projects.

a) National Environmental Policy Act:

As implemented by the Council on Environmental Quality (CEQ) regulations (40 Code of Federal Regulations [CFR] 1500-1508), and FAA orders 5050.4B NEPA Instructions for Airport Actions and 1050.1E Environmental Impacts - Policies and Procedures analyzes the potential impact(s) of the Proposed Action and reasonable alternatives. It is intended to provide sufficient evidence and analysis for determining whether to prepare a Finding of No Significant Impact or an Environmental Impact Statement (EIS).

b) Historic Sites Act of 1935:

The Historic Sites Act of 1935 (16 USC 461-467) established a national policy for the preservation of historic resources, including sites and buildings. This Act led to the establishment of the National Historic Landmarks program and forms the basis for the Historic American Building Survey/Historic American Engineering Record, a National Park Service (NPS) program that establishes standards for conducting architectural and engineering documentation.

c) National Historic Preservation Act:

The National Historic Preservation Act (NHPA) of 1966, as amended (16 USC 470), recognized the nation's historic heritage and established a national policy for the preservation of historic properties as well as the National Register of Historic Places (NRHP). Section 106 of the NHPA requires agencies to take into account the effects of undertakings on historic properties, and affords the Advisory Council on Historic

Preservation (ACHP) and the State Historic Preservation Officer (SHPO) a reasonable opportunity to comment on such undertakings. The Section 106 process, as defined in 36 CFR §800, provides for the identification and evaluation of historic properties, for determining the effects of undertakings on such properties, and for developing ways to resolve adverse effects in consultation with consulting parties.

d) Endangered Species Act:

The Endangered Species Act (ESA), as amended (16 USC 1531 *et seq.*), establishes a process for identifying and listing plant and animal species. It requires all Federal agencies to carry out programs for the conservation of federally listed endangered and threatened plants and animals. It also prohibits actions by Federal agencies that would likely jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of designated critical habitat. Section 7 of the ESA requires Federal agencies proposing actions that may affect listed species or critical habitats to first consult with the U.S. Fish and Wildlife Service to ensure that they do not jeopardize listed species or destroy critical habitat.

e) Department of Transportation Act, Section 4(f):

Section 4(f) of the Department of Transportation Act does not allow: "[U]se of any publicly owned land from a public park, recreation area or wildlife and waterfowl refuge of national, state, or local significance or land of an historic site of national, state or local significance as determined by such officials unless (1) there is no feasible and prudent alternatives to the use of such land and (2) such program includes all possible planning… to minimize harm resulting from such use."

CHAPTER 9: AIRPORT LAYOUT DRAWING SET

The Airport Layout Plan (ALP) is a set of drawings that show improvements recommended by this Master Plan. In addition to the proposed airport improvements, the ALP set also shows existing runways, taxiways, airport property boundary, and other existing facilities. The ALP set includes a number of individual drawings. Several of these drawings are required while others may be included in the ALP set to provide detailed drawings that provide a clear picture of recommended capital improvement. Information that is usually included are drawings that show runway details and data, approach and departure profiles, airspace protection surfaces, obstruction information, terminal area plans, land-use information and airport property maps. The ALP is prepared in conformance with the FAA's AC 150/5070-6B, "Airport Master Plans." The FAA provides guidance in the development of the ALP set and is responsible for review and approval of the ALP set.

- Title Sheet –Contains approval signature blocks, airport location maps, and other pertinent information as required by the FAA.
- Airport Layout Plan – illustrates the existing and future airport facilities. The drawing also includes required facility identifications, description labels, imaginary surfaces, runway protection zones, runway safety areas and basic airport and runway data tables.
- Airport Surfaces: Airport Airspace/ Inner Portion of the Approach Surface – 14 CFR Part 77, Objects Affecting Navigable Airspace, define this as a drawing depicting obstacle identification surfaces for the full extent of all airport development. It also should depict airspace obstructions for the portions of the surfaces excluded from the inner portion of the approach surface drawing.
- Terminal Area Layout– Consists of two drawings showing current and planned improvements, presenting a large-scale depiction of areas with significant terminal facility development.
- Land Use Plan Existing and Land Use Plan Proposed. On and off airport drawings that depict the land uses within and adjacent to the airport property boundary.
- Airport Property Map – A drawing depicting the airport property boundary, the various tracts of land that were acquired to develop the airport, and the method of acquisition.

CHAPTER 10: CAPITAL IMPROVEMENT PROGRAM

The Capital Improvement Program (CIP) represents a phasing and cost estimate for implementing the airport improvements that emerged from the AMP process. The CIP is divided into three phases: short-term (2010-2015), near term (2016-2020), and long-term (2021-2030). The CIP must be viewed as a constantly evolving document. Planning for Chuuk International Airport should remain flexible and should incorporate annually updated estimates of costs and priorities. The CIP is structured in a manner that presents a logical sequence of improvements, while attempting to reflect available funding from available sources to the airport. Such as loans and grants from various foreign agencies.

Projects in the ACIP respond to FAA's emphasis on the following goals:

- Ensure that the air transport of people, services and goods is provided in a safe and secure environment.
- Preserve and upgrade the existing airport system in order to allow for increased capacity as well as to ensure reliable and efficient use of existing capacity.
- Improve the compatibility of airports with the surrounding communities.
- Provide sufficient access to an airport for the majority of the population.

