

APPENDIX E

Air Quality Calculations and Modeling



Summary	Summarizes total emissions by calendar year for Modified Alternative 1 - Construction Phase (Saipan).
Combustion and Evaporative	Estimates emissions from non-road equipment exhaust and evaporative volatile organic compound emissions.
Fugitive	Estimates particulate emissions from construction activities including earthmoving, vehicle traffic, and windblown dust.
Grading	Estimates the number of days of site preparation, to be used for estimating heavy equipment exhaust and earthmoving dust emissions.
Construction Commuter	Estimates emissions for construction workers commuting to the site.
Haul Truck On-Road	Estimates emissions from hauling construction materials to the project site.

Summary of Air Quality Emissions from Divert EIS - Modified Alternative 1 - Construction Phase (Saipan)

	NO_x (ton)	VOC (ton)	CO (ton)	SO₂ (ton)	PM₁₀ (ton)	PM_{2.5} (ton)	CO₂ (ton)
Construction Combustion/Evaporative	6.39	0.94	2.75	0.41	0.44	0.43	738.47
Construction Fugitive Dust	-	-	-	-	48.52	3.88	-
Construction Commuter	0.49	0.60	6.99	0.01	0.02	0.01	437.30
Haul Truck On-Road	13.36	1.24	7.14	0.04	0.43	0.41	3,464.53
TOTAL	20.24	2.79	16.89	0.46	49.41	4.72	4,640.30

Annual Summary of Air Quality Emissions from Divert EIS - Modified Alternative 1 - Construction Phase (Saipan)*

	Point and Area Sources Combined						
	NO_x (tpy)	VOC (tpy)	CO (tpy)	SO₂ (tpy)	PM₁₀ (tpy)	PM_{2.5} (tpy)	CO₂ (metric tons)
CY 01	6.75	0.93	5.63	0.15	16.47	1.57	1,403.20
CY 02	6.75	0.93	5.63	0.15	16.47	1.57	1,403.20
CY 03	6.75	0.93	5.63	0.15	16.47	1.57	1,403.20

* Construction duration is estimated to be 36 months and the emissions are assumed to be distributed evenly over the construction period.

Combustion and Evaporative Emissions - Modified Alternative 1 - Construction Phase (Saipan)

Combustion Emissions of VOC, NO_x, SO₂, CO, PM_{2.5}, PM₁₀, and CO₂ due to Construction

Assumptions

When multiple options exist under the general construction activities the most conservative value will be used to quantify air emission.

General Construction Activities	Area Disturbed (ft ²)
Construct Maintenance Facility	6,100 ft ²
Construct Airport/Seaport Fuel Storage (operational, Bulk and at the Port of Saipan)	324,958 ft ²
Construct Fuel Hydrant System	161,172 ft ²
Construct Hazardous Cargo Pad	250,470 ft ²
Construct Parking Apron	502,682 ft ²

Total General Construction Area:	1,245,382 ft ²	28.6 acres
Total Demolition Area:	0 ft ²	0.0 acres
Total Pavement Area:	502,682 ft ²	11.5 acres
Total Disturbed Area:	1,245,382 ft ²	28.6 acres
Construction Duration:	36 months	
1 Yr Project Construction Activity:	240 days/yr	Assume 12 months, 4 weeks per month, 5 days per week.

Emission Factors Used for Construction Equipment

References: Guide to Air Quality Assessment, Sacramento Metropolitan Air Quality Management District (SMAQMD), 2004; and U.S. EPA NONROAD Emissions Model, Version 2005.0.0. Emission factors are taken from the NONROAD model and were provided to HDR by Larry Landman of the Air Quality and Modeling Center (Landman.Larry@epamail.epa.gov) on 12/14/07. Factors provided are for the weighted average US fleet for CY2007. Assumptions regarding the type and number of equipment are from SMAQMD Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd. ^a per 10 acres	NO _x (lb/day)	VOC ^b (lb/day)	CO (lb/day)	SO ₂ ^c (lb/day)	PM ₁₀ (lb/day)	PM _{2.5} (lb/day)	CO ₂ (lb/day)
Bulldozer	1	13.60	0.96	5.50	1.02	0.89	0.87	1456.90
Motor Grader	1	9.69	0.73	3.20	0.80	0.66	0.64	1141.65
Water Truck	1	18.36	0.89	7.00	1.64	1.00	0.97	2342.98
Total per 10 acres of activity	3	41.64	2.58	15.71	0.83	2.55	2.47	4941.53

Paving

Equipment	No. Reqd. ^a per 10 acres	NO _x (lb/day)	VOC ^b (lb/day)	CO (lb/day)	SO ₂ ^c (lb/day)	PM ₁₀ (lb/day)	PM _{2.5} (lb/day)	CO ₂ (lb/day)
Paver	1	3.83	0.37	2.06	0.28	0.35	0.34	401.93
Roller	1	4.82	0.44	2.51	0.37	0.43	0.42	536.07
Truck	2	36.71	1.79	14.01	3.27	1.99	1.93	4685.95
Total per 10 acres of activity	4	45.37	2.61	18.58	0.91	2.78	2.69	5623.96

Demolition

Equipment	No. Reqd. ^a per 10 acres	NO _x (lb/day)	VOC ^b (lb/day)	CO (lb/day)	SO ₂ ^c (lb/day)	PM ₁₀ (lb/day)	PM _{2.5} (lb/day)	CO ₂ (lb/day)
Loader	1	13.45	0.99	5.58	0.95	0.93	0.90	1360.10
Haul Truck	1	18.36	0.89	7.00	1.64	1.00	0.97	2342.98
Total per 10 acres of activity	2	31.81	1.89	12.58	0.64	1.92	1.87	3703.07

Building Construction

Equipment ^d	No. Reqd. ^a per 10 acres	NO _x (lb/day)	VOC ^b (lb/day)	CO (lb/day)	SO ₂ ^c (lb/day)	PM ₁₀ (lb/day)	PM _{2.5} (lb/day)	CO ₂ (lb/day)
Stationary								
Generator Set	1	2.38	0.32	1.18	0.15	0.23	0.22	213.06
Industrial Saw	1	2.62	0.32	1.97	0.20	0.32	0.31	291.92
Welder	1	1.12	0.38	1.50	0.08	0.23	0.22	112.39
Mobile (non-road)								
Truck	1	18.36	0.89	7.00	1.64	1.00	0.97	2342.98
Forklift	1	5.34	0.56	3.33	0.40	0.55	0.54	572.24
Crane	1	9.57	0.66	2.39	0.65	0.50	0.49	931.93
Total per 10 acres of activity	6	39.40	3.13	17.38	3.12	2.83	2.74	4464.51

Architectural Coatings

Equipment	No. Reqd. ^a per 10 acres	NO _x (lb/day)	VOC ^b (lb/day)	CO (lb/day)	SO ₂ ^c (lb/day)	PM ₁₀ (lb/day)	PM _{2.5} (lb/day)	CO ₂ (lb/day)
Air Compressor	1	3.57	0.37	1.57	0.25	0.31	0.30	359.77
Total per 10 acres of activity	1	3.57	0.37	1.57	0.25	0.31	0.30	359.77

- The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.
- The SMAQMD 2004 reference lists emission factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC. The NONROAD model contains emissions factors for total HC and for VOC. The factors used here are the VOC factors.
- The NONROAD emission factors assume that the average fuel burned in nonroad trucks is 1100 ppm sulfur. Trucks that would be used for the Proposed Actions will all be fueled by highway grade diesel fuel which cannot exceed 500 ppm sulfur. These estimates therefore over-estimate SO₂ emissions by more than a factor of two.
- Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

Combustion and Evaporative Emissions - Modified Alternative 1 - Construction Phase (Saipan) - Continued

Project-Specific Combustion and Evaporative Emission Factor Summary

Source	Equipment Multiplier*	Project-Specific Emission Factors (lb/day)						
		NO _x	VOC	CO	SO ₂ **	PM ₁₀	PM _{2.5}	CO ₂
Grading Equipment	3	124.924	7.731	47.130	2.498	7.637	7.407	14824.579
Paving Equipment	1	45.367	2.606	18.578	0.907	2.776	2.693	5623.957
Demolition Equipment	1	31.808	1.886	12.584	0.636	1.923	1.865	3703.074
Building Construction	1	39.396	3.130	17.382	3.116	2.829	2.744	4464.512
Air Compressor for Architectural Coating	1	3.574	0.373	1.565	0.251	0.309	0.300	359.773
Architectural Coating**			46.893					

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project.

**Emission factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994

Example: SMAQMD Emission Factor for Grading Equipment NO_x = (Total Grading NO_x per 10 acre)*(Equipment Multiplier)

Summary of Input Parameters

	Total Area (ft ²)	Total Area (acres)	Total Days	
Grading:	1,245,382	28.59	6	(from "Grading" worksheet)
Paving:	502,682	11.54	55	
Demolition:	0	0.00	0	
Building Construction:	331,058	7.60	240	
Architectural Coating:	331,058	7.60	20	(per SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative. The 'Total Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition. The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Project Combustion and Evaporative Emissions by Activity (lbs)

	NO _x	VOC	CO	SO ₂	PM ₁₀	PM _{2.5}	CO ₂
Grading Equipment	749.54	46.39	282.78	14.99	45.82	44.44	88,947
Paving	2,495.20	143.31	1,021.81	49.90	152.69	148.10	309,318
Demolition	-	-	-	-	-	-	0
Building Construction	9,455.12	751.15	4,171.75	747.92	678.97	658.60	1,071,483
Architectural Coatings	71.48	945.33	31.31	5.02	6.19	6.00	7,195
Total Emissions (lbs):	12,771.34	1,886.18	5,507.65	817.84	883.66	857.15	1,476,943

Results: Project Annual Combustion and Evaporative Emission Rates

	NO _x	VOC	CO	SO ₂	PM ₁₀	PM _{2.5}	CO ₂
Total Project Combustion and Evaporative Emissions (lbs)	12,771.34	1,886.18	5,507.65	817.84	883.66	857.15	1,476,943
Total Project Combustion and Evaporative Emissions (tons)	6.39	0.94	2.75	0.41	0.44	0.43	738.47

Construction Fugitive Dust Emissions - Proposed Action [Modified Alternative 1 - Construction Phase (Saipan)]

Construction Fugitive Dust Emission Factors

	Emission Factor	Units	Source
General Construction Activities	0.19	ton PM ₁₀ /acre-month	MRI 1996; EPA 2001; EPA 2006
New Road Construction	0.42	ton PM ₁₀ /acre-month	MRI 1996; EPA 2001; EPA 2006
PM_{2.5} Emissions			
PM _{2.5} Multiplier	0.10	(10% of PM ₁₀ emissions assumed to be PM _{2.5})	EPA 2001; EPA 2006
Control Efficiency	0.50	(assume 50% control efficiency for PM ₁₀ and PM _{2.5} emissions)	EPA 2001; EPA 2006

Project Assumptions

New Roadway Construction (0.42 ton PM₁₀/acre-month)

Duration of Construction Project	12 months
Area	11.5 acres

General Construction Activities (0.19 ton PM₁₀/acre-month)

Duration of Construction Project	12 months
Area	17.1 acres

	Project Emissions (tons/year)			
	PM ₁₀ uncontrolled	PM ₁₀ controlled	PM _{2.5} uncontrolled	PM _{2.5} controlled
New Roadway Construction	58.16	29.08	5.82	2.91
General Construction Activities	38.87	19.44	1.94	0.97
Total	97.04	48.52	7.76	3.88

Construction Fugitive Dust Emission Factors

General Construction Activities Emission Factor

0.19 ton PM₁₀/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The area-based emission factor for construction activities is based on a study completed by the Midwest Research Institute (MRI) Improvement of Specific Emission Factors (BACM Project No. 1), March 29, 1996. The MRI study evaluated seven construction projects in Nevada and California (Las Vegas, Coachella Valley, South Coast Air Basin, and the San Joaquin Valley). The study determined an average emission factor of 0.11 ton PM₁₀/acre-month for sites without large-scale cut/fill operations. A worst-case emission factor of 0.42 ton PM₁₀/acre-month was calculated for sites with active large-scale earth moving operations. The monthly emission factors are based on 168 work-hours per month (MRI 1996). A subsequent MRI Report in 1999, Estimating Particulate Matter Emissions From Construction Operations, calculated the 0.19 ton PM₁₀/acre-month emission factor by applying 25% of the large-scale earthmoving emission factor (0.42 ton PM₁₀/acre-month) and 75% of the average emission factor (0.11 ton PM₁₀/acre-month). The 0.19 ton PM₁₀/acre-month emission factor is referenced by the EPA for non-residential construction activities in recent procedures documents for the National Emission Inventory (EPA 2001; EPA 2006). The 0.19 ton PM₁₀/acre-month emission factor represents a refinement of EPA's original AP-42 area-based total suspended particulate (TSP) emission factor in Section 13.2.3 Heavy Construction Operations. In addition to the EPA, this methodology is also supported by the South Coast Air Quality Management District as well as the Western Regional Air Partnership (WRAP) which is funded by the EPA and is administered jointly by the Western Governor's Association and the National Tribal Environmental Council. The emission factor is assumed to encompass a variety of non-residential construction activities including building construction (commercial, industrial, institutional, governmental), public works, and travel on unpaved roads. The EPA National Emission Inventory documentation assumes that the emission factors are uncontrolled and recommends a control efficiency of 50% for PM₁₀ and PM_{2.5} in PM nonattainment areas.

New Road Construction Emission Factor

0.42 ton PM₁₀/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The emission factor for new road construction is based on the worst-case conditions emission factor from the MRI 1996 study described above (0.42 tons PM₁₀/acre-month). It is assumed that road construction involves extensive earthmoving and heavy construction vehicle travel resulting in emissions that are higher than other general construction projects. The 0.42 ton PM₁₀/acre-month emission factor for road construction is referenced in recent procedures documents for the EPA National Emission Inventory (EPA 2001; EPA 2006).

PM_{2.5} Multiplier

0.10

PM_{2.5} emissions are estimated by applying a particle size multiplier of 0.10 to PM₁₀ emissions. This methodology is consistent with the procedures documents for the National Emission Inventory (EPA 2006).

Control Efficiency for PM₁₀ and PM_{2.5}

0.50

The EPA National Emission Inventory documentation recommends a control efficiency of 50% for PM₁₀ and PM_{2.5} in PM nonattainment areas (EPA 2006). Wetting controls will be applied during project construction.

References:

- EPA 2001. *Procedures Document for National Emissions Inventory, Criteria Air Pollutants, 1985-1999*. EPA-454/R-01-006. Office of Air Quality Planning and Standards, United States Environmental Protection Agency. March 2001.
- EPA 2006. *Documentation for the Final 2002 Nonpoint Sector (Feb 06 version) National Emission Inventory for Criteria and Hazardous Air Pollutants*. Prepared for: Emissions Inventory and Analysis Group (C339-02) Air Quality Assessment Division Office of Air Quality Planning and Standards, United States Environmental Protection Agency. July 2006.
- MRI 1996. *Improvement of Specific Emission Factors (BACM Project No. 1)*. Midwest Research Institute (MRI). Prepared for the California South Coast Air Quality Management District, March 29, 1996.

Grading Schedule - Proposed Action [Modified Alternative 1 - Construction Phase (Saipan)]

Estimate of time required to grade a specified area.

Input Parameters

Construction area: 28.6 acres/yr (from Combustion Worksheet)
 Qty Equipment: 9.0 (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions

Terrain is mostly flat.
 An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.
 200 hp bulldozers are used for site clearing.
 300 hp bulldozers are used for stripping, excavation, and backfill.
 Vibratory drum rollers are used for compacting.
 Stripping, Excavation, Backfill and Compaction require an average of two passes each.
 Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	28.59	3.57
2230 500 0300	Stripping	Topsoil & stockpiling, adverse soil	1,650	cu. yd/day	2.05	0.49	28.59	13.98
2315 432 5220	Excavation	Bulk, open site, common earth, 150' haul	800	cu. yd/day	0.99	1.01	14.30	14.41
2315 120 5220	Backfill	Structural, common earth, 150' haul	1,950	cu. yd/day	2.42	0.41	14.30	5.91
2315 310 5020	Compaction	Vibrating roller, 6" lifts, 3 passes	2,300	cu. yd/day	2.85	0.35	28.59	10.03
TOTAL								47.91

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr: 47.91
 Qty Equipment: 9.00
 Grading days/yr: 5.32

Construction/Staff Commuter Emissions - Modified Alternative 1 - Construction Phase (Saipan)

Emissions from construction workers commuting to the job site are estimated in this spreadsheet.

Emission Estimation Method: Air Force Civil Engineer Center (AFCEE), Air Emissions Factor Guide to Air Force Mobile Sources, October 2014.

Assumptions:

Passenger vehicle emission factors for scenario year 2015 are used.
 The average roundtrip commute for a construction/staff worker = 40 miles
 Number of construction days = 240 days
 Number of construction/Staff workers (daily) = 75 people

Note: None

Personal Operating Vehicle (POV) On-Road Emission Factors for Year 2016 (grams/mile)

NO _x	VOC	CO	SO ₂	PM ₁₀	PM _{2.5}	CO ₂
0.614	0.759	8.810	0.010	0.025	0.011	551.000

Source: Emission factors for all pollutants are from Table 5-28: On-Road Vehicle Emission Factors - 2016 POV, Gasoline Light Duty Trucks (LDGT) at low altitude, within AFCEE Air Emissions Factor Guide to Air Force Mobile Sources, October 2014.

Construction Commuter Emissions

	NO _x	VOC	CO	SO ₂	PM ₁₀	PM _{2.5}	CO ₂
lbs	974.603	1204.762	13984.127	15.873	39.683	17.460	874603.175
tons	0.487	0.602	6.992	0.0079	0.0198	0.0087	437.302

Example Calculation: NO_x emissions (lbs) = 60 miles/day * NO_x emission factor (lb/mile) * number of construction days * number of workers

Construction/Haul Truck Emissions - Modified Alternative 1 - Construction Phase (Saipan)

Emissions from hauling construction supplies, demolition debris, fill, and excavated material are estimated in this spreadsheet.

Emission Estimation Method: Air Force Center for Environmental Excellence (AFCEE) Air Emissions Factor Guide to Air Force Mobile Sources, Dec. 2009.

Concrete Mixing and Dump Truck Assumptions:

Dump trucks carry 11 cubic yards of material per trip.

Concrete mixing trucks carry 10 cubic yards of material per trip.

The average distance from the port to Commercial Concrete Supply Company is 7 miles; therefore, dump trucks will travel 14 miles round trip.

The average distance from the Commercial Concrete Supply Company (CCSC) to the project site is 2 miles; therefore, concrete trucks will travel 4 miles round trip.

Fill Materials Assumptions:

Haul trucks carry 20 cubic yards of material per trip.

The average distance from the project site to the materials source is 20 miles; therefore, building material haul trucks will travel 40 miles round trip.

Estimated number of trips required by haul trucks = total amount of material/20 cubic yards per truck

Amount of demolition debris =	0 cubic yards	No Demolition in the Proposed Action
Amount of cement transported from port to CCSC =	1,122 cubic yards	
Amount of concrete transported from CCSC to project site =	17,980 cubic yards	
Amount of Excavation Materials for New Buildings =	553,503 cubic yards	Construction area multiplied by depth of disturbance which is assumed to be 12 feet.
Amount of Building Materials =	415,127 cubic yards	Construction area multiplied by 9 feet.
Number of dump trucks required (port to CCSC) =	102 heavy duty diesel haul truck trips, Cells rounded up	
Number of concrete mixing trucks required (CCSC to project site) =	1798 heavy duty diesel haul truck trips, Cells rounded up	
Number of trucks required (Building Materials) =	48,432 heavy duty diesel haul truck trips	
Miles per trip (port to CCSC) =	14 miles	
Miles per trip (CCSC to project site) =	4 miles	
Miles per trip (Building Materials) =	40 miles	

Low Altitude Heavy Duty Diesel Vehicle 8b (HDDV8b) Average Emission Factors (grams/mile)

	NO _x	VOC	CO	SO ₂	PM ₁₀	PM _{2.5}	CO ₂
HDDV8b	6.23	0.58	3.33	0.02	0.2	0.19	1615

Notes:

Emission factors for all pollutants are from Appendix A - On-Road Vehicle Emission Factors within AFCEE Air Emissions Factor Guide to Air Force Mobile Sources, Dec. 2009. Emission factors from calendar year 2015 were used assuming the average vehicle model year is 2005.

HDDV8b Haul Truck Emissions

	NO _x	VOC	CO	SO ₂	PM ₁₀	PM _{2.5}	CO ₂
lbs	26,726.10	2,488.14	14,285.38	85.80	857.98	815.08	6,929,051.32
tons	13.36	1.24	7.14	0.04	0.43	0.41	3,464.53

Example Calculation: NO_x emissions (lbs) = 40 miles per trip * 48,432 trips * NO_x emission factor (g/mile) * lb/453.6 g

No Statistical Area Available for GSN

Row #	State	County	Tier-1	Point Source Emissions					Area Source Emissions (Non-Point and Mobile Sources)					
				CO	NO _x	PM ₁₀	PM _{2.5}	SO ₂	VOC	CO	NO _x	PM ₁₀	PM _{2.5}	SO ₂
No Data Available														
Grand Total				0	0	0	0	0	0	0	0	0	0	0

SOURCE:

<http://www.epa.gov/ttn/chief/eiinformation.html>

USEPA - AirData NET Tier Report

*Net Air pollution sources (area and point) in tons per year (2002)

Site visited on 02 February 2012.

No Air Quality Control Region Identified

	CO	NO _x	PM ₁₀	PM _{2.5}	SO ₂	VOC
CNMI	0	0	0	0	0	0
CNMI DEQ	0	0	0	0	0	0

- Summary** Summarizes total emissions by calendar year for Modified Alternative 1 - Implementation Phase (Saipan).
- Airfield Operations** Airfield operations consist of taxi, take-off and landings (sorties/LTOs), touch-and-go operations (TGOs), and low flybys (LFB) by aircraft.
- Fuel Truck and Commuter Vehicle Emissions** Estimates emissions for workers and operational vehicles commuting to the site of the Proposed Action.
- Fuel Transfer Emissions** Fuel loading operations under the Proposed Action involves the loading of fuel into tanker trucks and aircraft.
- Internal Combustion Engine (ICE) Emissions** Estimates Emissions from Internal Combustion Engines (e.g Generators)
- Fuel Storage Tanks** Estimates emissions from Above Ground Storage Tanks.

Criteria Pollutant and VOC Emissions Summary for Modified Alternative 1 - Implementation Phase (Saipan) (tons/year)

Source Category	PM10	PM2.5	CO	NOx	SOx	VOCs
Airfield Operations	0.055	0.053	18.672	6.771	0.982	1.246
Fuel Truck and Commuter Vehicle Emissions	0.017	0.013	0.189	0.367	0.001	0.032
Fuel Transfer	N/A	N/A	N/A	N/A	N/A	0.008
Fuel Storage Tanks	N/A	N/A	N/A	N/A	N/A	1.190
Total Criteria and VOC Pollutant Emissions (tons/year)	0.07	0.07	18.86	7.14	0.98	2.48

Greenhouse Gas (GHG) Emissions Summary for Modified Alternative 1 - Implementation Phase (Saipan) (metric tonnes/year)

Source Category	CO ₂ -equivalent (lb/year)	CO ₂ -equivalent (kg/year)	CO ₂ -equivalent (metric tonne/year)
Airfield Operations*	8,833,755	4,006,991	4,007
Fuel Truck and Commuter Vehicle Emissions	205,537	93,232	93
Fuel Transfer	0	0	0
Fuel Storage Tanks	0	0	0
Total GHG Emissions	9,039,293	4,100,223	4,100

DATA - Airfield Operations for Modified Alternative 1 - Implementation Phase (Saipan)

Aircraft exercises under this alternative are based on assuming 2 to 4 KC-135R aircraft operating up to 8 weeks per year for a maximum of 720 KC-135R operations per year. Each operation is equivalent to one landing or one take-off (1 LTO Cycle = 2 operations).

Landing and Takeoff (LTO) Cycles

Description	Quantity
# of KC-135R LTO's per year	360

Legend

Airfield Activity Data (Worst Case Scenario)

Aircraft Model	Aircraft Model Used to Match to Available Emission Factors	Engine Model	# Engines	APU Model	# APUs	Noise	LTO Cycles
KC-135R	KC-135-R	F108-CF-201	4	No data on APUs		See below	360

Note: F108-CF-201 is the military designation of the CFM56-2B-1 engine.

Emission Factors (EFs) and Constants - Airfield Operations for Modified Alternative 1 - Implementation Phase (Saipan)

Aircraft Criteria Pollutant Emission Factors

Aircraft Model	Engine Model	# Engines	Reference Thrust Mode	LTO/TGO Thrust Mode	Fuel Flow (lb/hr)	Emission Factors in lb Pollutant per 1000 lb Fuel Burned						
						PM10	PM2.5	CO	NO _x	SO ₂	VOCs	TIM
KC-135R	F108-CF-201	4	Idle	Idle	1016	0.06	0.06	30.70	4.00	1.06	2.10	47.7
KC-135R	F108-CF-201	4	Approach	Approach	2468	0.06	0.05	4.20	8.20	1.06	0.09	5.2
KC-135R	F108-CF-201	4	Climbout	Climbout	6500	0.05	0.05	0.90	16.00	1.06	0.06	1.6
KC-135R	F108-CF-201	4	Takeoff	Takeoff	7818	0.07	0.06	0.90	18.05	1.06	0.05	0.7

Emission factors from Air Force Civil Engineer Center (AFCEC) October 2014 Air Emissions Guide for Air Force Mobile Sources, Table 2-8

APU Emission Factors

Aircraft Model	# APU	APU Model	APU Emission Factors in lb Pollutant per hour						APU (hr)
			PM10	PM2.5	CO	NO _x	SO ₂	VOCs	
KC-135R			No Data Available.						

Emission Factors (EFs) and Constants - Airfield Operations for Modified Alternative 1 - Implementation Phase (Saipan)

Default Time-in-Mode

Aircraft Type	Typical Duration by Mode (minutes)					
	Taxi/Idle-out	Takeoff	Climbout	Approach	Taxi/Idle-in	Total
KC-135R	32.8	0.7	1.6	5.2	14.9	55.2

Default Time-in-Mode rates are from AFCEC October 2014 Air Emissions Guide for Air Force Mobile Sources, Table 2-4

Emission Factors (EFs) and Constants - Airfield Operations for Modified Alternative 1 - Implementation Phase (Saipan)

Greenhouse Gas Emission Factors

Units	CO ₂	CH ₄	N ₂ O
kg/gal fuel	9.80	---	---
g/gal fuel	---	0.27	0.31

Reference: Footnote 2, from Table 2-8 of the AFCEC October 2014 Air Emissions Guide for Air Force Mobile Sources.

Calculations - Airfield Operations for Modified Alternative 1 - Implementation Phase (Saipan)

Criteria Pollutant and VOC Emissions per LTO by Aircraft Type

Calculated as the sum of the products of [(minutes) * (fuel flow/minute) * (lbs pollutant/lb fuel)] for each of the thrust modes.

Reported Aircraft Model	APU	Emission in lb Pollutant per LTO							
		Fuel (lb)	PM10 (lb)	PM2.5 (lb)	CO (lb)	NOx (lb)	SOx (lb)	VOCs (lb)	
KC-135R	0	5144.6	0.3	0.3	103.7	37.6	5.5	6.9	0

Total Criteria Pollutant and VOC Emissions for maximum LTO's by Aircraft Type

Reported Aircraft Model	APU	Total LTO's	Fuel (lb)	PM10 (tons)	PM2.5 (tons)	CO (tons)	NOx (tons)	SOx (tons)	VOCs (tons)	APU
			KC-135R	0	360	1,852,065.6	0.05	0.05	18.67	
Worst Case Scenario			1,852,065.60	0.05	0.05	18.67	6.77	0.98	1.25	0

Total gallons of fuel used for LTOs (277,671 gal.) is based on the 6.67 lb/gal density of JP-8 as provided in footnote 2. of Table 2-8 of the AFCEC October 2014 Air Emissions Guide for Air Force Mobile Sources. Emissions from LTO's are for the time up to and down from 3,000 feet elevation which is the default mixing height.

Calculations - Airfield Operations for Modified Alternative 1 - Implementation Phase (Saipan)

Greenhouse Gas Emissions

Assume aircraft will use 7,500 pounds of fuel per LTO cycle, which is from the ground to 10,000 feet and from 10,000 feet back to a landing.

This estimated fuel use was obtained from Maj. Travis Miyashiro, HIANG, PACAF A5XP. Fuel use and associated emissions above 10,000 feet are accounted for in the MIRC EIS.

Quantity (gallons)	Fuel Type	CH ₄ (kg)	N ₂ O (kg)	CO ₂ (kg)	CO ₂ -equivalent (kg)	CO ₂ -equivalent (metric tonne)
404,798	JP-8	109	125	3,967,016	4,006,991	4,007

The CH₄ and N₂O Global Warming Potential multipliers are 25 and 298, respectively from EPA's Climate Leadership, Emission Factors for Greenhouse Gas Inventories, Last Modified 4 April 2014.

DATA - Fuel Truck and Commuter Vehicle Emissions for Modified Alternative 1 - Implementation Phase (Saipan)

Given: Six 10,000 gal Fuel Trucks will take 2 days at 8 hrs/day and 3 hours on a third day to travel from Saipan Port to Saipan International Airport (Site of Proposed Action) and to fill the airport tanks with the needed fuel; 420,000 gallons total. The six 10,000 gallon fuel trucks will make three round trips per day for the first two days and one round trip each on the third day.

Under the commercial lodging option six busses will transport a total of 256 personnel 4 roundtrips/day for a total of 24 roundtrips/day for 8 weeks.

Assumptions: A Gross Vehicle Weight (GVW) of 36,200 lbs will be used, based off of an 84 passenger Blue Bird bus.

Assume fuel truck GVW > 60,000 lbs since fuel load alone is 83,400 lbs.

Assume fuel trucks travel at 55 miles per hour

Assume 40 miles per roundtrip for busses.

Vehicle Weight Classes for Which Emission Factors are Published

Vehicle Category	Description	SCC
LDGV	Light-Duty Gasoline Vehicles (i.e., passenger cars) does not include SUVs, vans or pickups	A2201001000
LDGT1	Light-Duty Gasoline Trucks 1 (0-6,000 lbs GVW - includes pickup trucks, sport utility vehicles and vans)	A2201020000
LDGT3	Light-Duty Gasoline Trucks 3 (6,001-8,500 lbs. GVW - includes pickup trucks, sport utility vehicles and vans)	A2201040000
HDGV2B	Class 2b Heavy-Duty Gasoline Vehicles (8501-10,000 lbs GVW)	A2201070000
HDGV5	Class 5 Heavy-Duty Gasoline Vehicles (16,001-19,500 lbs GVW)	A2201070000
HDGV8A	Class 8a Heavy-Duty Gasoline Vehicles (33,001-60,000 lbs GVW)	A2201070000
LDDV	Light-Duty Diesel Vehicles (Passenger Cars)	
LDDT34	Light-Duty Diesel Trucks 3 and 4 (6,001-8,500 lbs GVW)	A2230002000
HDDV2B	Class 2b Heavy-Duty Diesel Vehicles (8501-10,000 lbs GVW - includes pickup trucks)	A2230070000
HDDV5	Class 5 Heavy-Duty Diesel Vehicles (16,001-19,500 lbs GVW)	A2230070000
HDDV8A	Class 8a Heavy-Duty Diesel Vehicles (33,001-60,000 lbs GVW)	A2230070000
HDDV8B	Class 8b Heavy-Duty Diesel Vehicles (>60,000 lbs GVW)	A2230070000
MC	Motorcycles	A2201080000

Emission Factors - Fuel Truck and Commuter Vehicle Emissions for Modified Alternative 1 - Implementation Phase (Saipan)

Emission Factors for Calendar Year 2015

Vehicle Class	Model Year	Emission Factors in grams per Mile ^a								
		PM ₁₀	PM _{2.5}	CO	NOx	SOx	VOCs	CO ₂	Fugitive PM ₁₀	Fugitive PM _{2.5}
HDDV8A*	2005	0.2	0.19	2.8	5.47	0.01	0.48	1544.1	0.05	0.01
HDDV8B**	2005	0.2	0.19	3.33	6.23	0.02	0.58	1615.2	0.05	0.01

* Low Altitude Emission Factors for Heavy Duty Diesel Vehicles Class 8a

**Low Altitude Emission Factors for Heavy Duty Diesel Vehicles Class 8b

a) Emission factors from Appendix A of Air Emissions Factor Guide to Air Force Mobile Sources, AFCEE, December 2009

Greenhouse Gas Emission Factors for Calendar Year 2015

Vehicle Class	CH ₄ (g/mile)	N ₂ O (g/mile)
HDDV	0.0051	0.0048

g/mile = grams per mile

CH₄ = Methane; N₂O = Nitrous Oxide

b) Emission Factors from EPA's Climate Leadership, Emission Factors for Greenhouse Gas Inventories, Last Modified 4 April 2014 (<http://www.epa.gov/climateleadership/documents/emission-factors.pdf>).

Emission Calculations - Fuel Truck and Commuter Vehicle Emissions for Modified Alternative 1 - Implementation Phase (Saipan)

Miles for Commuter Emissions for 8 week training exercises

Vehicle Class	Speed Miles/hour	Miles/Trip	Total Trips/Day	Hours/Day	Total Days	Total Miles
HDDV8A - Class 8a Heavy-Duty Diesel Vehicles (33,001-60,000 lbs GVW)	---	40	24	---	56	53,760
HDDV8B - Class 8b Heavy-Duty Diesel Vehicles (>60,000 lbs GVW)	55	---	---	48	2,375	6,270

Criteria and VOC Emissions for Commuters

Vehicle Class	Model Year	Annual Miles	Criteria Pollutant Emissions (tons/year)					
			PM ₁₀	PM _{2.5}	CO	NOx	SOx	VOCs
HDDV8A - Class 8a Heavy-Duty Diesel Vehicles (33,001-60,000 lbs GVW)	2005	53,760	0.015	0.012	0.166	0.324	0.001	0.028
HDDV8B - Class 8b Heavy-Duty Diesel Vehicles (>60,000 lbs GVW)	2005	6,270	0.002	0.001	0.023	0.043	0.000	0.004
Total			0.017	0.013	0.189	0.367	0.001	0.032

Particulate emissions include exhaust, brake wear, tire wear. Assume paved road.

Greenhouse Gas Emissions for Commuters

Vehicle Class	Annual Miles	CO ₂ (lb/year)	CH ₄ (lb/year)	N ₂ O (lb/year)	CH ₄ GWP Multiplier	N ₂ O GWP Multiplier	CO ₂ Equivalent (lb/year)	CO ₂ Equivalent (metric tonnes/year)
HDDV8A - Class 8a Heavy-Duty Diesel Vehicles (33,001-60,000 lbs GVW)	53,760	183,004.44	0.60	0.57	25	298	183,189.08	83.09
HDDV8B - Class 8b Heavy-Duty Diesel Vehicles (>60,000 lbs GVW)	6,270	22,326.51	0.07	0.07	25	298	22,348.04	10.14
Total		205,330.95	0.67	0.64	---	---	205,537.13	93.23

GWP = Global Warming Potential; 100-year GWP values obtained from EPA's Climate Leadership, Emission Factors for Greenhouse Gas Inventories, Last Modified 4 April 2014 (<http://www.epa.gov/climateleadership/documents/emission-factors.pdf>)

Emission Calculations Method - Fuel Truck and Commuter Vehicle Emissions for Modified Alternative 1 - Implementation Phase (Saipan)

Calculation Method: Equation 4-1, AFCEE 2009, Mobile Emissions Guide

$$EP = VMTVehCat * EFPolVehCat * 0.002205$$

Where,

EP = Emissions of each individual pollutant (lb/yr)

VMTVehCat = Annual vehicle miles traveled by each vehicle category (LDGV, LDGT1, LDDV, etc.) (mi/yr)

EFPolVehCat = Emission factor of each pollutant for each vehicle category (g/mi)

0.002205 = Factor for converting grams to pounds (g/lb).

DATA - Fuel Loading Emissions for Modified Alternative 1 - Implementation Phase (Saipan)

Given:

Total Exercise Days (8 weeks)	56
Initial Fuel Fill Days	2.333333333
Remaining Fuel Fill Days	0
Total # of Fuel Trucks	6
Total Gallons per Fuel Truck	10,000
Trips per day per Fuel Truck	3
1 bbl conversion to gallons	42
Total Fuel (gal) during Initial Fill	420,000
Total Fuel (gal) during Remaining Exercise	0
Total Fuel (gal) during Exercise (8 Weeks)	420,000

Proposed Action Fuel Loading Operations

Location	Description	Fuel Type	Fuel Transferred (gal)	Category
Flightline	Loading Aircraft from Hydrants	JP-8	420,000.0	Loading
Seaport, Loading Racks (50,000 bbl tank 1)	Loading Refueler Trucks	JP-8	210000	Loading
Seaport, Loading Racks (50,000 bbl tank 2)	Loading Refueler Trucks	JP-8	210000	Loading

Emission Factors - Fuel Loading Emissions for Modified Alternative 1 - Implementation Phase (Saipan)

JP-8 emission factors (lb/Mgal)	Dispensing	Loading
	Splash	Bottom fill
Molecular Weight =	130	
True Vapor Pressure (psia) =	0.011	
Dispensing Displacement losses =	0.0487	0.020
Spillage =	0.7	
Total =	0.749	

AP-42 Table 7.1-2 dated 11/06
 AP-42 Table 7.1-2 dated 11/06 @ 70F (annual avg.)
 AP-42 Section 5.2 dated 6/08 Equation (1)
 AP-42 Table 5.2-7 dated 6/08

Emission Calculations - Fuel Loading Emissions for Modified Alternative 1 - Implementation Phase (Saipan)

Location	Description	Fuel Type	Fuel Transferred	Displaced Vapor	Spillage	Total VOC	Total VOC
			(gal)	(lb)	(lb)	(lb)	(ton)
Flightline	Loading Aircraft from Hydrants	JP-8	420,000	8.5	0	8.5	0.004
Seaport, Loading Racks (50,000 bbl tank 1)	Loading Refueler Trucks	JP-8	210,000	4.2	0	4.2	0.002
Seaport, Loading Racks (50,000 bbl tank 2)	Loading Refueler Trucks	JP-8	210,000	4.2	0	4.2	0.002
Total			840,000	17	0	17	0.01

Emission Calculations Method - Fuel Loading Emissions for Modified Alternative 1 - Implementation Phase (Saipan)

Displacement emissions for Diesel and JP-8 were estimated using Equation (1) from AP-42 Section 5.2, Transportation and Marketing of Petroleum Liquids, dated 6/08

$$L_L = 12.46 (SPM)/T$$

Where

L_L = Loading loss in lb/10³ gal

S = Saturation Factor 1.45 for splash loading, 0.6 for bottom loading

M = molecular weight,

T = temperature of bulk liquid (assume average annual ambient temperature)

DATA - Fuel Storage Tank Emissions for Modified Alternative 1 - Implementation Phase (Saipan)

Fuel storage tank emissions were estimated using the U.S. EPA TANKS storage tank emissions calculation software (Version 4.0.9d). The emissions calculations algorithms in the TANKS program are based on Chapter 7 of EPA's AP-42. Honolulu, Hawaii was used as a surrogate location for the tanks as meteorological data does not exist in TANKS for CNMI. Jet Kerosene fuel was used as the surrogate for JP-8 in the TANKS model as it is the closest in characteristics to JP-8.

Emission Calculations Summary from TANKS*

Tank Type	Throughput (gal.)	Working Loss (lbs)	Breathing Loss (lbs)	VOC Total (lbs)	VOC Total (tons)
Tank 1 (Seaport)- 50,000 bbl, cut and cover or AST	210,000	9.63	585.39	595.02	0.30
Tank 2 (Seaport)- 50,000 bbl, cut and cover or AST	210,000	9.63	585.39	595.02	0.30
Tank 3 (Airport) - 50,000 bbl, cut and cover or AST	210,000	9.63	585.39	595.02	0.30
Tank 4 (Airport) - 50,000 bbl, cut and cover or AST	210,000	9.63	585.39	595.02	0.30
Total		38.52	2341.56	2380.08	1.19

*See the following references for TANKS printouts. (SM11 - TANKS) & (SM12 - TANKS)

4200000

Summary	Summarizes total emissions by calendar year for Modified Alternative 2A - Construction Phase (Tinian North).
Combustion and Evaporative	Estimates emissions from non-road equipment exhaust and evaporative volatile organic compound emissions.
Fugitive	Estimates particulate emissions from construction activities including earthmoving, vehicle traffic, and windblown dust.
Grading	Estimates the number of days of site preparation, to be used for estimating heavy equipment exhaust and earthmoving dust emissions.
Construction Commuter	Estimates emissions for construction workers commuting to the site.
Haul Truck On-Road	Estimates emissions from hauling construction materials to the project site.

Summary of Air Quality Emissions from Divert EIS - Modified Alternative 2A - Construction Phase (Tinian North)

	NO_x (ton)	VOC (ton)	CO (ton)	SO₂ (ton)	PM₁₀ (ton)	PM_{2.5} (ton)	CO₂ (ton)
Construction Combustion/Evaporative	19.668	2.119	8.316	0.956	1.306	1.266	2,329.220
Construction Fugitive Dust	-	-	-	-	230.883	21.912	-
Construction Commuter	0.975	1.205	13.984	0.0159	0.040	0.017	874.603
Haul Truck On-Road	9.815	0.914	5.246	0.032	0.315	0.299	2,544.627
TOTAL	30.46	4.24	27.55	1.00	232.54	23.50	5,748.45

Annual Summary of Air Quality Emissions from Divert EIS - Modified Alternative 2A - Construction Phase (Tinian North)*

	Point and Area Sources Combined						
	NO_x (tpy)	VOC (tpy)	CO (tpy)	SO₂ (tpy)	PM₁₀ (tpy)	PM_{2.5} (tpy)	CO₂ (metric tons)
CY 01	10.15	1.41	9.18	0.33	77.51	7.83	1,738.30
CY 02	10.15	1.41	9.18	0.33	77.51	7.83	1,738.30
CY 03	10.15	1.41	9.18	0.33	77.51	7.83	1,738.30

* Construction duration is estimated to be 36 months and the emissions are assumed to be distributed evenly over the construction period.