Using these emphases, key development projects for the airport's future have been identified and developed. In summary, these projects address existing demands and projected demands on the airport. The initial project phase addresses many pressing issues on the airside or airfield, and follows a program of development which focused on the landside, i.e., terminal area, new passenger parking and circulation, and other needed improvements. They are currently several capital improvement projects that are under construction or recently completed. The following is a list of these projects:

- Air Rescue/Fire Fighting Facility (completed, 2011)
- Perimeter Fence (completed, 2010)
- Upgrades to Airfield Lighting & Signage (completed, 2010)
- Runway Seal Coat & Marking Upgrade (completed, 2010)
- Perimeter AOA Road (under construction, est. completion 2012)

10.1 Facilities Phasing Plan

The planning horizon for this master plan update is 20 years with 5, 10 and 20-year milestones shown in Table 10-1.

Table 10-1. Facilities Phasing Plan

Phase	Year
Phase I	2012 to 2016
Phase II	2017 to 2021
Phase III	2022 to 2031

The overall phasing and scheduling of developments mentioned in this chapter are a merging of Chuuk International Airport's existing Capital Improvement Program and the recommended facilities and projects that are the output of this Airport Master Plan Update. A cursory review of the CIP project listing, indicates a significant 'front loading' of recommended projects within Phase I, representing the years 2012 to 2016.

For Chuuk International Airport, a variety of airfield upgrades and improvements will need to be undertaken to improve the basic infrastructure and provide additional measures of safety to support ongoing aircraft operations. Both the Phase 2 and Phase 3 projects provide the Airport with an outlook of future needs, but as they move into the near term horizon they need to be re-assessed as demand changes or funding sources are better defined.

For airfield upgrade and infrastructure projects, the recommended early phasing of these types of projects is primarily due to the anticipated life span of the FAA ACIP program. This program, implemented by the FAA Airports Division, has literally transformed the airports in the Federated States of Micronesia in terms of bringing up the level of airport infrastructure, airfield paving, signage/lighting, ARFF facilities and trucks, and various training programs to transfer expertise and technical skills to the staff and management of these airports and public works sectors.

Order-of-magnitude engineering costs were developed for each of the master plan projects and can be found in the tables below. The cost estimates associated with the Master Plan projects reflect allowances for Sponsor administration, engineering/design, contingencies, and construction management of 30%. In addition, project costs include an assumption of 5% simple interest to account for future inflation in Phase 2 and Phase 3 projects. . A schedule for the complete Capital Improvement Plan is shown in Table 10-6.

10.2 Phase 1 Improvements (2012 – 2016)

Phase 1 development consists of the following capital projects:

- Electrical Vault (Chuuk State/FAA collocated)
- Remove/Mitigate Obstructions: Approach and Airfield Environment
- Shoreline Revetment Upgrade
- Pave Existing Drainage Swale
- New Public Access Road and New AOA Perimeter Fence
- ARFF Truck Access Road: Apron to Backside of ARFF
- Terminal Area Vehicle Parking Lot & Area Lighting
- Fire Hydrants: Public (Landside) Of Terminal Building
- Central Security/AOA Access Facility

Table 10-2. Capital Improvement Program – Phase 1 (2012-2016)

Projects	Cost (US Dollars)
Electrical Vault (Chuuk State/FAA collocated)	$1,300,000
Remove/Mitigate Obstructions: Approach and Airfield Environment	$130,000
Shoreline Revetment Upgrade	$1,950,000
Pave Existing Drainage Swale	$2,600,000
New Public Access Road and New AOA Perimeter Fence	$3,250,000
ARFF Truck Access Road: Apron to Backside of ARFF	$650,000
New Airport Parking Lot and Lighting Upgrade	$585,000
Fire Hydrants: Public (Landside) Of Terminal Building	$97,500
Central Security/AOA Access Facility	$195,000
Total	**$10,757,500.00**

10.3 Phase 2 Improvements (2017 – 2021)

Phase 2 development consists of the following capital projects:

- Remove/Mitigate Obstructions: Approach and Airfield Environment
- Runway Rehabilitation
- GPS Precision Approach
- LED Upgrade for Airfield Lighting
- Maintenance Workshop/Yard

- Mixed Use Cargo Facility

Table 10-3. Capital Improvement Program – Phase 2 (2017-2021)

Project	Cost (US Dollars)
Remove/Mitigate Obstructions: Approach and Airfield Environment	$217,500
Runway Rehabilitation	$43,500,000
GPS Precision Approach	$580,000
LED Upgrade for Airfield Lighting	$725,000
Maintenance Workshop/Yard	$362,500
Mixed Use Cargo Facility	$870,000
Total	$46,255,000.00

10.4 Phase 3 Improvements (2022 – 2031)

Phase 3 development consists of the following capital projects:

- Remove/Mitigate Obstructions: Approach and Airfield Environment
- Runway Seal Coat and Airfield Marking Upgrades
- Upgrades to Airfield Lighting & Signage
- ARFF Rehabilitation
- Terminal Rehabilitation

Table 10-4. Capital Improvement Program – Phase 3 (2022-2031)

Projects	Cost (US Dollars)
Remove/Mitigate Obstructions: Approach and Airfield Environment	$262,500
Runway Seal Coat and Airfield Marking Upgrades (X2)	$3,500,000 ($1,750,000 per)
Upgrades to Airfield Lighting & Signage	$2,625,000
ARFF Rehabilitation	$5,250,000
Terminal Rehabilitation	$3,500,000
Total	**$15,137,500**

10.5 Capital Improvement Plan Total Cost (2012 -2031)

The following is a breakdown of the total cost of the Airport Capital Improvement Plan

Table 10-5. Capital Improvement Program Total Cost (2012-2031)

Capital Improvement Program 2012-2031	
Phase 1	$10,757,500
Phase 2	$46,690,000
Phase 3	$15,137,500
Total	**$72,585,000.00**

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FIGURE 10-1. CAPITAL IMPROVEMENT PROGRAM SCHEDULE