Combustion and Evaporative Emissions - Modified Alternative 2A - Construction Phase (Tinian North)

Combustion Emissions of VOC, NO_x, SO₂, CO, PM_{2.5}, PM₁₀, and CO₂ due to Construction

Assumptions

When multiple options exist under the general construction activities the most conservative value will be used to quantify air emission.

General Construction Activities

	Area Disturbed (ft ²)
Construct Taxiway	1,385,300 ft ²
Construct Road Re-Route	40,585 ft ²
Construct New Access Roads	128,924 ft ²
Construct Maintenance Facility	7,570 ft ²
Construct Jet Fuel System and Fire Pump System (Operational, Bulk and at the Port of Tinian)	891,266 ft ²
Construct Hazardous Cargo Pad	299,754 ft ²
Construct Parking Apron	1,729,805 ft ²

Total General Construction Area:	898,836 ft ²	
	20.6 acres	
Total Demolition Area:	0 ft ²	
	0.0 acres	
Total Pavement Area:	3,584,368 ft ²	
	82.3 acres	
Total Disturbed Area:	4,483,204 ft ²	
	102.9 acres	
Construction Duration:	36 months	
1 Yr Project Construction Activity:	240 days/yr	Assume 12 months, 4 weeks per month, 5 days per week.

Emission Factors Used for Construction Equipment

References: Guide to Air Quality Assessment, Sacramento Metropolitan Air Quality Management District (SMAQMD), 2004; and U.S. EPA NONROAD Emissions Model, Version 2005.0.0
Emission factors are taken from the NONROAD model and were provided to e³M by Larry Landman of the Air Quality and Modeling Center (Landman.Larry@epamail.epa.gov) on 12/14/07. Factors provided are for the weighted average US fleet for CY2007.
Assumptions regarding the type and number of equipment are from SMAQMD Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd. ^a per 10 acres	NO _x (lb/day)	VOC ^b (lb/day)	CO (lb/day)	SO ₂ ^c (lb/day)	PM ₁₀ (lb/day)	PM _{2.5} (lb/day)	CO ₂ (lb/day)
Bulldozer	1	13.60	0.96	5.50	1.02	0.89	0.87	1456.90
Motor Grader	1	9.69	0.73	3.20	0.80	0.68	0.64	1141.65
Water Truck	1	18.36	0.89	7.00	1.64	1.00	0.97	2342.98
Total per 10 acres of activity	3	41.64	2.58	15.71	0.83	2.55	2.47	4941.53

Paving

Equipment	No. Reqd. ^a per 10 acres	NO _x (lb/day)	VOC ^b (lb/day)	CO (lb/day)	SO ₂ ^c (lb/day)	PM ₁₀ (lb/day)	PM _{2.5} (lb/day)	CO ₂ (lb/day)
Paver	1	3.83	0.37	2.06	0.28	0.35	0.34	401.93
Roller	1	4.82	0.44	2.51	0.37	0.43	0.42	536.07
Truck	2	36.71	1.79	14.01	3.27	1.99	1.93	4685.95
Total per 10 acres of activity	4	45.37	2.61	18.58	0.91	2.78	2.69	5623.96

Demolition

Equipment	No. Reqd. ^a per 10 acres	NO _x (lb/day)	VOC ^b (lb/day)	CO (lb/day)	SO ₂ ^c (lb/day)	PM ₁₀ (lb/day)	PM _{2.5} (lb/day)	CO ₂ (lb/day)
Loader	1	13.45	0.99	5.58	0.95	0.93	0.90	1360.10
Haul Truck	1	18.36	0.89	7.00	1.64	1.00	0.97	2342.98
Total per 10 acres of activity	2	31.81	1.89	12.58	0.64	1.92	1.87	3703.07

Building Construction

Equipment ^d	No. Reqd. ^a per 10 acres	NO _x (lb/day)	VOC ^b (lb/day)	CO (lb/day)	SO ₂ ^c (lb/day)	PM ₁₀ (lb/day)	PM _{2.5} (lb/day)	CO ₂ (lb/day)
Stationary								
Generator Set	1	2.38	0.32	1.18	0.15	0.23	0.22	213.06
Industrial Saw	1	2.62	0.32	1.97	0.20	0.32	0.31	291.92
Welder	1	1.12	0.38	1.50	0.08	0.23	0.22	112.39
Mobile (non-road)								
Truck	1	18.36	0.89	7.00	1.64	1.00	0.97	2342.98
Forklift	1	5.34	0.56	3.33	0.40	0.55	0.54	572.24
Crane	1	9.57	0.66	2.39	0.65	0.50	0.49	931.93
Total per 10 acres of activity	6	39.40	3.13	17.38	3.12	2.83	2.74	4464.51

Architectural Coatings

Equipment	No. Reqd. ^a per 10 acres	NO _x (lb/day)	VOC ^b (lb/day)	CO (lb/day)	SO ₂ ^c (lb/day)	PM ₁₀ (lb/day)	PM _{2.5} (lb/day)	CO ₂ (lb/day)
Air Compressor	1	3.57	0.37	1.57	0.25	0.31	0.30	359.77
Total per 10 acres of activity	1	3.57	0.37	1.57	0.25	0.31	0.30	359.77

- The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity. (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.
- The SMAQMD 2004 reference lists emission factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC. The NONROAD model contains emissions factors for total HC and for VOC. The factors used here are the VOC factors.
- The NONROAD emission factors assume that the average fuel burned in nonroad trucks is 1100 ppm sulfur. Trucks that would be used for the Proposed Actions will all be fueled by highway grade diesel fuel which cannot exceed 500 ppm sulfur. These estimates therefore over-estimate SO₂ emissions by more than a factor of two.
- Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

Combustion and Evaporative Emissions - Modified Alternative 2A - Construction Phase (Tinian North) - Continued

Project-Specific Combustion and Evaporative Emission Factor Summary

Source	Equipment Multiplier*	Project-Specific Emission Factors (lb/day)						
		NO _x	VOC	CO	SO ₂ **	PM ₁₀	PM _{2.5}	CO ₂
Grading Equipment	10	416.412	25.770	157.099	8.328	25.455	24.691	49415.263
Paving Equipment	8	362.938	20.846	148.627	7.259	22.209	21.543	44991.655
Demolition Equipment	1	31.808	1.886	12.584	0.636	1.923	1.865	3703.074
Building Construction	2	78.793	6.260	34.765	6.233	5.658	5.488	8929.023
Air Compressor for Architectural Coating	2	7.148	0.746	3.131	0.502	0.619	0.600	719.547
Architectural Coating**			77.268					

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project.

**Emission factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994
 Example: SMAQMD Emission Factor for Grading Equipment NO_x = (Total Grading NO_x per 10 acre)/(Equipment Multiplier)

Summary of Input Parameters

	Total Area (ft ²)	Total Area (acres)	Total Days	
Grading:	4,483,204	102.92	6	(from "Grading" worksheet)
Paving:	3,584,368	82.29	49	
Demolition:	0	0.00	0	
Building Construction:	898,836	20.63	240	
Architectural Coating:	898,836	20.63	20	(per SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative. The 'Total Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition. The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Project Combustion and Evaporative Emissions by Activity (lbs)

	NO _x	VOC	CO	SO ₂	PM ₁₀	PM _{2.5}	CO ₂
Grading Equipment	2,498.47	154.62	942.59	49.97	152.73	148.15	296.492
Paving	17,783.98	1,021.44	7,282.74	355.68	1,088.23	1,055.58	2,204.591
Demolition	-	-	-	-	-	-	0
Building Construction	18,910.23	1,502.31	8,343.51	1,495.85	1,357.94	1,317.20	2,142.966
Architectural Coatings	142.96	1,560.28	62.62	10.05	12.37	12.00	14,391
Total Emissions (lbs):	39,335.65	4,238.65	16,631.46	1,911.54	2,611.27	2,532.94	4,658.439

Results: Project Annual Combustion and Evaporative Emission Rates

	NO _x	VOC	CO	SO ₂	PM ₁₀	PM _{2.5}	CO ₂
Total Project Combustion and Evaporative Emissions (lbs)	39,335.65	4,238.65	16,631.46	1,911.54	2,611.27	2,532.94	4,658.439
Total Project Combustion and Evaporative Emissions (tons)	19.67	2.12	8.32	0.96	1.31	1.27	2,329.22

Construction Fugitive Dust Emissions - Proposed Action [Modified Alternative 2A - Construction Phase (Tinian North)]

Construction Fugitive Dust Emission Factors

	Emission Factor	Units	Source
General Construction Activities	0.19 ton PM ₁₀ /acre-month		MRI 1996; EPA 2001; EPA 2006
New Road Construction	0.42 ton PM ₁₀ /acre-month		MRI 1996; EPA 2001; EPA 2006
PM_{2.5} Emissions			
PM _{2.5} Multiplier	0.10	(10% of PM ₁₀ emissions assumed to be PM _{2.5})	EPA 2001; EPA 2006
Control Efficiency	0.50	(assume 50% control efficiency for PM ₁₀ and PM _{2.5} emissions)	EPA 2001; EPA 2006

Project Assumptions

New Roadway Construction (0.42 ton PM₁₀/acre-month)

Duration of Construction Project	12 months
Area	82.3 acres

General Construction Activities (0.19 ton PM₁₀/acre-month)

Duration of Construction Project	12 months
Area	20.6 acres

	Project Emissions (tons/year)			
	PM₁₀ uncontrolled	PM₁₀ controlled	PM_{2.5} uncontrolled	PM_{2.5} controlled
New Roadway Construction	414.72	207.36	41.47	20.74
General Construction Activities	47.05	23.52	2.35	1.18
Total	461.77	230.88	43.82	21.91

General Construction Activities Emission Factor

0.19 ton PM₁₀/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The area-based emission factor for construction activities is based on a study completed by the Midwest Research Institute (MRI) Improvement of Specific Emission Factors (BACM Project No. 1), March 29, 1996. The MRI study evaluated seven construction projects in Nevada and California (Las Vegas, Coachella Valley, South Coast Air Basin, and the San Joaquin Valley). The study determined an average emission factor of 0.11 ton PM₁₀/acre-month for sites without large-scale cut/fill operations. A worst-case emission factor of 0.42 ton PM₁₀/acre-month was calculated for sites with active large-scale earth moving operations. The monthly emission factors are based on 168 work-hours per month (MRI 1996). A subsequent MRI Report in 1999, Estimating Particulate Matter Emissions From Construction Operations, calculated the 0.19 ton PM₁₀/acre-month emission factor by applying 25% of the large-scale earthmoving emission factor (0.42 ton PM₁₀/acre-month) and 75% of the average emission factor (0.11 ton PM₁₀/acre-month). The 0.19 ton PM₁₀/acre-month emission factor is referenced by the EPA for non-residential construction activities in recent procedures documents for the National Emission Inventory (EPA 2001; EPA 2006). The 0.19 ton PM₁₀/acre-month emission factor represents a refinement of EPA's original AP-42 area-based total suspended particulate (TSP) emission factor in Section 13.2.3 Heavy Construction Operations. In addition to the EPA, this methodology is also supported by the South Coast Air Quality Management District as well as the Western Regional Air Partnership (WRAP) which is funded by the EPA and is administered jointly by the Western Governor's Association and the National Tribal Environmental Council. The emission factor is assumed to encompass a variety of non-residential construction activities including building construction (commercial, industrial, institutional, governmental), public works, and travel on unpaved roads. The EPA National Emission Inventory documentation assumes that the emission factors are uncontrolled and recommends a control efficiency of 50% for PM₁₀ and PM_{2.5} in PM nonattainment areas.

New Road Construction Emission Factor

0.42 ton PM₁₀/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The emission factor for new road construction is based on the worst-case conditions emission factor from the MRI 1996 study described above (0.42 tons PM₁₀/acre-month). It is assumed that road construction involves extensive earthmoving and heavy construction vehicle travel resulting in emissions that are higher than other general construction projects. The 0.42 ton PM₁₀/acre-month emission factor for road construction is referenced in recent procedures documents for the EPA National Emission Inventory (EPA 2001; EPA 2006).

PM_{2.5} Multiplier

0.10

PM_{2.5} emissions are estimated by applying a particle size multiplier of 0.10 to PM₁₀ emissions. This methodology is consistent with the procedures documents for the National Emission Inventory (EPA 2006).

Control Efficiency for PM₁₀ and PM_{2.5}

0.50

The EPA National Emission Inventory documentation recommends a control efficiency of 50% for PM₁₀ and PM_{2.5} in PM nonattainment areas (EPA 2006). Wetting controls will be applied during project construction.

References:

EPA 2001. *Procedures Document for National Emissions Inventory, Criteria Air Pollutants, 1985-1999*. EPA-454/R-01-006. Office of Air Quality Planning and Standards, United States Environmental Protection Agency. March 2001.

EPA 2006. *Documentation for the Final 2002 Nonpoint Sector (Feb 06 version) National Emission Inventory for Criteria and Hazardous Air Pollutants*. Prepared for: Emissions Inventory and Analysis Group (C339-02) Air Quality Assessment Division Office of Air Quality Planning and Standards, United States Environmental Protection Agency. July 2006.

MRI 1996. *Improvement of Specific Emission Factors (BACM Project No. 1)*. Midwest Research Institute (MRI). Prepared for the California South Coast Air Quality Management District, March 29, 1996.

Grading Schedule - Proposed Action [Modified Alternative 2A - Construction Phase (Tinian North)]

Estimate of time required to grade a specified area.

Input Parameters

Construction area: 102.9 acres/yr (from Combustion Worksheet)
 Qty Equipment: 31.0 (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions

Terrain is mostly flat.
 An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.
 200 hp bulldozers are used for site clearing.
 300 hp bulldozers are used for stripping, excavation, and backfill.
 Vibratory drum rollers are used for compacting.
 Stripping, Excavation, Backfill and Compaction require an average of two passes each.
 Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	102.92	12.87
2230 500 0300	Stripping	Topsoil & stockpiling, adverse soil	1,650	cu. yd/day	2.05	0.49	102.92	50.32
2315 432 5220	Excavation	Bulk, open site, common earth, 150' haul	800	cu. yd/day	0.99	1.01	51.46	51.89
2315 120 5220	Backfill	Structural, common earth, 150' haul	1,950	cu. yd/day	2.42	0.41	51.46	21.29
2315 310 5020	Compaction	Vibrating roller, 6" lifts, 3 passes	2,300	cu. yd/day	2.85	0.35	102.92	36.10
TOTAL								172.45

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr: 172.45
 Qty Equipment: 31.00
 Grading days/yr: 5.56

Construction/Staff Commuter Emissions - Modified Alternative 2A - Construction Phase (Tinian North)

Emissions from construction workers commuting to the job site are estimated in this spreadsheet.

Emission Estimation Method: Air Force Civil Engineer Center (AFCEE), Air Emissions Factor Guide to Air Force Mobile Sources, October 2014.

Assumptions:

Passenger vehicle emission factors for scenario year 2015 are used.
 The average roundtrip commute for a construction/staff worker = 40 miles
 Number of construction days = 240 days
 Number of construction/Staff workers (daily) = 150 people

Note: None

Personal Operating Vehicle (POV) On-Road Emission Factors for Year 2016 (grams/mile)

NO _x	VOC	CO	SO ₂	PM ₁₀	PM _{2.5}	CO ₂
0.614	0.759	8.810	0.010	0.025	0.011	551.000

Source: Emission factors for all pollutants are from Table 5-28: On-Road Vehicle Emission Factors - 2016 POV, Gasoline Light Duty Trucks (LDGT) at low altitude, within AFCEC Air Emissions Factor Guide to Air Force Mobile Sources, October 2014.

Construction Commuter Emissions

	NO _x	VOC	CO	SO ₂	PM ₁₀	PM _{2.5}	CO ₂
lbs	1,949,206	2,409,524	27,968,254	31,746	79,365	34,921	1,749,206,349
tons	0.975	1.205	13.984	0.016	0.040	0.017	874.603

Example Calculation: NO_x emissions (lbs) = 60 miles/day * NO_x emission factor (lb/mile) * number of construction days * number of workers

Construction/Haul Truck Emissions - Modified Alternative 2A - Construction Phase (Tinian North)

Emissions from hauling construction supplies, demolition debris, fill, and excavated material are estimated in this spreadsheet.

Emission Estimation Method: Air Force Center for Environmental Excellence (AFCEE) Air Emissions Factor Guide to Air Force Mobile Sources, Dec. 2009.

Concrete Mixing and Dump Truck Assumptions:

Dump trucks carry 11 cubic yards of material per trip.
 Concrete mixing trucks carry 10 cubic yards of material per trip.
 The average distance from the port to Commercial Concrete Supply Company is 1.7 miles; therefore, dump trucks will travel 3.4 miles round trip.
 The average distance from the Commercial Concrete Supply Company (CCSC) to the project site is 2.3 miles; therefore, concrete trucks will travel 4.6 miles round trip.

Fill Materials Assumptions:

Haul trucks carry 20 cubic yards of material per trip.
 The average distance from the project site to the materials source is 20 miles; therefore, building material haul trucks will travel 40 miles round trip.
 Estimated number of trips required by haul trucks = total amount of material/20 cubic yards per truck

Amount of demolition debris =	0 cubic yards	No Demolition in the Proposed Action
Amount of cement transported from port to CCSC =	4,004 cubic yards	
Amount of concrete transported from CCSC to project site =	64,780 cubic yards	
Amount of Excavation Materials for New Structures/Buildings =	399,483 cubic yards	Construction area multiplied by depth of disturbance which is assumed to be 12 feet.
Amount of Building/Structure Materials =	299,612 cubic yards	Construction area multiplied by 9 feet.

Number of dump trucks required (port to CCSC) =	364 heavy duty diesel haul truck trips, Cells rounded up
Number of concrete mixing trucks required (CCSC to project site) =	6478 heavy duty diesel haul truck trips, Cells rounded up
Number of trucks required (Building Materials) =	34,955 heavy duty diesel haul truck trips
Miles per trip (port to CCSC) =	3.4 miles
Miles per trip (CCSC to project site) =	4.6 miles
Miles per trip (Building Materials) =	40.0 miles

Low Altitude Heavy Duty Diesel Vehicle 8b (HDDV8b) Average Emission Factors (grams/mile)

	NO _x	VOC	CO	SO ₂	PM ₁₀	PM _{2.5}	CO ₂
HDDV8b	6.23	0.58	3.33	0.02	0.20	0.19	1615

Notes:

Emission factors for all pollutants are from Appendix A - On-Road Vehicle Emission Factors within AFCEE Air Emissions Factor Guide to Air Force Mobile Sources, Dec. 2009.
 Emission factors from calendar year 2015 were used assuming the average vehicle model year is 2005.

HDDV8b Haul Truck Emissions

	NO _x	VOC	CO	SO ₂	PM ₁₀	PM _{2.5}	CO ₂
lbs	19,629.80	1,827.49	10,492.33	63.02	630.17	598.66	5,089,253.54
tons	9.81	0.91	5.25	0.03	0.32	0.30	2,544.63

Example Calculation: NO_x emissions (lbs) = 40 miles per trip * 34,955 trips * NO_x emission factor (g/mile) * lb/453.6 g

No Statistical Area Available for TNI

Row #	State	County	Tier-1	Point Source Emissions					Area Source Emissions (Non-Point and Mobile Sources)						
				CO	NO _x	PM ₁₀	PM _{2.5}	SO ₂	VOC	CO	NO _x	PM ₁₀	PM _{2.5}	SO ₂	VOC
No Data Available															
Grand Total				0	0	0	0	0	0	0	0	0	0	0	0

SOURCE:

<http://www.epa.gov/ttn/chiefeiiinformation.html>

USEPA - AirData NET Tier Report

*Net Air pollution sources (area and point) in tons per year (2002)

Site visited on 02 February 2012.

No Air Quality Control Region Identified

	CO	NO _x	PM ₁₀	PM _{2.5}	SO ₂	VOC
CNMI	0	0	0	0	0	0
CNMI DEQ	0	0	0	0	0	0

Summary	Summarizes total emissions by calendar year for Modified Alternative 2a - Implementation Phase (Tinian North).
Airfield Operations	Aircraft operations consist of taxi, take-off and landings (sorties or LTOs), touch-and-go operations (TGOs), and low flybys (LFB) by base aircraft.
Fuel Truck and Commuter Vehicle Emissions	Estimates emissions for workers and operational vehicles commuting to the site of the Proposed Action.
Fuel Transfer Emissions	Fuel loading operations under the Proposed Action involves the loading of fuel into tanker trucks and aircraft.
Internal Combustion Engine (ICE) Emissions	Estimates Emissions from Internal Combustion Engines (e.g Generators)
Fuel Storage Tanks	Estimates emissions from Above Ground Storage Tanks.

Criteria Pollutant and VOC Emissions Summary for Modified Alternative 2a - Implementation Phase (Tinian North) (tons/year)

Source Category	PM10	PM2.5	CO	NOx	SOx	VOCs
Airfield Operations	0.05	0.05	18.67	6.77	0.98	1.25
Fuel Truck and Commuter Vehicle Emissions	0.02	0.01	0.19	0.37	0.00	0.03
Fuel Transfer	N/A	N/A	N/A	N/A	N/A	0.01
Fuel Storage Tanks	N/A	N/A	N/A	N/A	N/A	1.91
Total Criteria and VOC Pollutant Emissions (tons/year)	0.07	0.07	18.86	7.14	0.98	3.19

Greenhouse Gas (GHG) Emissions Summary for Modified Alternative 2a - Implementation Phase (Tinian North) (metric tonnes/year)

Source Category	CO ₂ -equivalent (lb/year)	CO ₂ -equivalent (kg/year)	CO ₂ -equivalent (metric tonne/year)
Airfield Operations*	8,833,755	4,006,991	4,007
Fuel Truck and Commuter Vehicle Emissions	205,537	93,232	93
Fuel Transfer	0	0	0
Fuel Storage Tanks	0	0	0
Total GHG Emissions	9,039,293	4,100,223	4,100

DATA - Airfield Operations for Modified Alternative 2a - Implementation Phase (Tinian North)

Aircraft exercises under this alternative are based on assuming 2 to 4 KC-135R aircraft operating up to 8 weeks per year for a maximum of 720 KC-135R operations per year. Each operation is equivalent to one landing or one take-off (1 LTO Cycle = 2 operations).

Landing and Takeoff (LTO) Cycles

Description	Quantity
# of KC-135R LTO's per year	360

Legend

Airfield Activity Data (Worst Case Scenario)

Aircraft Model	Aircraft Model Used to Match to Available Emission Factors	Engine Model	Engines	APU Model	APUs	Notes	LTO Cycles
KC-135R	KC-135-R	F108-CF-201	4	No data on APUs		See below	360

Note: F108-CF-201 is the military designation of the CFM56-2B-1 engine.

Emission Factors (EFs) and Constants - Airfield Operations for Modified Alternative 2a - Implementation Phase (Tinian North)

Aircraft Criteria Pollutant Emission Factors

Aircraft Model	Engine Model	Engines	Reference Thrust Mode	LTO/GO Thrust Mode	Fuel Flow (lb/hr)	Emission Factors in lb Pollutant per 1000 lb Fuel Burned						
						PM10	PM2.5	CO	NO _x	SO ₂	VOCs	TIM
KC-135R	F108-CF-201	4	Idle	Idle	1016	0.06	0.06	30.70	4.00	1.06	2.10	47.7
KC-135R	F108-CF-201	4	Approach	Approach	2468	0.06	0.05	4.20	8.20	1.06	0.09	5.2
KC-135R	F108-CF-201	4	Climbout	Climbout	6500	0.05	0.05	0.90	16.00	1.06	0.06	1.6
KC-135R	F108-CF-201	4	Takeoff	Takeoff	7818	0.07	0.06	0.90	18.05	1.06	0.05	0.7

Emission factors from Air Force Civil Engineer Center (AFCEC) October 2014 Air Emissions Guide for Air Force Mobile Sources, Table 2-8

APU Emission Factors

Aircraft Model	# APU	APU Model	APU Emission Factors in lb Pollutant per hour							APU (hr)
			PM10	PM2.5	CO	NO _x	SO ₂	VOCs		
KC-135R			No Data Available.							

Emission Factors (EFs) and Constants - Airfield Operations for Modified Alternative 2a - Implementation Phase (Tinian North)

Default Time-In-Mode

Aircraft Type	Typical Duration by Mode (minutes)					
	Taxi/Idle	Takeoff	Climbout	Approach	Taxi/Idle-in	Total
KC-135R	32.8	0.7	1.6	5.2	14.9	55.2

Default Time-In-Mode rates are from AFCEC October 2014 Air Emissions Guide for Air Force Mobile Sources, Table 2-4

Emission Factors (EFs) and Constants - Airfield Operations for Modified Alternative 2a - Implementation Phase (Tinian North)

Greenhouse Gas Emission Factors

Units	CO ₂	CH ₄	N ₂ O
kg/gal fuel	9.80	---	---
g/gal fuel	---	0.27	0.31

Reference: Footnote 2, from Table 2-8 of the AFCEC August 2013 Air Emissions Guide for Air Force Mobile Sources.

Calculations - Airfield Operations for Modified Alternative 2a - Implementation Phase (Tinian North)

Criteria Pollutant and VOC Emissions per LTO by Aircraft Type

Calculated as the sum of the products of [(minutes) * (fuel flow/minute) * (lbs pollutant/lb fuel)] for each of the thrust modes.

Reported Aircraft Model	APU	Emission in lb Pollutant per LTO							
		Fuel (lb)	PM10 (lb)	PM2.5 (lb)	CO (lb)	NOx (lb)	SOx (lb)	VOCs (lb)	APU
KC-135R	0	5144.6	0.3	0.3	103.7	37.6	5.5	6.9	0

Total Criteria Pollutant and VOC Emissions for maximum LTO's by Aircraft Type

Reported Aircraft Model	APU	Total LTO's	Emission in lb Pollutant per LTO							
			Fuel (lb)	PM10 (tons)	PM2.5 (tons)	CO (tons)	NOx (tons)	SOx (tons)	VOCs (tons)	APU
KC-135R	0	360	1,852,065.6	0.05	0.05	18.67	6.77	0.98	1.25	0
Worst Case Scenario			1,852,065.60	0.05	0.05	18.67	6.77	0.98	1.25	0

Total gallons of fuel used for LTOs (277,671 gal.) is based on the 6.67 lb/gal density of JP-8 as provided in footnote 2. of Table 2-8 of the AFCEC October 2014 Air Emissions Guide for Air Force Mobile Sources. Emissions from LTO's are for the time up to and down from 3,000 feet elevation which is the default mixing height.

Calculations - Airfield Operations for Modified Alternative 2a - Implementation Phase (Tinian North)

Greenhouse Gas Emissions

Assume aircraft will use 7,500 pounds of fuel per LTO cycle, which is from the ground to 10,000 feet and from 10,000 feet back to a landing. This estimated fuel use was obtained from Maj. Travis Miyashiro, HIANG, PACAF ASXP. Fuel use and associated emissions above 10,000 feet are accounted for in the MIRC EIS.

Quantity (gallons)	Fuel Type	CH ₄ (kg)	N ₂ O (kg)	CO ₂ (kg)	CO ₂ -equivalent (kg)	CO ₂ -equivalent (metric tonne)
404,798	JP-8	109	125	3,367,016	4,006,991	4,007

The CH₄ and N₂O Global Warming Potential multipliers are 25 and 298, respectively from EPA's Climate Leadership, Emission Factors for Greenhouse Gas Inventories. Last Modified 4 April 2014.

DATA - Fuel Truck and Commuter Vehicle Emissions for Modified Alternative 2a - Implementation Phase (Tinian North)

Given: Six 10,000 gal Fuel Trucks will take 2 days at 8 hrs/day and 3 hours on a third day to travel from Tinian Seaport to Tinian Airport (Site of Proposed Action) and to fill the airport tanks with the needed fuel; 420,000 gallons total. The six 10,000 gallon fuel trucks will make three round trips per day for the first two days and one round trip each on the third day.

Under the commercial lodging option six busses will transport a total of 256 personnel 4 roundtrips/day for a total of 24 roundtrips/day for 8 weeks.

Assumptions: A Gross Vehicle Weight (GVW) of 36,200 lbs will be used, based off of an 84 passenger Blue Bird bus.

Assume fuel truck GVW > 60,000 lbs since fuel load alone is 83,400 lbs.

Assume fuel trucks travel at 55 miles per hour

Assume 40 miles per roundtrip for busses.

Vehicle Weight Classes for Which Emission Factors are Published

Vehicle Category	Description	SCC
LDGV	Light-Duty Gasoline Vehicles (i.e., passenger cars) does not include SUVs, vans or pickups	A2201001000
LDGT1	Light-Duty Gasoline Trucks 1 (0-6,000 lbs GVW - includes pickup trucks, sport utility vehicles and vans)	A2201020000
LDGT3	Light-Duty Gasoline Trucks 3 (6,001-8,500 lbs. GVW - includes pickup trucks, sport utility vehicles and vans)	A2201040000
HDBG2B	Class 2b Heavy-Duty Gasoline Vehicles (8501-10,000 lbs GVW)	A2201070000
HDBG5	Class 5 Heavy-Duty Gasoline Vehicles (16,001-19,500 lbs GVW)	A2201070000
HDBG8A	Class 8a Heavy-Duty Gasoline Vehicles (33,001-60,000 lbs GVW)	A2201070000
LDDV	Light-Duty Diesel Vehicles (Passenger Cars)	
LDDT34	Light-Duty Diesel Trucks 3 and 4 (6,001-8,500 lbs GVW)	A2230002000
HDDV2B	Class 2b Heavy-Duty Diesel Vehicles (8501-10,000 lbs GVW - includes pickup trucks)	A2230070000
HDDV5	Class 5 Heavy-Duty Diesel Vehicles (16,001-19,500 lbs GVW)	A2230070000
HDDV8A	Class 8a Heavy-Duty Diesel Vehicles (33,001-60,000 lbs GVW)	A2230070000
HDDV8B	Class 8b Heavy-Duty Diesel Vehicles (>60,000 lbs GVW)	A2230070000
MC	Motorcycles	A2201080000

Emission Factors - Fuel Truck and Commuter Vehicle Emissions for Modified Alternative 2a - Implementation Phase (Tinian North)

Emission Factors for Calendar Year 2015

Vehicle Class	Model Year	Emission Factors in grams per Mile ^a								
		PM ₁₀	PM _{2.5}	CO	NOx	SOx	NOCs	CO ₂	Fugitive PM ₁₀	Fugitive PM _{2.5}
HDDVSA*	2005	0.2	0.19	2.8	5.47	0.01	0.48	1544.1	0.05	0.01
HDDVSB**	2005	0.2	0.19	3.33	6.23	0.02	0.58	1615.2	0.05	0.01

* Low Altitude Emission Factors for Heavy Duty Diesel Vehicles Class 8a

**Low Altitude Emission Factors for Heavy Duty Diesel Vehicles Class 8b

a) Emission factors from Appendix A of Air Emissions Factor Guide to Air Force Mobile Sources, AFCEE, December 2009

Greenhouse Gas Emission Factors for Calendar Year 2015

Vehicle Class	CH ₄ (g/mile)	N ₂ O (g/mile)
HDDV	0.0051	0.0048

g/mile = grams per mile

CH₄ = Methane; N₂O = Nitrous Oxide

b) Emission Factors from EPA's Climate Leadership, Emission Factors for Greenhouse Gas Inventories, Last Modified 4 April 2014 (<http://www.epa.gov/climateleadership/documents/emission-factors.pdf>).

Emission Calculations - Fuel Truck and Commuter Vehicle Emissions for Modified Alternative 2a - Implementation Phase (Tinian North)

Miles for Commuter Emissions for 8 week training exercises

Vehicle Class	Speed		Total Trips/Day	Hours/Day	Total Days	Total Miles
	Miles/hour	Miles/Trip				
HDDV8A - Class 8a Heavy-Duty Diesel Vehicles (33,001-60,000 lbs GVW)		40	24		56	53,760
HDDV8B - Class 8b Heavy-Duty Diesel Vehicles (>60,000 lbs GVW)	55			48	2,375	6,270

Criteria and VOC Emissions for Commuters

Vehicle Class	Model Year	Annual Miles	Criteria Pollutant Emissions (tons/year)					
			PM ₁₀	PM _{2.5}	CO	NO _x	SO _x	VOCs
HDDV8A - Class 8a Heavy-Duty Diesel Vehicles (33,001-60,000 lbs GVW)	2005	53,760	0.015	0.012	0.166	0.324	0.001	0.028
HDDV8B - Class 8b Heavy-Duty Diesel Vehicles (>60,000 lbs GVW)	2005	6,270	0.002	0.001	0.023	0.043	0.000	0.004
Total			0.017	0.013	0.189	0.367	0.001	0.032

Particulate emissions include exhaust, brake wear, tire wear. Assume paved road.

Greenhouse Gas Emissions for Commuters

Vehicle Class	Annual Miles	CO ₂ (lb/year)	CH ₄ (lb/year)	N ₂ O (lb/year)	CH ₄ GWP Multiplier	N ₂ O GWP Multiplier	CO ₂ Equivalent (lb/year)	CO ₂ Equivalent (metric tonnes/year)
HDDV8A - Class 8a Heavy-Duty Diesel Vehicles (33,001-60,000 lbs GVW)	53,760	183,004.44	0.60	0.57	25	298	183,189.08	83.09
HDDV8B - Class 8b Heavy-Duty Diesel Vehicles (>60,000 lbs GVW)	6,270	22,326.51	0.07	0.07	25	298	22,348.04	10.14
Total		205,330.95	0.67	0.64	---	---	205,537.13	93.23

GWP = Global Warming Potential; 100-year GWP values obtained from EPA's Climate Leadership, Emission Factors for Greenhouse Gas Inventories, Last Modified 4 April 2014 (<http://www.epa.gov/climateleadership/documents/emission-factors.pdf>)

Emission Calculations Method - Fuel Truck and Commuter Vehicle Emissions for Modified Alternative 2a - Implementation Phase (Tinian North)

Calculation Method: Equation 4-1, AFCEE 2009, Mobile Emissions Guide

$$EP = VMTVehCat * EFPoVehCat * 0.002205$$

Where,

EP = Emissions of each individual pollutant (lb/yr)

VMTVehCat = Annual vehicle miles traveled by each vehicle category (LDGV, LDGT1, LDDV, etc.) (mi/yr)

EFPoVehCat = Emission factor of each pollutant for each vehicle category (g/mi)

0.002205 = Factor for converting grams to pounds (g/lb).

DATA - Fuel Loading Emissions for Modified Alternative 2a - Implementation Phase (Tinian North)

Given:

Total Exercise Days (8 weeks)	56
Initial Fuel Fill Days	2.333333333
Remaining Fuel Fill Days	0
Total # of Fuel Trucks	6
Total Gallons per Fuel Truck	10,000
Trips per day per Fuel Truck	3
1 bbl conversion to gallons	42
Total Fuel (gal) during Initial Fill	420,000
Total Fuel (gal) during Remaining Exercise	0
Total Fuel (gal) during Exercise (8 Weeks)	420,000

Proposed Action Fuel Loading Operations

Location	Description	Fuel Type	Fuel Transferred (gal)	Category
Flightline	Loading Aircraft from Truck Fill Stands	JP-8	420,000	Loading
Seaport, Loading Racks (50,000 bbl tank 1)	Loading Refueler Trucks	JP-8	210,000	Loading
Seaport, Loading Racks (50,000 bbl tank 2)	Loading Refueler Trucks	JP-8	210,000	Loading

Emission Factors - Fuel Loading Emissions for Modified Alternative 2a - Implementation Phase (Tinian North)

JP-8 emission factors (lb/Mgal)	Dispensing	Loading
	Splash	Bottom fill
Molecular Weight =	130	0.020
True Vapor Pressure (psia) =	0.011	
Dispensing Displacement losses =	0.0487	
Spillage =	0.7	
Total =	0.749	

AP-42 Table 7.1-2 dated 11/06
 AP-42 Table 7.1-2 dated 11/06 @ 70F (annual avg.)
 AP-42 Section 5.2 dated 6/08 Equation (1)
 AP-42 Table 5.2-7 dated 6/08

Emission Calculations - Fuel Loading Emissions for Modified Alternative 2a - Implementation Phase (Tinian North)

Location	Description	Fuel Type	Fuel Transferred	Displaced Vapor	Spillage	Total VOC	Total VOC
			(gal)	(lb)	(lb)	(lb)	(tons)
Flightline	Loading Aircraft from Truck Fill Stands	JP-8	420,000	8.5	0	8.5	0.004
Seaport, Loading Racks (50,000 bbl tank 1)	Loading Refueler Trucks	JP-8	210,000	4.2	0	4.2	0.002
Seaport, Loading Racks (50,000 bbl tank 2)	Loading Refueler Trucks	JP-8	210,000	4.2	0	4.2	0.002
Total			840,000	17	0	16.94	0.01

Emission Calculations Method - Fuel Loading Emissions for Modified Alternative 2a - Implementation Phase (Tinian North)

Displacement emissions for Diesel and JP-8 were estimated using Equation (1) from AP-42 Section 5.2, Transportation and Marketing of Petroleum Liquids, dated 6/08

$$L_L = 12.46 (SPM)/T$$

Where

L_L = Loading loss in lb/10³ gal

S = Saturation Factor 1.45 for splash loading, 0.6 for bottom loading

M = molecular weight,

T = temperature of bulk liquid (assume average annual ambient temperature)

DATA - Fuel Storage Tank Emissions for Modified Alternative 2a - Implementation Phase (Tinian North)

Fuel storage tank emissions were estimated using the U.S. EPA TANKS storage tank emissions calculation software (Version 4.0.9d). The emissions calculations algorithms in the TANKS program are based on Chapter 7 of EPA's AP-42. Honolulu, Hawaii was used as a surrogate location for the tanks as meteorological data does not exist in TANKS for CNMI. Jet Kerosene fuel was used as the surrogate for JP-8 in the TANKS model as it is the closest in characteristics to JP-8.

Emission Calculations Summary from TANKS*

Tank Type	Throughput (gal.)	Working Loss (lbs)	Breathing Loss (lbs)	VOC Total (lbs)	VOC Total (tons)
Tank 1 (Seaport) - 50,000 bbl, cut and cover or AST	210,000	9.63	585.39	595.02	0.30
Tank 2 (Seaport) - 50,000 bbl, cut and cover or AST	210,000	9.63	585.39	595.02	0.30
Tank 3 (Airport) - 60,000 bbl, cut and cover or AST	114,545	5.25	714.88	720.13	0.36
Tank 4 (Airport) - 60,000 bbl, cut and cover or AST	114,545	5.25	714.88	720.13	0.36
Tank 5 (Airport) - 100,000 bbl, cut and cover or AST	190,909	8.75	1172.01	1180.76	0.59
Total		38.51	3,772.55	3,811.06	1.91

*See the following references for TANKS printouts. (SM12 - TANKS) & (SM13 - TANKS)

Summary	Summarizes total emissions by calendar year for Modified Alternative 2B - Construction Phase (Tinian South).
Combustion and Evaporative	Estimates emissions from non-road equipment exhaust and evaporative volatile organic compound emissions.
Fugitive	Estimates particulate emissions from construction activities including earthmoving, vehicle traffic, and windblown dust.
Grading	Estimates the number of days of site preparation, to be used for estimating heavy equipment exhaust and earthmoving dust emissions.
Construction Commuter	Estimates emissions for construction workers commuting to the site.
Haul Truck On-Road	Estimates emissions from hauling construction materials to the project site.

Summary of Air Quality Emissions from Divert EIS - Modified Alternative 2B - Construction Phase (Tinian South)

	NO_x (ton)	VOC (ton)	CO (ton)	SO₂ (ton)	PM₁₀ (ton)	PM_{2.5} (ton)	CO₂ (ton)
Construction Combustion/Evaporative	13.236	1.755	5.702	0.827	0.912	0.885	1,535.230
Construction Fugitive Dust	-	-	-	-	95.708	8.371	-
Construction Commuter	0.650	0.803	9.323	0.0106	0.026	0.012	583.069
Haul Truck On-Road	9.929	0.924	5.307	0.032	0.319	0.303	2,574.326
TOTAL	23.82	3.48	20.33	0.87	96.97	9.57	4,692.62

Annual Summary of Air Quality Emissions from Divert EIS - Modified Alternative 2B - Construction Phase (Tinian South)*

	Point and Area Sources Combined						
	NO_x (tpy)	VOC (tpy)	CO (tpy)	SO₂ (tpy)	PM₁₀ (tpy)	PM_{2.5} (tpy)	CO₂ (metric tons)
CY 01	7.94	1.16	6.78	0.29	32.32	3.19	1,419.03
CY 02	7.94	1.16	6.78	0.29	32.32	3.19	1,419.03
CY 03	7.94	1.16	6.78	0.29	32.32	3.19	1,419.03

* Construction duration is estimated to be 36 months and the emissions are assumed to be distributed evenly over the construction period.

Combustion Emissions - Modified Alternative 2B - Construction Phase (Tinian South)

Combustion Emissions of VOC, NO_x, SO₂, CO, PM_{2.5}, PM₁₀, and CO₂ due to Construction

Assumptions

When multiple options exist under the general construction activities the most conservative value will be used to quantify air emissions.

General Construction Activities

Area Disturbed (ft²)

Construct New Access Roads	177,294 ft ²
Construct Maintenance Facility	7,972 ft ²
Construct Jet Fuel System and Fire Pump System (Operational, Bulk and at the Port of Tinian)	908,933 ft ²
Construct Hazardous Cargo Pad	230,165 ft ²
Construct Parking Apron	832,128 ft ²

Total General Construction Area:	916,905 ft ²	21.0 acres
Total Demolition Area:	0 ft ²	0.0 acres
Total Pavement Area:	1,239,587 ft ²	28.5 acres
Total Disturbed Area:	2,156,492 ft ²	49.5 acres
Construction Duration:	36 months	
1 Yr Project Construction Activity:	240 days/yr	Assume 12 months, 4 weeks per month, 5 days per week.

Emission Factors Used for Construction Equipment

References: Guide to Air Quality Assessment, Sacramento Metropolitan Air Quality Management District (SMAQMD), 2004; and U.S. EPA NONROAD Emissions Model, Version 2005.0.0
 Emission factors are taken from the NONROAD model and were provided to e³M by Larry Landman of the Air Quality and Modeling Center (Landman.Larry@epamail.epa.gov) on 12/14/07. Factors provided are for the weighted average US fleet for CY2007.
 Assumptions regarding the type and number of equipment are from SMAQMD Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd. ^a per 10 acres	NO _x (lb/day)	VOC ^b (lb/day)	CO (lb/day)	SO ₂ ^c (lb/day)	PM ₁₀ (lb/day)	PM _{2.5} (lb/day)	CO ₂ (lb/day)
Bulldozer	1	13.60	0.96	5.50	1.02	0.89	0.87	1456.90
Motor Grader	1	9.69	0.73	3.20	0.80	0.66	0.64	1141.65
Water Truck	1	18.36	0.89	7.00	1.64	1.00	0.97	2342.98
Total per 10 acres of activity	3	41.64	2.58	15.71	0.83	2.55	2.47	4941.53

Paving

Equipment	No. Reqd. ^a per 10 acres	NO _x (lb/day)	VOC ^b (lb/day)	CO (lb/day)	SO ₂ ^c (lb/day)	PM ₁₀ (lb/day)	PM _{2.5} (lb/day)	CO ₂ (lb/day)
Paver	1	3.83	0.37	2.06	0.28	0.35	0.34	401.93
Roller	1	4.82	0.44	2.51	0.37	0.43	0.42	536.07
Truck	2	36.71	1.79	14.01	3.27	1.99	1.93	4685.95
Total per 10 acres of activity	4	45.37	2.61	18.58	0.91	2.78	2.69	5623.96

Demolition

Equipment	No. Reqd. ^a per 10 acres	NO _x (lb/day)	VOC ^b (lb/day)	CO (lb/day)	SO ₂ ^c (lb/day)	PM ₁₀ (lb/day)	PM _{2.5} (lb/day)	CO ₂ (lb/day)
Loader	1	13.45	0.99	5.58	0.95	0.93	0.90	1360.10
Haul Truck	1	18.36	0.89	7.00	1.64	1.00	0.97	2342.98
Total per 10 acres of activity	2	31.81	1.89	12.58	0.64	1.92	1.87	3703.07

Building Construction

Equipment ^d	No. Reqd. ^a per 10 acres	NO _x (lb/day)	VOC ^b (lb/day)	CO (lb/day)	SO ₂ ^c (lb/day)	PM ₁₀ (lb/day)	PM _{2.5} (lb/day)	CO ₂ (lb/day)
Stationary								
Generator Set	1	2.38	0.32	1.18	0.15	0.23	0.22	213.06
Industrial Saw	1	2.62	0.32	1.97	0.20	0.32	0.31	291.92
Welder	1	1.12	0.38	1.50	0.08	0.23	0.22	112.39
Mobile (non-road)								
Truck	1	18.36	0.89	7.00	1.64	1.00	0.97	2342.98
Forklift	1	5.34	0.56	3.33	0.40	0.55	0.54	572.24
Crane	1	9.57	0.66	2.39	0.65	0.50	0.49	931.93
Total per 10 acres of activity	6	39.40	3.13	17.38	3.12	2.83	2.74	4464.51

Architectural Coatings

Equipment	No. Reqd. ^a per 10 acres	NO _x (lb/day)	VOC ^b (lb/day)	CO (lb/day)	SO ₂ ^c (lb/day)	PM ₁₀ (lb/day)	PM _{2.5} (lb/day)	CO ₂ (lb/day)
Air Compressor	1	3.57	0.37	1.57	0.25	0.31	0.30	359.77
Total per 10 acres of activity	1	3.57	0.37	1.57	0.25	0.31	0.30	359.77

- The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.
- The SMAQMD 2004 reference lists emission factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC. The NONROAD model contains emissions factors for total HC and for VOC. The factors used here are the VOC factors.
- The NONROAD emission factors assume that the average fuel burned in nonroad trucks is 1100 ppm sulfur. Trucks that would be used for the Proposed Actions will all be fueled by highway grade diesel fuel which cannot exceed 500 ppm sulfur. These estimates therefore over-estimate SO₂ emissions by more than a factor of two.
- Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

Combustion Emissions - Modified Alternative 2B - Construction Phase (Tinian South) - Continued

Project-Specific Combustion and Evaporative Emission Factor Summary

Source	Equipment Multiplier*	Project-Specific Emission Factors (lb/day)						
		NO _x	VOC	CO	SO ₂ **	PM ₁₀	PM _{2.5}	CO ₂
Grading Equipment	5	208,206	12,885	78,549	4,164	12,728	12,346	247,076.32
Paving Equipment	3	136,102	7,817	55,735	2,722	8,328	8,078	168,718.71
Demolition Equipment	1	31,808	1,886	12,584	0,636	1,923	1,865	37,030.74
Building Construction	2	78,793	6,260	34,765	6,233	5,658	5,488	89,290.23
Air Compressor for Architectural Coating	2	7,148	0,746	3,131	0,502	0,619	0,600	7,195.47
Architectural Coating**			78,040					

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project.

**Emission factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994
 Example: SMAQMD Emission Factor for Grading Equipment NO_x = (Total Grading NO_x per 10 acre)/(Equipment Multiplier)

Summary of Input Parameters

	Total Area (ft ²)	Total Area (acres)	Total Days	
Grading:	2,156,492	49.51	6	(from "Grading" worksheet)
Paving:	1,239,587	28.46	45	
Demolition:	0	0.00	0	
Building Construction:	916,905	21.05	240	
Architectural Coating:	916,905	21.05	20	(per SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative. The 'Total Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition. The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Project Combustion and Evaporative Emissions by Activity (lbs)

	NO _x	VOC	CO	SO ₂	PM ₁₀	PM _{2.5}	CO ₂
Grading Equipment	1,249.24	77.31	471.30	24.98	76.37	74.07	148,246
Paving	6,169.95	354.38	2,526.67	123.40	377.55	366.22	764,858
Demolition	-	-	-	-	-	-	0
Building Construction	18,910.23	1,502.31	8,343.51	1,495.85	1,357.94	1,317.20	2,142,966
Architectural Coatings	142.96	1,575.74	62.62	10.05	12.37	12.00	14,391
Total Emissions (lbs):	26,472.38	3,509.73	11,404.09	1,654.28	1,824.23	1,769.50	3,070,460

Results: Project Annual Combustion and Evaporative Emission Rates

	NO _x	VOC	CO	SO ₂	PM ₁₀	PM _{2.5}	CO ₂
Total Project Combustion and Evaporative Emissions (lbs)	26,472.38	3,509.73	11,404.09	1,654.28	1,824.23	1,769.50	3,070,460
Total Project Combustion and Evaporative Emissions (tons)	13.24	1.75	5.70	0.83	0.91	0.88	1,535.23

Construction Fugitive Dust Emissions - Proposed Action [Modified Alternative 2B - Construction Phase (Tinian South)]

Construction Fugitive Dust Emission Factors

	Emission Factor	Units	Source
General Construction Activities	0.19 ton PM ₁₀ /acre-month		MRI 1996; EPA 2001; EPA 2006
New Road Construction	0.42 ton PM ₁₀ /acre-month		MRI 1996; EPA 2001; EPA 2006
PM_{2.5} Emissions			
PM _{2.5} Multiplier	0.10	(10% of PM ₁₀ emissions assumed to be PM _{2.5})	EPA 2001; EPA 2006
Control Efficiency			
	0.50	(assume 50% control efficiency for PM ₁₀ and PM _{2.5} emissions)	EPA 2001; EPA 2006

Project Assumptions

New Roadway Construction (0.42 ton PM₁₀/acre-month)

Duration of Construction Project	12 months
Area	28.5 acres

General Construction Activities (0.19 ton PM₁₀/acre-month)

Duration of Construction Project	12 months
Area	21.0 acres

	Project Emissions (tons/year)			
	PM ₁₀ uncontrolled	PM ₁₀ controlled	PM _{2.5} uncontrolled	PM _{2.5} controlled
New Roadway Construction	143.42	71.71	14.34	7.17
General Construction Activities	47.99	24.00	2.40	1.20
Total	191.42	95.71	16.74	8.37

General Construction Activities Emission Factor

0.19 ton PM₁₀/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The area-based emission factor for construction activities is based on a study completed by the Midwest Research Institute (MRI) Improvement of Specific Emission Factors (BACM Project No. 1), March 29, 1996. The MRI study evaluated seven construction projects in Nevada and California (Las Vegas, Coachella Valley, South Coast Air Basin, and the San Joaquin Valley). The study determined an average emission factor of 0.11 ton PM₁₀/acre-month for sites without large-scale cut/fill operations. A worst-case emission factor of 0.42 ton PM₁₀/acre-month was calculated for sites with active large-scale earth moving operations. The monthly emission factors are based on 168 work-hours per month (MRI 1996). A subsequent MRI Report in 1999, Estimating Particulate Matter Emissions From Construction Operations, calculated the 0.19 ton PM₁₀/acre-month emission factor by applying 25% of the large-scale earthmoving emission factor (0.42 ton PM₁₀/acre-month) and 75% of the average emission factor (0.11 ton PM₁₀/acre-month). The 0.19 ton PM₁₀/acre-month emission factor is referenced by the EPA for non-residential construction activities in recent procedures documents for the National Emission Inventory (EPA 2001; EPA 2006). The 0.19 ton PM₁₀/acre-month emission factor represents a refinement of EPA's original AP-42 area-based total suspended particulate (TSP) emission factor in Section 13.2.3 Heavy Construction Operations. In addition to the EPA, this methodology is also supported by the South Coast Air Quality Management District as well as the Western Regional Air Partnership (WRAP) which is funded by the EPA and is administered jointly by the Western Governor's Association and the National Tribal Environmental Council. The emission factor is assumed to encompass a variety of non-residential construction activities including building construction (commercial, industrial, institutional, governmental), public works, and travel on unpaved roads. The EPA National Emission Inventory documentation assumes that the emission factors are uncontrolled and recommends a control efficiency of 50% for PM₁₀ and PM_{2.5} in PM nonattainment areas.

New Road Construction Emission Factor

0.42 ton PM₁₀/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The emission factor for new road construction is based on the worst-case conditions emission factor from the MRI 1996 study described above (0.42 tons PM₁₀/acre-month). It is assumed that road construction involves extensive earthmoving and heavy construction vehicle travel resulting in emissions that are higher than other general construction projects. The 0.42 ton PM₁₀/acre-month emission factor for road construction is referenced in recent procedures documents for the EPA National Emission Inventory (EPA 2001; EPA 2006).

PM_{2.5} Multiplier

0.10

PM_{2.5} emissions are estimated by applying a particle size multiplier of 0.10 to PM₁₀ emissions. This methodology is consistent with the procedures documents for the National Emission Inventory (EPA 2006).

Control Efficiency for PM₁₀ and PM_{2.5}

0.50

The EPA National Emission Inventory documentation recommends a control efficiency of 50% for PM₁₀ and PM_{2.5} in PM nonattainment areas (EPA 2006). Wetting controls will be applied during project construction.

References:

EPA 2001. *Procedures Document for National Emissions Inventory, Criteria Air Pollutants, 1985-1999*. EPA-454/R-01-006. Office of Air Quality Planning and Standards, United States Environmental Protection Agency. March 2001.

EPA 2006. *Documentation for the Final 2002 Nonpoint Sector (Feb 06 version) National Emission Inventory for Criteria and Hazardous Air Pollutants*. Prepared for: Emissions Inventory and Analysis Group (C339-02) Air Quality Assessment Division Office of Air Quality Planning and Standards, United States Environmental Protection Agency. July 2006.

MRI 1996. *Improvement of Specific Emission Factors (BACM Project No. 1)*. Midwest Research Institute (MRI). Prepared for the California South Coast Air Quality Management District, March 29, 1996.

Grading Schedule - Proposed Action [Modified Alternative 2B - Construction Phase (Tinian South)]

Estimate of time required to grade a specified area.

Input Parameters

Construction area: 49.5 acres/yr (from Combustion Worksheet)
 Qty Equipment: 15.0 (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions

Terrain is mostly flat.
 An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.
 200 hp bulldozers are used for site clearing.
 300 hp bulldozers are used for stripping, excavation, and backfill.
 Vibratory drum rollers are used for compacting.
 Stripping, Excavation, Backfill and Compaction require an average of two passes each.
 Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	49.51	6.19
2230 500 0300	Stripping	Topsoil & stockpiling, adverse soil	1,650	cu. yd/day	2.05	0.49	49.51	24.20
2315 432 5220	Excavation	Bulk, open site, common earth, 150' haul	800	cu. yd/day	0.99	1.01	24.75	24.96
2315 120 5220	Backfill	Structural, common earth, 150' haul	1,950	cu. yd/day	2.42	0.41	24.75	10.24
2315 310 5020	Compaction	Vibrating roller, 6" lifts, 3 passes	2,300	cu. yd/day	2.85	0.35	49.51	17.36
TOTAL								82.95

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr: 82.95
 Qty Equipment: 15.00
 Grading days/yr: 5.53

Construction/Staff Commuter Emissions - Modified Alternative 2B - Construction Phase (Tinian South)

Emissions from construction workers commuting to the job site are estimated in this spreadsheet.

Emission Estimation Method: Emission Estimation Method: Air Force Civil Engineer Center (AFCEE), Air Emissions Factor Guide to Air Force Mobile Sources, October 2014.

Assumptions:

Passenger vehicle emission factors for scenario year 2015 are used.
 The average roundtrip commute for a construction/staff worker = 40 miles
 Number of construction days = 240 days
 Number of construction/Staff workers (daily) = 100 people

Note: None

Personal Operating Vehicle (POV) On-Road Emission Factors for Year 2016 (grams/mile)

NO _x	VOC	CO	SO ₂	PM ₁₀	PM _{2.5}	CO ₂
0.614	0.759	8.810	0.010	0.025	0.011	551.000

Source: Emission factors for all pollutants are from Table 5-28: On-Road Vehicle Emission Factors - 2016 POV, Gasoline Light Duty Trucks (LDGT) at low altitude, within AFCEE Air Emissions Factor Guide to Air Force Mobile Sources, October 2014.

Construction Commuter Emissions

	NO _x	VOC	CO	SO ₂	PM ₁₀	PM _{2.5}	CO ₂
lbs	1,299.471	1,606.349	18,645.503	21.164	52.910	23.280	1,166,137.566
tons	0.650	0.803	9.323	0.011	0.026	0.012	583.069

Example Calculation: NO_x emissions (lbs) = 60 miles/day * NO_x emission factor (lb/mile) * number of construction days * number of workers

Construction/Haul Truck Emissions - Modified Alternative 2B - Construction Phase (Tinian South)

Emissions from hauling construction supplies, demolition debris, fill, and excavated material are estimated in this spreadsheet.

Emission Estimation Method: Air Force Center for Environmental Excellence (AFCEE) Air Emissions Factor Guide to Air Force Mobile Sources, Dec. 2009.

Concrete Mixing and Dump Truck Assumptions:

Dump trucks carry 11 cubic yards of material per trip.
 Concrete mixing trucks carry 10 cubic yards of material per trip.
 The average distance from the port to Commercial Concrete Supply Company is 1.7 miles; therefore, dump trucks will travel 3.4 miles round trip.
 The average distance from the Commercial Concrete Supply Company (CCSC) to the project site is 2.3 miles; therefore, concrete trucks will travel 4.6 miles round trip.

Fill Materials Assumptions:

Haul trucks carry 20 cubic yards of material per trip.
 The average distance from the project site to the materials source is 20 miles; therefore, building material haul trucks will travel 40 miles round trip.
 Estimated number of trips required by haul trucks = total amount of material/20 cubic yards per truck

Amount of demolition debris =	0 cubic yards	No Demolition in the Proposed Action
Amount of cement transported from port to CCSC =	2,530 cubic yards	
Amount of concrete transported from CCSC to project site =	40,930 cubic yards	
Amount of Excavation Materials for New Structures/Buildings =	407,513 cubic yards	Construction area multiplied by depth of disturbance which is assumed to be 12 feet.
Amount of Building/Structure Materials =	305,635 cubic yards	Construction area multiplied by 9 feet.

Number of dump trucks required (port to CCSC) =	230 heavy duty diesel haul truck trips, Cells rounded up
Number of concrete mixing trucks required (CCSC to project site) =	4093 heavy duty diesel haul truck trips, Cells rounded up
Number of trucks required (Building Materials) =	35,657 heavy duty diesel haul truck trips
Miles per trip (port to CCSC) =	3.4 miles
Miles per trip (CCSC to project site) =	4.6 miles
Miles per trip (Building Materials) =	40.0 miles

Low Altitude Heavy Duty Diesel Vehicle 8b (HDDV8b) Average Emission Factors (grams/mile)

	NO _x	VOC	CO	SO ₂	PM ₁₀	PM _{2.5}	CO ₂
HDDV8b	6.23	0.58	3.33	0.02	0.20	0.19	1615

Notes:

Emission factors for all pollutants are from Appendix A - On-Road Vehicle Emission Factors within AFCEE Air Emissions Factor Guide to Air Force Mobile Sources, Dec. 2009.
 Emission factors from calendar year 2015 were used assuming the average vehicle model year is 2005.

HDDV8b Haul Truck Emissions

	NO _x	VOC	CO	SO ₂	PM ₁₀	PM _{2.5}	CO ₂
lbs	19,858.90	1,848.82	10,614.79	63.75	637.52	605.65	5,148,651.07
tons	9.93	0.92	5.31	0.03	0.32	0.30	2,574.33

Example Calculation: NO_x emissions (lbs) = 40 miles per trip * 35,657 trips * NO_x emission factor (g/mile) * lb/453.6 g

No Statistical Area Available for TNI

Row #	State	County	Tier-1	Point Source Emissions						Area Source Emissions (Non-Point and Mobile Sources)					
				CO	NO _x	PM ₁₀	PM _{2.5}	SO ₂	VOC	CO	NO _x	PM ₁₀	PM _{2.5}	SO ₂	VOC
No Data Available															
Grand Total				0	0	0	0	0	0	0	0	0	0	0	0

SOURCE:

<http://www.epa.gov/ttn/chiefeiiinformation.html>

USEPA - AirData NET Tier Report

*Net Air pollution sources (area and point) in tons per year (2002)

Site visited on 02 February 2012.

No Air Quality Control Region Identified

	CO	NO _x	PM ₁₀	PM _{2.5}	SO ₂	VOC
CNMI	0	0	0	0	0	0
CNMI DEQ	0	0	0	0	0	0

Summary	Summarizes total emissions by calendar year for Modified Alternative 2b - Implementation Phase (Tinian South).
Airfield Operations	Aircraft operations consist of taxi, take-off and landings (sorties or LTOs), touch-and-go operations (TGOs), and low flybys (LFB) by base aircraft.
Fuel Truck and Commuter Vehicle Emissions	Estimates emissions for workers and operational vehicles commuting to the site of the Proposed Action.
Fuel Transfer Emissions	Fuel loading operations under the Proposed Action involves the loading of fuel into tanker trucks and aircraft.
Internal Combustion Engine (ICE) Emissions	Estimates Emissions from Internal Combustion Engines (e.g Generators)
Fuel Storage Tanks	Estimates emissions from Above Ground Storage Tanks.

Criteria Pollutant and VOC Emissions Summary for Modified Alternative 2b - Implementation Phase (Tinian South) (tons/year)

Source Category	PM10	PM2.5	CO	NOx	SOx	VOCs
Airfield Operations	0.05	0.05	18.67	6.77	0.98	1.25
Fuel Truck and Commuter Vehicle Emissions	0.02	0.01	0.19	0.37	0.00	0.03
Fuel Transfer	N/A	N/A	N/A	N/A	N/A	0.01
Fuel Storage Tanks	N/A	N/A	N/A	N/A	N/A	1.91
Total Criteria and VOC Pollutant Emissions (tons/year)	0.07	0.07	18.86	7.14	0.98	3.19

Greenhouse Gas (GHG) Emissions Summary for Modified Alternative 2b - Implementation Phase (Tinian South) (metric tonnes/year)

Source Category	CO ₂ -equivalent (lb/year)	CO ₂ -equivalent (kg/year)	CO ₂ -equivalent (metric tonne/year)
Airfield Operations*	8,833,755	4,006,991	4,007
Fuel Truck and Commuter Vehicle Emissions	205,537	93,232	93
Fuel Transfer	0	0	0
Fuel Storage Tanks	0	0	0
Total GHG Emissions	9,039,293	4,100,223	4,100

DATA - Airfield Operations for Modified Alternative 2b - Implementation Phase (Tinian South)

Aircraft exercises under this alternative are based on assuming 2 to 4 KC-135R aircraft operating up to 8 weeks per year for a maximum of 720 KC-135R operations per year. Each operation is equivalent to one landing or one take-off (1 LTO cycle = 2 operations).

Landing and Takeoff (LTO) Cycles

Description	Quantity
# of KC-135R LTO's per year	360

Legend

Airfield Activity Data (Worst Case Scenario)

Aircraft Model	Aircraft Model Used to Match to Available Emission Factors	Engine Model	# Engines	APU Model	# APUs	Notes	LTO Cycles
KC-135R	KC-135-R	F108-CF-201	4	No data on APUs		See below	360

Note: F108-CF-201 is the military designation of the CFM56-2B-1 engine.

Emission Factors (EFs) and Constants - Airfield Operations for Modified Alternative 2b - Implementation Phase (Tinian South)

Aircraft Criteria Pollutant Emission Factors

Aircraft Model	Engine Model	# Engines	Reference Thrust Mode	LTO/TGO Thrust Mode	Fuel Flow (lb/hr)	Emission Factors in lb Pollutant per 1000 lb Fuel Burned						
						PM10	PM2.5	CO	NO _x	SO ₂	VOCs	TIM
KC-135R	F108-CF-201	4	Idle	Idle	1016	0.06	0.06	30.70	4.00	1.06	2.10	47.7
KC-135R	F108-CF-201	4	Approach	Approach	2468	0.06	0.05	4.20	8.20	1.06	0.09	5.2
KC-135R	F108-CF-201	4	Climbout	Climbout	6500	0.05	0.05	0.90	16.00	1.06	0.06	1.6
KC-135R	F108-CF-201	4	Takeoff	Takeoff	7818	0.07	0.06	0.90	18.05	1.06	0.05	0.7

Emission factors from Air Force Civil Engineer Center (AFCEC) October 2014 Air Emissions Guide for Air Force Mobile Sources, Table 2-8

APU Emission Factors

Aircraft Model	# APU	APU Model	APU Emission Factors in lb Pollutant per hour						APU (hr)
			PM10	PM2.5	CO	NO _x	SO ₂	VOCs	
KC-135R			No Data Available						

Emission Factors (EFs) and Constants - Airfield Operations for Modified Alternative 2b - Implementation Phase (Tinian South)

Default Time-In-Mode

Aircraft Type	Typical Duration by Mode (minutes)					Total
	Taxi/Idle	Takeoff	Climbout	Approach	Taxi/Idle-in	
KC-135R	32.8	0.7	1.6	5.2	14.9	55.2

Default Time-In-Mode rates are from AFCEC October 2014 Air Emissions Guide for Air Force Mobile Sources, Table 2-4

Emission Factors (EFs) and Constants - Airfield Operations for Modified Alternative 2b - Implementation Phase (Tinian South)

Greenhouse Gas Emission Factors

Units	CO ₂	CH ₄	N ₂ O
kg/gal fuel	9.80	---	---
g/gal fuel	---	0.27	0.31

Reference: Footnote 2, from Table 2-8 of the AFCEC October 2014 Air Emissions Guide for Air Force Mobile Sources.

Calculations - Airfield Operations for Modified Alternative 2a - Implementation Phase (Tinian North)

Criteria Pollutant and VOC Emissions per LTO by Aircraft Type

Calculated as the sum of the products of [(minutes) * (fuel flow/minute) * (lbs pollutant/lb fuel)] for each of the thrust modes.

Reported Aircraft Model	APU	Fuel (lb)	Emission in lb Pollutant per LTO					APU	
			PM10 (lb)	PM2.5 (lb)	CO (lb)	NOx (lb)	SOx (lb)		VOCs (lb)
KC-135R	0	5144.6	0.3	0.3	103.7	37.6	5.5	6.9	0

Total Criteria Pollutant and VOC Emissions for maximum LTO's by Aircraft Type

Reported Aircraft Model	APU	Total LTO's	Fuel (lb)	PM10 (tons)	PM2.5 (tons)	CO (tons)	NOx (tons)	SOx (tons)	VOCs (tons)	APU
			KC-135R	0	360	1,852,065.6	0.05	0.05	18.67	
Worst Case Scenario			1,852,065.60	0.05	0.05	18.67	6.77	0.98	1.25	0

Total gallons of fuel used for LTOs (277,671 gal.) is based on the 6.67 lb/gal density of JP-8 as provided in footnote 2. of Table 2-6 of the AFCEC October 2014 Air Emissions Guide for Air Force Mobile Sources. Emissions from LTO's are for the time up to and down from 3,000 feet elevation which is the default mixing height.

Calculations - Airfield Operations for Modified Alternative 2a - Implementation Phase (Tinian North)

Greenhouse Gas Emissions

Assume aircraft will use 7,500 pounds of fuel per LTO cycle, which is from the ground to 10,000 feet and from 10,000 feet back to a landing. This estimated fuel use was obtained from Hqs. Travis Miyashiro, HIANG, PACAF ASXP. Fuel use and associated emissions above 10,000 feet are accounted for in the MIRC EIS.

Quantity (gallons)	Fuel Type	CH ₄ (kg)	N ₂ O (kg)	CO ₂ (kg)	CO ₂ -equivalent (kg)	CO ₂ -equivalent (metric tonne)
404,798	JP-8	109	125	3,967,016	4,006,991	4,007

The CH₄ and N₂O Global Warming Potential multipliers are 25 and 298, respectively from EPA's Climate Leadership, Emission Factors for Greenhouse Gas Inventories, Last Modified 4 April 2014.

DATA - Fuel Truck and Commuter Vehicle Emissions for Modified Alternative 2b - Implementation Phase (Tinian South)

Given: Six 10,000 gal Fuel Trucks will take 2 days at 8 hrs/day and 3 hours on a third day to travel from Tinian Seaport to Tinian Airport (Site of Proposed Action) and to fill the airport tanks with the needed fuel; 420,000 gallons total. The six 10,000 gallon fuel trucks will make three round trips per day for the first two days and one round trip each on the third day.

Under the commercial lodging option six busses will transport a total of 256 personnel 4 roundtrips/day for a total of 24 roundtrips/day for 8 weeks.

Assumptions: A Gross Vehicle Weight (GVW) of 36,200 lbs will be used, based off of an 84 passenger Blue Bird bus.

Assume fuel truck GVW > 60,000 lbs since fuel load alone is 83,400 lbs.

Assume fuel trucks travel at 55 miles per hour

Assume 40 miles per roundtrip for busses.

Vehicle Weight Classes for Which Emission Factors are Published

Vehicle Category	Description	SCC
LDGV	Light-Duty Gasoline Vehicles (i.e., passenger cars) does not include SUVs, vans or pickups	A2201001000
LDGT1	Light-Duty Gasoline Trucks 1 (0-6,000 lbs GVW - includes pickup trucks, sport utility vehicles and vans)	A2201020000
LDGT3	Light-Duty Gasoline Trucks 3 (6,001-8,500 lbs. GVW - includes pickup trucks, sport utility vehicles and vans)	A2201040000
HDBGV2B	Class 2b Heavy-Duty Gasoline Vehicles (8501-10,000 lbs GVW)	A2201070000
HDBGV5	Class 5 Heavy-Duty Gasoline Vehicles (16,001-19,500 lbs GVW)	A2201070000
HDBGV8A	Class 8a Heavy-Duty Gasoline Vehicles (33,001-60,000 lbs GVW)	A2201070000
LDDV	Light-Duty Diesel Vehicles (Passenger Cars)	
LDDT34	Light-Duty Diesel Trucks 3 and 4 (6,001-8,500 lbs GVW)	A2230002000
HDDV2B	Class 2b Heavy-Duty Diesel Vehicles (8501-10,000 lbs GVW - includes pickup trucks)	A2230070000
HDDV5	Class 5 Heavy-Duty Diesel Vehicles (16,001-19,500 lbs GVW)	A2230070000
HDDV8A	Class 8a Heavy-Duty Diesel Vehicles (33,001-60,000 lbs GVW)	A2230070000
HDDV8B	Class 8b Heavy-Duty Diesel Vehicles (>60,000 lbs GVW)	A2230070000
MC	Motorcycles	A2201080000

Emission Factors - Fuel Truck and Commuter Vehicle Emissions for Modified Alternative 2b - Implementation Phase (Tinian South)

Emission Factors for Calendar Year 2015

Vehicle Class	Model Year	Emission Factors in grams per Mile ^a								
		PM ₁₀	PM _{2.5}	CO	NOx	SOx	NOC's	CO ₂	Fugitive PM ₁₀	Fugitive PM _{2.5}
HDDVSA*	2005	0.2	0.19	2.8	5.47	0.01	0.48	1544.1	0.05	0.01
HDDVSB**	2005	0.2	0.19	3.33	6.23	0.02	0.58	1615.2	0.05	0.01

* Low Altitude Emission Factors for Heavy Duty Diesel Vehicles Class 8a

**Low Altitude Emission Factors for Heavy Duty Diesel Vehicles Class 8b

a) Emission factors from Appendix A of Air Emissions Factor Guide to Air Force Mobile Sources, AFCEE, December 2009

Greenhouse Gas Emission Factors for Calendar Year 2015

Vehicle Class	CH ₄ (g/mile)	N ₂ O (g/mile)
HDDV	0.0051	0.0048

g/mile = grams per mile

CH₄ = Methane; N₂O = Nitrous Oxide

b) Emission Factors from EPA's Climate Leadership, Emission Factors for Greenhouse Gas Inventories, Last Modified 4 April 2014 (<http://www.epa.gov/climateleadership/documents/emission-factors.pdf>).

Emission Calculations - Fuel Truck and Commuter Vehicle Emissions for Modified Alternative 2b - Implementation Phase (Tinian South)

Miles for Commuter Emissions for 8 week training exercises

Vehicle Class	Speed		Total Trips/Day	Hours/Day	Total Days	Total Miles
	Miles/hour	Miles/Trip				
HDDV8A - Class 8a Heavy-Duty Diesel Vehicles (33,001-60,000 lbs GVW)		40	24		56	53,760
HDDV8B - Class 8b Heavy-Duty Diesel Vehicles (>60,000 lbs GVW)	55			48	2,375	6,270

Criteria and VOC Emissions for Commuters

Vehicle Class	Model Year	Annual Miles	Criteria Pollutant Emissions (tons/year)					
			PM ₁₀	PM _{2.5}	CO	NO _x	SO _x	VOCs
HDDV8A - Class 8a Heavy-Duty Diesel Vehicles (33,001-60,000 lbs GVW)	2005	53,760	0.015	0.012	0.166	0.324	0.001	0.028
HDDV8B - Class 8b Heavy-Duty Diesel Vehicles (>60,000 lbs GVW)	2005	6,270	0.002	0.001	0.023	0.043	0.000	0.004
Total			0.017	0.013	0.189	0.367	0.001	0.032

Particulate emissions include exhaust, brake wear, tire wear. Assume paved road.

Greenhouse Gas Emissions for Commuters

Vehicle Class	Annual Miles	CO ₂ (lb/year)	CH ₄ (lb/year)	N ₂ O (lb/year)	CH ₄ GWP Multiplier	N ₂ O GWP Multiplier	CO ₂ Equivalent (lb/year)	CO ₂ Equivalent (metric tonnes/year)
HDDV8A - Class 8a Heavy-Duty Diesel Vehicles (33,001-60,000 lbs GVW)	53,760	183,004.44	0.60	0.57	25	298	183,189.08	83.09
HDDV8B - Class 8b Heavy-Duty Diesel Vehicles (>60,000 lbs GVW)	6,270	22,326.51	0.07	0.07	25	298	22,348.04	10.14
Total		205,330.95	0.67	0.64	---	---	205,537.13	93.23

GWP = Global Warming Potential; 100-year GWP values obtained from EPA's Climate Leadership, Emission Factors for Greenhouse Gas Inventories, Last Modified 4 April 2014 (<http://www.epa.gov/climateleadership/documents/emission-factors.pdf>)

Emission Calculations Method - Fuel Truck and Commuter Vehicle Emissions for Modified Alternative 2b - Implementation Phase (Tinian South)

Calculation Method: Equation 4-1, AFCEE 2009, Mobile Emissions Guide

$$EP = VMTVehCat * EFPoVehCat * 0.002205$$

Where,

EP = Emissions of each individual pollutant (lb/yr)

VMTVehCat = Annual vehicle miles traveled by each vehicle category (LDGV, LDGT1, LDDV, etc.) (mi/yr)

EFPoVehCat = Emission factor of each pollutant for each vehicle category (g/mi)

0.002205 = Factor for converting grams to pounds (g/lb).

DATA - Fuel Loading Emissions for Modified Alternative 2b - Implementation Phase (Tinian South)

Given:

Total Exercise Days (8 weeks)	56
Initial Fuel Fill Days	2.333333333
Remaining Fuel Fill Days	0
Total # of Fuel Trucks	6
Total Gallons per Fuel Truck	10,000
Trips per day per Fuel Truck	3
1 bbl conversion to gallons	42
Total Fuel (gal) during Initial Fill	420,000
Total Fuel (gal) during Remaining Exercise	0
Total Fuel (gal) during Exercise (8 Weeks)	420,000

Proposed Action Fuel Loading Operations

Location	Description	Fuel Type	Fuel Transferred (gal)	Category
Flightline	Loading Aircraft from Truck Fill Stands	JP-8	420,000	Loading
Seaport, Loading Racks (50,000 bbl tank 1)	Loading Refueler Trucks	JP-8	210,000	Loading
Seaport, Loading Racks (50,000 bbl tank 2)	Loading Refueler Trucks	JP-8	210,000	Loading

Emission Factors - Fuel Loading Emissions for Modified Alternative 2b - Implementation Phase (Tinian South)

JP-8 emission factors (lb/Mgal)	Dispensing	Loading
	Splash	Bottom fill
Molecular Weight =	130	0.020
True Vapor Pressure (psia) =	0.011	
Dispensing Displacement losses =	0.0487	
Spillage =	0.7	
Total =	0.749	

AP-42 Table 7.1-2 dated 11/06
 AP-42 Table 7.1-2 dated 11/06 @ 70F (annual avg.)
 AP-42 Section 5.2 dated 6/08 Equation (1)
 AP-42 Table 5.2-7 dated 6/08

Emission Calculations - Fuel Loading Emissions for Modified Alternative 2b - Implementation Phase (Tinian South)

Location	Description	Fuel Type	Fuel Transferred	Displaced Vapor	Spillage	Total VOC	Total VOC
			(gal)	(lb)	(lb)	(lb)	(tons)
Flightline	Loading Aircraft from Truck Fill Stands	JP-8	420,000	8.5	0	8.5	0.004
Seaport, Loading Racks (50,000 bbl tank 1)	Loading Refueler Trucks	JP-8	210,000	4.2	0	4.2	0.002
Seaport, Loading Racks (50,000 bbl tank 2)	Loading Refueler Trucks	JP-8	210,000	4.2	0	4.2	0.002
Total			840,000	17	0	16.94	0.01

Emission Calculations Method - Fuel Loading Emissions for Modified Alternative 2b - Implementation Phase (Tinian South)

Displacement emissions for Diesel and JP-8 were estimated using Equation (1) from AP-42 Section 5.2, Transportation and Marketing of Petroleum Liquids, dated 6/08

$$L_L = 12.46 (SPM)/T$$

Where

L_L = Loading loss in lb/10³ gal

S = Saturation Factor 1.45 for splash loading, 0.6 for bottom loading

M = molecular weight,

T = temperature of bulk liquid (assume average annual ambient temperature)

DATA - Fuel Storage Tank Emissions for Modified Alternative 2b - Implementation Phase (Tinian South)

Fuel storage tank emissions were estimated using the U.S. EPA TANKS storage tank emissions calculation software (Version 4.0.9d). The emissions calculations algorithms in the TANKS program are based on Chapter 7 of EPA's AP-42. Honolulu, Hawaii was used as a surrogate location for the tanks as meteorological data does not exist in TANKS for CNMI. Jet Kerosene fuel was used as the surrogate for JP-8 in the TANKS model as it is the closest in characteristics to JP-8.

Emission Calculations Summary from TANKS*

Tank Type	Throughput (gal.)	Working Loss (lbs)	Breathing Loss (lbs)	VOC Total (lbs)	VOC Total (tons)
Tank 1 (Seaport) - 50,000 bbl, cut and cover or AST	210,000	9.63	585.39	595.02	0.30
Tank 2 (Seaport) - 50,000 bbl, cut and cover or AST	210,000	9.63	585.39	595.02	0.30
Tank 3 (Airport) - 60,000 bbl, cut and cover or AST	114,545	5.25	714.88	720.13	0.36
Tank 4 (Airport) - 60,000 bbl, cut and cover or AST	114,545	5.25	714.88	720.13	0.36
Tank 5 (Airport) - 100,000 bbl, cut and cover or AST	190,909	8.75	1172.01	1180.76	0.59
Total		38.51	3,772.55	3,811.06	1.91

*See the following references for TANKS printouts. (SM12 - TANKS) & (SM13 - TANKS)

Summary	Summarizes total emissions by calendar year for Modified Alternative 3A - Construction Phase (Hybrid Saipan/Tinian North).
Combustion and Evaporative	Estimates emissions from non-road equipment exhaust and evaporative volatile organic compound emissions.
Fugitive	Estimates particulate emissions from construction activities including earthmoving, vehicle traffic, and windblown dust.
Grading	Estimates the number of days of site preparation, to be used for estimating heavy equipment exhaust and earthmoving dust emissions.
Construction Commuter	Estimates emissions for construction workers commuting to the site.
Haul Truck On-Road	Estimates emissions from hauling construction materials to the project site.

Summary of Air Quality Emissions from Divert EIS - Modified Alternative 3A - Construction Phase (Hybrid Saipan/Tinian North)

	NO_x (ton)	VOC (ton)	CO (ton)	SO₂ (ton)	PM₁₀ (ton)	PM_{2.5} (ton)	CO₂ (ton)
Construction Combustion/Evaporative	18.431	2.016	7.813	0.931	1.230	1.193	2,176.608
Construction Fugitive Dust	-	-	-	-	202.801	19.198	-
Construction Commuter	1.137	1.406	16.315	0.0185	0.046	0.020	1,020.370
Haul Truck On-Road	9.025	0.840	4.824	0.029	0.290	0.275	2,339.687
TOTAL	28.59	4.26	28.95	0.98	204.37	20.69	5,536.67

Annual Summary of Air Quality Emissions from Divert EIS - Modified Alternative 3A - Construction Phase (Hybrid Saipan/Tinian North)*

	Point and Area Sources Combined						
	NO_x (tpy)	VOC (tpy)	CO (tpy)	SO₂ (tpy)	PM₁₀ (tpy)	PM_{2.5} (tpy)	CO₂ (metric tons)
CY 01	9.53	1.42	9.65	0.33	68.12	6.90	1,674.26
CY 02	9.53	1.42	9.65	0.33	68.12	6.90	1,674.26
CY 03	9.53	1.42	9.65	0.33	68.12	6.90	1,674.26

* Construction duration is estimated to be 36 months and the emissions are assumed to be distributed evenly over the construction period.

Combustion Emissions - Modified Alternative 3A - Construction Phase (Hybrid Saipan/Tinian North)

Combustion Emissions of VOC, NO_x, SO₂, CO, PM_{2.5}, PM₁₀, and CO₂ due to Construction

Assumptions

When multiple options exist under the general construction activities the most conservative value will be used to quantify air emission.

General Construction Activities	Area Disturbed (ft ²)
Construct Taxiway (Tinian N.)	1,385,300 ft ²
Construct Road Re-Route (Tinian N.)	40,585 ft ²
Construct New Access Roads (Tinian N.)	128,924 ft ²
Construct Maintenance Facility (Saipan)	6,100 ft ²
Construct Maintenance Facility (Tinian N.)	7,570 ft ²
Construct Jet Fuel System and Fire Pump System (Operational, Bulk and at the Port of Tinian) (Saipan/Tinian N.)	813,496 ft ²
Construct Hazardous Cargo Pad (Saipan)	250,470 ft ²
Construct Hazardous Cargo Pad (Tinian N.)	299,754 ft ²
Construct Parking Apron (Tinian N.)	1,026,340 ft ²

Total General Construction Area:	827,166 ft ²
	19.0 acres
Total Demolition Area:	0 ft ²
	0.0 acres
Total Pavement Area:	3,131,373 ft ²
	71.9 acres
Total Disturbed Area:	3,958,539 ft ²
	90.9 acres
Construction Duration:	36 months
1 Yr Project Construction Activity:	240 days/yr

Assume 12 months, 4 weeks per month, 5 days per week.

Emission Factors Used for Construction Equipment

References: Guide to Air Quality Assessment, Sacramento Metropolitan Air Quality Management District (SMAQMD), 2004; and U.S. EPA NONROAD Emissions Model, Version 2005.0.0
Emission factors are taken from the NONROAD model and were provided to e*M by Larry Landman of the Air Quality and Modeling Center (Landman.Larry@epamail.epa.gov) on 12/14/07. Factors provided are for the weighted average US fleet for CY2007. Assumptions regarding the type and number of equipment are from SMAQMD Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd. ^a per 10 acres	NO _x (lb/day)	VOC ^b (lb/day)	CO (lb/day)	SO ₂ ^c (lb/day)	PM ₁₀ (lb/day)	PM _{2.5} (lb/day)	CO ₂ (lb/day)
Bulldozer	1	13.60	0.96	5.50	1.02	0.89	0.87	1456.90
Motor Grader	1	9.69	0.73	3.20	0.80	0.66	0.64	1141.65
Water Truck	1	18.36	0.89	7.00	1.64	1.00	0.97	2342.98
Total per 10 acres of activity	3	41.64	2.58	15.71	0.83	2.55	2.47	4941.53

Paving

Equipment	No. Reqd. ^a per 10 acres	NO _x (lb/day)	VOC ^b (lb/day)	CO (lb/day)	SO ₂ ^c (lb/day)	PM ₁₀ (lb/day)	PM _{2.5} (lb/day)	CO ₂ (lb/day)
Paver	1	3.83	0.37	2.06	0.28	0.35	0.34	401.93
Roller	1	4.82	0.44	2.51	0.37	0.43	0.42	536.07
Truck	2	36.71	1.79	14.01	3.27	1.99	1.93	4685.95
Total per 10 acres of activity	4	45.37	2.61	18.58	0.91	2.78	2.69	5623.96

Demolition

Equipment	No. Reqd. ^a per 10 acres	NO _x (lb/day)	VOC ^b (lb/day)	CO (lb/day)	SO ₂ ^c (lb/day)	PM ₁₀ (lb/day)	PM _{2.5} (lb/day)	CO ₂ (lb/day)
Loader	1	13.45	0.99	5.58	0.95	0.93	0.90	1360.10
Haul Truck	1	18.36	0.89	7.00	1.64	1.00	0.97	2342.98
Total per 10 acres of activity	2	31.81	1.89	12.58	0.64	1.92	1.87	3703.07

Building Construction

Equipment ^d	No. Reqd. ^a per 10 acres	NO _x (lb/day)	VOC ^b (lb/day)	CO (lb/day)	SO ₂ ^c (lb/day)	PM ₁₀ (lb/day)	PM _{2.5} (lb/day)	CO ₂ (lb/day)
Stationary								
Generator Set	1	2.38	0.32	1.18	0.15	0.23	0.22	213.06
Industrial Saw	1	2.62	0.32	1.97	0.20	0.32	0.31	291.92
Welder	1	1.12	0.38	1.50	0.08	0.23	0.22	112.39
Mobile (non-road)								
Truck	1	18.36	0.89	7.00	1.64	1.00	0.97	2342.98
Forklift	1	5.34	0.56	3.33	0.40	0.55	0.54	572.24
Crane	1	9.57	0.66	2.39	0.65	0.50	0.49	931.93
Total per 10 acres of activity	6	39.40	3.13	17.38	3.12	2.83	2.74	4464.51

Architectural Coatings

Equipment	No. Reqd. ^a per 10 acres	NO _x (lb/day)	VOC ^b (lb/day)	CO (lb/day)	SO ₂ ^c (lb/day)	PM ₁₀ (lb/day)	PM _{2.5} (lb/day)	CO ₂ (lb/day)
Air Compressor	1	3.57	0.37	1.57	0.25	0.31	0.30	359.77
Total per 10 acres of activity	1	3.57	0.37	1.57	0.25	0.31	0.30	359.77

- The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.
- The SMAQMD 2004 reference lists emission factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC. The NONROAD model contains emissions factors for total HC and for VOC. The factors used here are the VOC factors.
- The NONROAD emission factors assume that the average fuel burned in nonroad trucks is 1100 ppm sulfur. Trucks that would be used for the Proposed Actions will all be fueled by highway grade diesel fuel which cannot exceed 500 ppm sulfur. These estimates therefore over-estimate SO₂ emissions by more than a factor of two.
- Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

Combustion Emissions - Modified Alternative 3A - Construction Phase (Hybrid Saipan/Tinian North) - Continued

Project-Specific Combustion and Evaporative Emission Factor Summary

Source	Equipment Multiplier*	Project-Specific Emission Factors (lb/day)						
		NO _x	VOC	CO	SO ₂ **	PM ₁₀	PM _{2.5}	CO ₂
Grading Equipment	9	374.771	23.193	141.389	7.495	22.910	22.222	44473.737
Paving Equipment	7	317.571	18.240	130.049	6.351	19.433	18.850	39367.698
Demolition Equipment	1	31.808	1.886	12.584	0.636	1.923	1.865	3703.074
Building Construction	2	78.793	6.260	34.765	6.233	5.658	5.488	8929.023
Air Compressor for Architectural Coating	2	7.148	0.746	3.131	0.502	0.619	0.600	719.547
Architectural Coating**			74.123					

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project.

**Emission factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994
 Example: SMAQMD Emission Factor for Grading Equipment NO_x = (Total Grading NO_x per 10 acre)/(Equipment Multiplier)

Summary of Input Parameters

	Total Area (ft ²)	Total Area (acres)	Total Days	
Grading:	3,958,539	90.88	6	(from "Grading" worksheet)
Paving:	3,131,373	71.89	49	
Demolition:	0	0.00	0	
Building Construction:	827,166	18.99	240	
Architectural Coating:	827,166	18.99	20	(per SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative. The 'Total Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition. The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Project Combustion and Evaporative Emissions by Activity (lbs)

	NO _x	VOC	CO	SO ₂	PM ₁₀	PM _{2.5}	CO ₂
Grading Equipment	2,248.63	139.16	848.33	44.97	137.46	133.33	266.842
Paving	15,560.98	893.76	6,372.40	311.22	952.20	923.63	1,929.017
Demolition	-	-	-	-	-	-	0
Building Construction	18,910.23	1,502.31	8,343.51	1,495.85	1,357.94	1,317.20	2,142.966
Architectural Coatings	142.96	1,497.39	62.62	10.05	12.37	12.00	14,391
Total Emissions (lbs):	36,862.80	4,032.62	15,626.86	1,862.09	2,459.97	2,386.17	4,353.216

Results: Project Annual Combustion and Evaporative Emission Rates

	NO _x	VOC	CO	SO ₂	PM ₁₀	PM _{2.5}	CO ₂
Total Project Combustion and Evaporative Emissions (lbs)	36,862.80	4,032.62	15,626.86	1,862.09	2,459.97	2,386.17	4,353.216
Total Project Combustion and Evaporative Emissions (tons)	18.43	2.02	7.81	0.93	1.23	1.19	2,176.61

Construction Fugitive Dust Emissions - Proposed Action [Modified Alternative 3A - Construction Phase (Hybrid Saipan/Tinian North)]

Construction Fugitive Dust Emission Factors

	Emission Factor	Units	Source
General Construction Activities	0.19 ton PM ₁₀ /acre-month		MRI 1996; EPA 2001; EPA 2006
New Road Construction	0.42 ton PM ₁₀ /acre-month		MRI 1996; EPA 2001; EPA 2006

PM_{2.5} Emissions

PM _{2.5} Multiplier	0.10	(10% of PM ₁₀ emissions assumed to be PM _{2.5})	EPA 2001; EPA 2006
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Control Efficiency

	0.50	(assume 50% control efficiency for PM ₁₀ and PM _{2.5} emissions)	EPA 2001; EPA 2006
--	------	--	--------------------

Project Assumptions

New Roadway Construction (0.42 ton PM₁₀/acre-month)

Duration of Construction Project	12 months
Area	71.9 acres

General Construction Activities (0.19 ton PM₁₀/acre-month)

Duration of Construction Project	12 months
Area	19.0 acres

	Project Emissions (tons/year)			
	PM₁₀ uncontrolled	PM₁₀ controlled	PM_{2.5} uncontrolled	PM_{2.5} controlled
New Roadway Construction	362.31	181.15	36.23	18.12
General Construction Activities	43.30	21.65	2.16	1.08
Total	405.60	202.80	38.40	19.20

General Construction Activities Emission Factor

0.19 ton PM₁₀/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The area-based emission factor for construction activities is based on a study completed by the Midwest Research Institute (MRI) Improvement of Specific Emission Factors (BACM Project No. 1), March 29, 1996. The MRI study evaluated seven construction projects in Nevada and California (Las Vegas, Coachella Valley, South Coast Air Basin, and the San Joaquin Valley). The study determined an average emission factor of 0.11 ton PM₁₀/acre-month for sites without large-scale cut/fill operations. A worst-case emission factor of 0.42 ton PM₁₀/acre-month was calculated for sites with active large-scale earth moving operations. The monthly emission factors are based on 168 work-hours per month (MRI 1996). A subsequent MRI Report in 1999, Estimating Particulate Matter Emissions From Construction Operations, calculated the 0.19 ton PM₁₀/acre-month emission factor by applying 25% of the large-scale earthmoving emission factor (0.42 ton PM₁₀/acre-month) and 75% of the average emission factor (0.11 ton PM₁₀/acre-month). The 0.19 ton PM₁₀/acre-month emission factor is referenced by the EPA for non-residential construction activities in recent procedures documents for the National Emission Inventory (EPA 2001; EPA 2006). The 0.19 ton PM₁₀/acre-month emission factor represents a refinement of EPA's original AP-42 area-based total suspended particulate (TSP) emission factor in Section 13.2.3 Heavy Construction Operations. In addition to the EPA, this methodology is also supported by the South Coast Air Quality Management District as well as the Western Regional Air Partnership (WRAP) which is funded by the EPA and is administered jointly by the Western Governor's Association and the National Tribal Environmental Council. The emission factor is assumed to encompass a variety of non-residential construction activities including building construction (commercial, industrial, institutional, governmental), public works, and travel on unpaved roads. The EPA National Emission Inventory documentation assumes that the emission factors are uncontrolled and recommends a control efficiency of 50% for PM₁₀ and PM_{2.5} in PM nonattainment areas.

New Road Construction Emission Factor

0.42 ton PM₁₀/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The emission factor for new road construction is based on the worst-case conditions emission factor from the MRI 1996 study described above (0.42 tons PM₁₀/acre-month). It is assumed that road construction involves extensive earthmoving and heavy construction vehicle travel resulting in emissions that are higher than other general construction projects. The 0.42 ton PM₁₀/acre-month emission factor for road construction is referenced in recent procedures documents for the EPA National Emission Inventory (EPA 2001; EPA 2006).

PM_{2.5} Multiplier

0.10

PM_{2.5} emissions are estimated by applying a particle size multiplier of 0.10 to PM₁₀ emissions. This methodology is consistent with the procedures documents for the National Emission Inventory (EPA 2006).

Control Efficiency for PM₁₀ and PM_{2.5}

0.50

The EPA National Emission Inventory documentation recommends a control efficiency of 50% for PM₁₀ and PM_{2.5} in PM nonattainment areas (EPA 2006). Wetting controls will be applied during project construction.

References:

EPA 2001. *Procedures Document for National Emissions Inventory, Criteria Air Pollutants, 1985-1999*. EPA-454/R-01-006. Office of Air Quality Planning and Standards, United States Environmental Protection Agency. March 2001.

EPA 2006. *Documentation for the Final 2002 Nonpoint Sector (Feb 06 version) National Emission Inventory for Criteria and Hazardous Air Pollutants*. Prepared for: Emissions Inventory and Analysis Group (C339-02) Air Quality Assessment Division Office of Air Quality Planning and Standards, United States Environmental Protection Agency. July 2006.

MRI 1996. *Improvement of Specific Emission Factors (BACM Project No. 1)*. Midwest Research Institute (MRI). Prepared for the California South Coast Air Quality Management District, March 29, 1996.

Grading Schedule - Proposed Action [Modified Alternative 3A - Construction Phase (Hybrid Saipan/Tinian North)]

Estimate of time required to grade a specified area.

Input Parameters

Construction area: 90.9 acres/yr (from Combustion Worksheet)
 Qty Equipment: 28.0 (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions

Terrain is mostly flat.
 An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.
 200 hp bulldozers are used for site clearing.
 300 hp bulldozers are used for stripping, excavation, and backfill.
 Vibratory drum rollers are used for compacting.
 Stripping, Excavation, Backfill and Compaction require an average of two passes each.
 Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	90.88	11.36
2230 500 0300	Stripping	Topsoil & stockpiling, adverse soil	1,650	cu. yd/day	2.05	0.49	90.88	44.43
2315 432 5220	Excavation	Bulk, open site, common earth, 150' haul	800	cu. yd/day	0.99	1.01	45.44	45.82
2315 120 5220	Backfill	Structural, common earth, 150' haul	1,950	cu. yd/day	2.42	0.41	45.44	18.80
2315 310 5020	Compaction	Vibrating roller, 6" lifts, 3 passes	2,300	cu. yd/day	2.85	0.35	90.88	31.87
TOTAL								152.27

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr: 152.27
 Qty Equipment: 28.00
 Grading days/yr: 5.44

Construction/Staff Commuter Emissions - Modified Alternative 3A - Construction Phase (Hybrid Saipan/Tinian North)

Emissions from construction workers commuting to the job site are estimated in this spreadsheet.

Emission Estimation Method: Air Force Civil Engineer Center (AFCEE), Air Emissions Factor Guide to Air Force Mobile Sources, October 2014.

Assumptions:

Passenger vehicle emission factors for scenario year 2015 are used.
 The average roundtrip commute for a construction/staff worker = 40 miles
 Number of construction days = 240 days
 Number of construction/Staff workers (daily) = 175 people

Note: None

Personal Operating Vehicle (POV) On-Road Emission Factors for Year 2016 (grams/mile)

NO _x	VOC	CO	SO ₂	PM ₁₀	PM _{2.5}	CO ₂
0.614	0.759	8.810	0.010	0.025	0.011	551.000

Source: Emission factors for all pollutants are from Table 5-28: On-Road Vehicle Emission Factors - 2016 POV, Gasoline Light Duty Trucks (LDGT) at low altitude, within AFCEC Air Emissions Factor Guide to Air Force Mobile Sources, October 2014.

Construction Commuter Emissions

	NO _x	VOC	CO	SO ₂	PM ₁₀	PM _{2.5}	CO ₂
lbs	2,274.074	2,811.111	32,629.630	37.037	92.593	40.741	2,040,740.741
tons	1.137	1.406	16.315	0.019	0.046	0.020	1,020.370

Example Calculation: NO_x emissions (lbs) = 60 miles/day * NO_x emission factor (lb/mile) * number of construction days * number of workers

Construction/Haul Truck Emissions - Modified Alternative 3A - Construction Phase (Hybrid Saipan/Tinian North)

Emissions from hauling construction supplies, demolition debris, fill, and excavated material are estimated in this spreadsheet.

Emission Estimation Method: Air Force Center for Environmental Excellence (AFCEE) Air Emissions Factor Guide to Air Force Mobile Sources, Dec. 2009.

Concrete Mixing and Dump Truck Assumptions:

Dump trucks carry 11 cubic yards of material per trip.

Concrete mixing trucks carry 10 cubic yards of material per trip.

Saipan

The average distance from the port to Commercial Concrete Supply Company is 7 miles; therefore, dump trucks will travel 14 miles round trip.

The average distance from the Commercial Concrete Supply Company (CCSC) to the project site is 2 miles; therefore, concrete trucks will travel 4 miles round trip.

Tinian N.

The average distance from the port to Commercial Concrete Supply Company is 1.7 miles; therefore, dump trucks will travel 3.4 miles round trip.

The average distance from the Commercial Concrete Supply Company (CCSC) to the project site is 2.3 miles; therefore, concrete trucks will travel 4.6 miles round trip.

Building Materials Assumptions:

Haul trucks carry 20 cubic yards of material per trip.

The average distance from the project site to the materials source is 20 miles; therefore, building material haul trucks will travel 40 miles round trip.

Estimated number of trips required by haul trucks = total amount of material/20 cubic yards per truck

Amount of demolition debris =	0 cubic yards	No Demolition in the Proposed Action
Amount of cement transported from port to CCSC (Saipan)=	396 cubic yards	
Amount of cement transported from port to CCSC (Tinian N.)=	3,190 cubic yards	
Amount of concrete transported from CCSC to project site (Saipan) =	5,610 cubic yards	
Amount of concrete transported from CCSC to project site (Tinian N.) =	51,580 cubic yards	
Amount of Excavation Materials for New Structures/Buildings (Saipan) =	61,372 cubic yards	Construction area multiplied by depth of disturbance which is assumed to be 12 feet.
Amount of Excavation Materials for New Structures/Buildings (Tinian N.) =	306,257 cubic yards	Construction area multiplied by depth of disturbance which is assumed to be 12 feet.
Amount of Building/Structure Materials (Saipan) =	46,029 cubic yards	Construction area multiplied by 9 feet.
Amount of Building/Structure Materials (Tinian N.) =	229,693 cubic yards	Construction area multiplied by 9 feet.
Number of dump trucks required (port to CCSC) (Saipan) =	36 heavy duty diesel haul truck trips, Cells rounded up	
Number of dump trucks required (port to CCSC) (Tinian N.) =	290 heavy duty diesel haul truck trips, Cells rounded up	
Number of concrete mixing trucks required (CCSC to project site) (Saipan) =	561 heavy duty diesel haul truck trips, Cells rounded up	
Number of concrete mixing trucks required (CCSC to project site) (Tinian N.) =	5158 heavy duty diesel haul truck trips, Cells rounded up	
Number of trucks required (Building Materials) (Saipan) =	5,370 heavy duty diesel haul truck trips	
Number of trucks required (Building Materials) (Tinian N.) =	26,798 heavy duty diesel haul truck trips	
Miles per roundtrip (port to CCSC) (Saipan) =	14 miles	
Miles per roundtrip (port to CCSC) (Tinian N.) =	3.4 miles	
Miles per roundtrip (CCSC to project site) (Saipan) =	4 miles	
Miles per roundtrip (CCSC to project site) (Tinian N.) =	4.6 miles	
Miles per roundtrip (Building Materials) (Saipan) =	40.0 miles	
Miles per roundtrip (Building Materials) (Tinian N.) =	40.0 miles	

Low Altitude Heavy Duty Diesel Vehicle 8b (HDDV8b) Average Emission Factors (grams/mile)

	NO _x	VOC	CO	SO ₂	PM ₁₀	PM _{2.5}	CO ₂
HDDV8b	6.23	0.58	3.33	0.02	0.20	0.19	1615

Notes:

Emission factors for all pollutants are from Appendix A - On-Road Vehicle Emission Factors within AFCEE Air Emissions Factor Guide to Air Force Mobile Sources, Dec. 2009.

Emission factors from calendar year 2015 were used assuming the average vehicle model year is 2005.

HDDV8b Haul Truck Emissions

	NO _x	VOC	CO	SO ₂	PM ₁₀	PM _{2.5}	CO ₂
lbs	18,049.47	1,680.31	9,647.30	57.94	579.42	550.45	4,679,374.22
tons	9.02	0.84	4.82	0.03	0.29	0.28	2,339.69

Example Calculation: NO_x emissions (lbs) = 40 miles per trip * 34,955 trips * NO_x emission factor (g/mile) * lb/453.6 g

No Statistical Area Available for TNI

Row #	State	County	Tier-1	Point Source Emissions						Area Source Emissions (Non-Point and Mobile Sources)					
				CO	NO _x	PM ₁₀	PM _{2.5}	SO ₂	VOC	CO	NO _x	PM ₁₀	PM _{2.5}	SO ₂	VOC
No Data Available															
Grand Total					0	0	0	0	0	0	0	0	0	0	0

SOURCE:

<http://www.epa.gov/ttn/chiefeiiinformation.html>

USEPA - AirData NET Tier Report

*Net Air pollution sources (area and point) in tons per year (2002)

Site visited on 02 February 2012.

No Air Quality Control Region Identified

	CO	NO _x	PM ₁₀	PM _{2.5}	SO ₂	VOC
CNMI	0	0	0	0	0	0
CNMI DEQ	0	0	0	0	0	0

Summary	Summarizes total emissions by calendar year for Modified Alternative 3a - Implementation Phase (Hybrid Saipan/Tinian North).
Airfield Operations	Aircraft operations consist of taxi, take-off and landings (sorties or LTOs), touch-and-go operations (TGOs), and low flybys (LFB) by base aircraft.
Fuel Truck and Commuter Vehicle Emissions	Estimates emissions for workers and operational vehicles commuting to the site of the Proposed Action.
Fuel Transfer Emissions	Fuel loading operations under the Proposed Action involves the loading of fuel into tanker trucks and aircraft.
Internal Combustion Engine (ICE) Emissions	Estimates Emissions from Internal Combustion Engines (e.g Generators)
Fuel Storage Tanks	Estimates emissions from Above Ground Storage Tanks.

Criteria Pollutant and VOC Emissions Summary for Modified Alternative 3a - Implementation Phase (Hybrid Saipan/Tinian North) (tons/year)

Source Category	PM10	PM2.5	CO	NOx	SOx	VOCs
Airfield Operations	0.05	0.05	18.67	6.77	0.98	1.25
Fuel Truck and Commuter Vehicle Emissions	0.02	0.01	0.19	0.37	0.00	0.03
Fuel Transfer	N/A	N/A	N/A	N/A	N/A	0.01
Fuel Storage Tanks	N/A	N/A	N/A	N/A	N/A	1.32
Total Criteria and VOC Pollutant Emissions (tons/year)	0.07	0.07	18.86	7.14	0.98	2.61

Greenhouse Gas (GHG) Emissions Summary for Modified Alternative 3a - Implementation Phase (Hybrid Saipan/Tinian North) (metric tonnes/year)

Source Category	CO ₂ -equivalent (lb/year)	CO ₂ -equivalent (kg/year)	CO ₂ -equivalent (metric tonne/year)
Airfield Operations*	8,833,755	4,006,991	4,007
Fuel Truck and Commuter Vehicle Emissions	205,537	93,232	93
Fuel Transfer	0	0	0
Fuel Storage Tanks	0	0	0
Total GHG Emissions	9,039,293	4,100,223	4,100

DATA - Airfield Operations for Modified Alternative 3a - Implementation Phase (Hybrid Saipan/Tinian North)

Aircraft exercises under this alternative are based on assuming 2 to 4 KC-135R aircraft operating up to 8 weeks per year for a maximum of 720 KC-135R operations per year. Each operation is equivalent to one landing or one take-off (1 LTO Cycle = 2 operations). These 720 total operations could occur at either Saipan or Tinian North.

Landing and Takeoff (LTO) Cycles

Description	Quantity
# of KC-135R LTO's per year	360

Legend

Airfield Activity Data (Worst Case Scenario)

Aircraft Model	Aircraft Model Used to Match to Available Emission Factors	Engine Model	# Engines	APU Model	# APUs	Notes	LTO Cycles
KC-135R	KC-135-R	F108-CF-201	4	No data on APUs		See below	360

Note: F108-CF-201 is the military designation of the CFM56-2B-1 engine.

Emission Factors (EFs) and Constants - Airfield Operations for Modified Alternative 3a - Implementation Phase (Hybrid Saipan/Tinian North)

Aircraft Criteria Pollutant Emission Factors

Aircraft Model	Engine Model	# Engines	Reference Thrust Mode	LTO/TGO Thrust Mode	Fuel Flow (lb/hr)	Emission Factors in lb Pollutant per 1000 lb Fuel Burned						
						PM10	PM2.5	CO	NO _x	SO ₂	VOCs	TIM
KC-135R	F108-CF-201	4	Idle	Idle	1016	0.06	0.06	30.70	4.00	1.06	2.10	47.7
KC-135R	F108-CF-201	4	Approach	Approach	2468	0.06	0.05	4.20	8.20	1.06	0.09	5.2
KC-135R	F108-CF-201	4	Climbout	Climbout	6500	0.05	0.05	0.90	16.00	1.06	0.06	1.6
KC-135R	F108-CF-201	4	Takeoff	Takeoff	7818	0.07	0.06	0.90	18.05	1.06	0.05	0.7

Emission factors from Air Force Civil Engineer Center (AFCEC) October 2014 Air Emissions Guide for Air Force Mobile Sources, Table 2-8

APU Emission Factors

Aircraft Model	# APU	APU Model	APU Emission Factors in lb Pollutant per hour						APU (hr)
			PM10	PM2.5	CO	NO _x	SO ₂	VOCs	
KC-135R			No Data Available						

Emission Factors (EFs) and Constants - Airfield Operations for Modified Alternative 3a - Implementation Phase (Hybrid Saipan/Tinian North)

Default Time-In-Mode

Aircraft Type	Typical Duration by Mode (minutes)					Total
	Taxi/Idle	Takeoff	Climbout	Approach	Taxi/Idle-in	
KC-135R	32.8	0.7	1.6	5.2	14.9	55.2

Default Time-In-Mode rates are from AFCEC October 2014 Air Emissions Guide for Air Force Mobile Sources, Table 2-4

Emission Factors (EFs) and Constants - Airfield Operations for Modified Alternative 3a - Implementation Phase (Hybrid Saipan/Tinian North)

Greenhouse Gas Emission Factors

Units	CO ₂	CH ₄	N ₂ O
kg/gal fuel	9.80	---	---
g/gal fuel	---	0.27	0.31

Reference: Footnote 2, from Table 2-8 of the AFCEC October 2014 Air Emissions Guide for Air Force Mobile Sources.

Calculations - Airfield Operations for Modified Alternative 3a - Implementation Phase (Hybrid Saipan/Tinian North)

Criteria Pollutant and VOC Emissions per LTO by Aircraft Type

Calculated as the sum of the products of [(minutes) * (fuel flow/minute) * (lbs pollutant/lb fuel)] for each of the thrust modes.

Reported Aircraft Model	APU	Emission in lb Pollutant per LTO							
		Fuel (lb)	PM10 (lb)	PM2.5 (lb)	CO (lb)	NOx (lb)	SOx (lb)	VOCs (lb)	APU
KC-135R	0	5144.6	0.3	0.3	103.7	37.6	5.5	6.9	0

Total Criteria Pollutant and VOC Emissions for maximum LTO's by Aircraft Type

Reported Aircraft Model	APU	Total LTO's	Emission in lb Pollutant per LTO							APU
			Fuel (lb)	PM10 (tons)	PM2.5 (tons)	CO (tons)	NOx (tons)	SOx (tons)	VOCs (tons)	
KC-135R	0	360	1,852,065.6	0.05	0.05	18.67	6.77	0.98	1.25	0
Worst Case Scenario										
			1,852,065.60	0.05	0.05	18.67	6.77	0.98	1.25	0

Total gallons of fuel used for LTOs (277,671 gal.) is based on the 6.67 lb/gal density of JP-8 as provided in footnote 2. of Table 2-8 of the AFCEC October 2014 Air Emissions Guide for Air Force Mobile Sources.

Calculations - Airfield Operations for Modified Alternative 3a - Implementation Phase (Hybrid Saipan/Tinian North)

Greenhouse Gas Emissions

Assume aircraft will use 7,500 pounds of fuel per LTO cycle, which is from the ground to 10,000 feet and from 10,000 feet back to a landing. This estimated fuel use was obtained from Hqs. Travis Miyashiro, HIANG, PACAF ASD/P. Fuel use and associated emissions above 10,000 feet are accounted for in the MIRC EIS.

Quantity (gallons)	Fuel Type	CH ₄ (kg)	N ₂ O (kg)	CO ₂ (kg)	CO ₂ -equivalent (kg)	CO ₂ -equivalent (metric tonne)
404,798	JP-8	109	125	3,957,016	4,066,991	4,007

The CH₄ and N₂O Global Warming Potential multipliers are 25 and 298, respectively from EPA's Climate Leadership, Emission Factors for Greenhouse Gas Inventories, Last Modified 4 April 2014.

DATA - Fuel Truck and Commuter Vehicle Emissions for Modified Alternative 3a - Implementation Phase (Hybrid Saipan/Tinian North)

Given:

Saipan

Six 10,000 gal Fuel Trucks will take 2 days at 8 hrs/day and 3 hours on a third day to travel from Saipan Seaport to Saipan International Airport (Site of Proposed Action) and to fill the airport tanks with the needed fuel; 420,000 gallons total. The six 10,000 gallon fuel trucks will make three round trips per day for the first two days and one round trip each on the third day.

Tinian North

Six 10,000 gal Fuel Trucks will take 2 days at 8 hrs/day and 3 hours on a third day to travel from Tinian Seaport to Tinian Airport (Site of Proposed Action) and to fill the airport tanks with the needed fuel; 420,000 gallons total. The six 10,000 gallon fuel trucks will make three round trips per day for the first two days and one round trip each on the third day.

Under the commercial lodging option at Saipan, six busses will transport a total of 256 personnel 4 roundtrips/day for a total of 24 roundtrips/day for 8 weeks. This same number of personnel, busses, and roundtrips could alternatively occur at Tinian.

Assumptions:

A Gross Vehicle Weight (GVW) of 36,200 lbs will be used, based off of an 84 passenger Blue Bird bus.

Assume fuel truck GVW > 60,000 lbs since fuel load alone is 83,400 lbs.

Assume fuel trucks travel at 55 miles per hour

Assume 40 miles per roundtrip for busses.

Vehicle Weight Classes for Which Emission Factors are Published

Vehicle Category	Description	SCC
LDGV	Light-Duty Gasoline Vehicles (i.e., passenger cars) does not include SUVs, vans or pickups	A2201001000
LDGT1	Light-Duty Gasoline Trucks 1 (0-6,000 lbs GVW - includes pickup trucks, sport utility vehicles and vans)	A2201020000
LDGT3	Light-Duty Gasoline Trucks 3 (6,001-8,500 lbs. GVW - includes pickup trucks, sport utility vehicles and vans)	A2201040000
HDBGV2B	Class 2b Heavy-Duty Gasoline Vehicles (8501-10,000 lbs GVW)	A2201070000
HDBGV5	Class 5 Heavy-Duty Gasoline Vehicles (16,001-19,500 lbs GVW)	A2201070000
HDBGV8A	Class 8a Heavy-Duty Gasoline Vehicles (33,001-60,000 lbs GVW)	A2201070000
LDDV	Light-Duty Diesel Vehicles (Passenger Cars)	
LDDT34	Light-Duty Diesel Trucks 3 and 4 (6,001-8,500 lbs GVW)	A2230002000
HDDV2B	Class 2b Heavy-Duty Diesel Vehicles (8501-10,000 lbs GVW - includes pickup trucks)	A2230070000
HDDV5	Class 5 Heavy-Duty Diesel Vehicles (16,001-19,500 lbs GVW)	A2230070000
HDDV8A	Class 8a Heavy-Duty Diesel Vehicles (33,001-60,000 lbs GVW)	A2230070000
HDDV8B	Class 8b Heavy-Duty Diesel Vehicles (>60,000 lbs GVW)	A2230070000
MC	Motorcycles	A2201080000

Emission Factors - Fuel Truck and Commuter Vehicle Emissions for Modified Alternative 3a - Implementation Phase (Hybrid Saipan/Tinian North)

Emission Factors for Calendar Year 2015

Vehicle Class	Model Year	Emission Factors in grams per Mile ^a								
		PM ₁₀	PM _{2.5}	CO	NO _x	NO _x	NOCs	CO ₂	Fugitive PM ₁₀	Fugitive PM _{2.5}
HDDVSA*	2005	0.2	0.19	2.8	5.47	0.01	0.48	1544.1	0.05	0.01
HDDVSB**	2005	0.2	0.19	3.33	6.23	0.02	0.58	1615.2	0.05	0.01

* Low Altitude Emission Factors for Heavy Duty Diesel Vehicles Class 8a

**Low Altitude Emission Factors for Heavy Duty Diesel Vehicles Class 8b

a) Emission factors from Appendix A of Air Emissions Factor Guide to Air Force Mobile Sources, AFCEE, December 2009

Greenhouse Gas Emission Factors for Calendar Year 2015

Vehicle Class	CH ₄ (g/mile)	N ₂ O (g/mile)
HDDV	0.0051	0.0048

g/mile = grams per mile

CH₄ = Methane; N₂O = Nitrous Oxide

b) Emission Factors from EPA's Climate Leadership, Emission Factors for Greenhouse Gas Inventories, Last Modified 4 April 2014 (<http://www.epa.gov/climateleadership/documents/emission-factors.pdf>).

Emission Calculations - Fuel Truck and Commuter Vehicle Emissions for Modified Alternative 3a - Implementation Phase (Hybrid Saipan/Tinian North)

Miles for Commuter Emissions for 8 week training exercises

Vehicle Class	Speed Miles/hour	Miles/Trip	Total Trips/Day	Hours/Day	Total Days	Total Miles
HDDV8A - Class 8a Heavy-Duty Diesel Vehicles (33,001-60,000 lbs GVW)		40	24		56	53,760
HDDV8B - Class 8b Heavy-Duty Diesel Vehicles (>60,000 lbs GVW)	55			48	2.375	6,270

Criteria and VOC Emissions for Commuters

Vehicle Class	Model Year	Annual Miles	Criteria Pollutant Emissions (tons/year)					
			PM ₁₀	PM _{2.5}	CO	NOx	SOx	VOCs
HDDV8A - Class 8a Heavy-Duty Diesel Vehicles (33,001-60,000 lbs GVW)	2005	53,760	0.015	0.012	0.166	0.324	0.001	0.028
HDDV8B - Class 8b Heavy-Duty Diesel Vehicles (>60,000 lbs GVW)	2005	6,270	0.002	0.001	0.023	0.043	0.000	0.004
Total			0.017	0.013	0.189	0.367	0.001	0.032

Particulate emissions include exhaust, brake wear, tire wear. Assume paved road.

Greenhouse Gas Emissions for Commuters

Vehicle Class	Annual Miles	CO ₂ (lb/year)	CH ₄ (lb/year)	N ₂ O (lb/year)	CH ₄ GWP Multiplier	N ₂ O GWP Multiplier	CO ₂ Equivalent (lb/year)	CO ₂ Equivalent (metric tonnes/year)
HDDV8A - Class 8a Heavy-Duty Diesel Vehicles (33,001-60,000 lbs GVW)	53,760	183,004.44	0.60	0.57	25	298	183,189.08	83.09
HDDV8B - Class 8b Heavy-Duty Diesel Vehicles (>60,000 lbs GVW)	6,270	22,326.51	0.07	0.07	25	298	22,348.04	10.14
Total		205,330.95	0.67	0.64	---	---	205,537.13	93.23

GWP = Global Warming Potential; 100-year GWP values obtained from EPA's Climate Leadership, Emission Factors for Greenhouse Gas Inventories, Last Modified 4 April 2014 (<http://www.epa.gov/climateleadership/documents/emission-factors.pdf>)

Emission Calculations Method - Fuel Truck and Commuter Vehicle Emissions for Modified Alternative 3a - Implementation Phase (Hybrid Saipan/Tinian North)

Calculation Method: Equation 4-1, AFCEE 2009, Mobile Emissions Guide

$$EP = VMTVehCat * EFPolVehCat * 0.002205$$

Where,

EP = Emissions of each individual pollutant (lb/yr)

VMTVehCat = Annual vehicle miles traveled by each vehicle category (LDGV, LDGT1, LDDV, etc.) (mi/yr)

EFPolVehCat = Emission factor of each pollutant for each vehicle category (g/mi)

0.002205 = Factor for converting grams to pounds (g/lb).

DATA - Fuel Loading Emissions for Modified Alternative 3a - Implementation Phase (Hybrid Saipan/Tinian North)

Given:		Saipan	
Total Exercise Days (8 weeks)		56	
Initial Fuel Fill Days		2.333333333	
Remaining Fuel Fill Days		0	
Total # of Fuel Trucks		6	
Total Gallons per Fuel Truck		10,000	
Trips per day per Fuel Truck		3	
1 bbl conversion to gallons		42	
Total Fuel (gal) during Initial Fill		420,000	
Total Fuel (gal) during Remaining Exercise		0	
Total Fuel (gal) during Exercise (8 Weeks)		420,000	

Proposed Action Fuel Loading Operations				
Location	Description	Fuel Type	Fuel Transferred (gal)	Category
Saipan Airport Flightline	Loading Aircraft from Truck Fill Stands	JP-8	420,000	Loading
Saipan Seaport, Loading Racks (50,000 bbl tank 1)	Loading Refueler Trucks	JP-8	210,000	Loading
Saipan Seaport, Loading Racks (50,000 bbl tank 2)	Loading Refueler Trucks	JP-8	210,000	Loading

Given:		Tinian North	
Total Exercise Days (8 weeks)		56	
Initial Fuel Fill Days		2.333333333	
Remaining Fuel Fill Days		0	
Total # of Fuel Trucks		6	
Total Gallons per Fuel Truck		10,000	
Trips per day per Fuel Truck		3	
1 bbl conversion to gallons		42	
Total Fuel (gal) during Initial Fill		420,000	
Total Fuel (gal) during Remaining Exercise		0	
Total Fuel (gal) during Exercise (8 Weeks)		420,000	

Proposed Action Fuel Loading Operations				
Location	Description	Fuel Type	Fuel Transferred (gal)	Category
Tinian North Flightline	Loading Aircraft from Truck Fill Stands	JP-8	420,000	Loading
Tinian Seaport, Loading Racks (50,000 bbl tank 1)	Loading Refueler Trucks	JP-8	210,000	Loading
Tinian Seaport, Loading Racks (50,000 bbl tank 2)	Loading Refueler Trucks	JP-8	210,000	Loading

Emission Factors - Fuel Loading Emissions for Modified Alternative 3a - Implementation Phase (Hybrid Saipan/Tinian North)

JP-8 emission factors (lb/Mgal)	Dispensing		Loading	
	Splash	Bottom fill		
Molecular Weight =	130			
True Vapor Pressure (psia) =	0.011			
Dispensing Displacement losses =	0.0487		0.020	
Spillage =	0.7			
Total =	0.749			

AP-42 Table 7.1-2 dated 11/06
 AP-42 Table 7.1-2 dated 11/06 @ 70F (annual avg.)
 AP-42 Section 5.2 dated 6/08 Equation (1)
 AP-42 Table 5.2-7 dated 6/08

Emission Calculations - Fuel Loading Emissions for Modified Alternative 3a - Implementation Phase (Hybrid Saipan/Tinian North)

Saipan

Location	Description	Fuel Type	Fuel Transferred	Displaced Vapor	Spillage	Total VOC	Total VOC
			(gal)	(lb)	(lb)	(lb)	(tons)
Saipan Airport Flightline	Loading Aircraft from Truck Fill Stands	JP-8	420,000	8.5	0	8.5	0.004
Saipan Seaport, Loading Racks (50,000 bbl tank 1)	Loading Refueler Trucks	JP-8	210,000	4.2	0	4.2	0.002
Saipan Seaport, Loading Racks (50,000 bbl tank 2)	Loading Refueler Trucks	JP-8	210,000	4.2	0	4.2	0.002
Total			840,000	17	0	16.94	0.01

Tinian

Location	Description	Fuel Type	Fuel Transferred	Displaced Vapor	Spillage	Total VOC	Total VOC
			(gal)	(lb)	(lb)	(lb)	(tons)
Tinian North Flightline	Loading Aircraft from Truck Fill Stands	JP-8	420,000	8.5	0	8.5	0.004
Tinian Seaport, Loading Racks (50,000 bbl tank 1)	Loading Refueler Trucks	JP-8	210,000	4.2	0	4.2	0.002
Tinian Seaport, Loading Racks (50,000 bbl tank 2)	Loading Refueler Trucks	JP-8	210,000	4.2	0	4.2	0.002
Total			840,000	17	0	16.94	0.01

Maximum Emissions **16.94** **0.01**

Emission Calculations Method - Fuel Loading Emissions for Modified Alternative 3a - Implementation Phase (Hybrid Saipan/Tinian North)

Displacement emissions for Diesel and JP-8 were estimated using Equation (1) from AP-42 Section 5.2, Transportation and Marketing of Petroleum Liquids, dated 6/08

$$L_L = 12.46 (SPM)/T$$

Where

L_L = Loading loss in lb/10³ gal

S = Saturation Factor 1.45 for splash loading, 0.6 for bottom loading

M = molecular weight,

T = temperature of bulk liquid (assume average annual ambient temperature)

DATA - Fuel Storage Tank Emissions for Modified Alternative 3a - Implementation Phase (Hybrid Saipan/Tinian North)

Fuel storage tank emissions were estimated using the U.S. EPA TANKS storage tank emissions calculation software (Version 4.0.9d). The emissions calculations algorithms in the TANKS program are based on Chapter 7 of EPA's AP-42. Honolulu, Hawaii was used as a surrogate location for the tanks as meteorological data does not exist in TANKS for CNMI. Jet Kerosene fuel was used as the surrogate for JP-8 in the TANKS model as it is the closest in characteristics to JP-8.

Emission Calculations Summary from TANKS* - Saipan

Tank Type	Throughput (gal.)	Working Loss (lbs)	Breathing Loss (lbs)	VOC Total (lbs)	VOC Total (tons)
Tank 1 (Saipan Seaport) - 50,000 bbl, cut and cover or AST	210,000	9.63	585.39	595.02	0.30
Tank 2 (Saipan Seaport) - 50,000 bbl, cut and cover or AST	210,000	9.63	585.39	595.02	0.30
Tank 3 (Saipan Airport) - 50,000 bbl, cut and cover or AST	210,000	9.63	585.39	595.02	0.30
Tank 4 (Saipan Airport) - 50,000 bbl, cut and cover or AST	210,000	9.63	585.39	595.02	0.30
Total		38.52	2,341.56	2,380.08	1.19

*See the following references for TANKS printouts. (SM12 - TANKS) & (SM13 - TANKS)

Emission Calculations Summary from TANKS* - Tinian North

Tank Type	Throughput (gal.)	Working Loss (lbs)	Breathing Loss (lbs)	VOC Total (lbs)	VOC Total (tons)
Tank 1 (Tinian Seaport) - 50,000 bbl, cut and cover or AST	210,000	9.63	585.39	595.02	0.30
Tank 2 (Tinian Seaport) - 50,000 bbl, cut and cover or AST	210,000	9.63	585.39	595.02	0.30
Tank 3 (Tinian Airport) - 60,000 bbl, cut and cover or AST	210,000	9.63	714.88	724.51	0.36
Tank 4 (Tinian Airport) - 60,000 bbl, cut and cover or AST	210,000	9.63	714.88	724.51	0.36
Total		38.52	2,600.54	2,639.06	1.32

*See the following references for TANKS printouts. (SM12 - TANKS) & (SM13 - TANKS)

Maximum Emissions	2,639.06	1.32
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Summary	Summarizes total emissions by calendar year for Modified Alternative 3B - Construction Phase (Hybrid Saipan/Tinian South).
Combustion and Evaporative	Estimates emissions from non-road equipment exhaust and evaporative volatile organic compound emissions.
Fugitive	Estimates particulate emissions from construction activities including earthmoving, vehicle traffic, and windblown dust.
Grading	Estimates the number of days of site preparation, to be used for estimating heavy equipment exhaust and earthmoving dust emissions.
Construction Commuter	Estimates emissions for construction workers commuting to the site.
Haul Truck On-Road	Estimates emissions from hauling construction materials to the project site.

Summary of Air Quality Emissions from Divert EIS - Modified Alternative 3B - Construction Phase (Hybrid Saipan/Tinian South)

	NO_x (ton)	VOC (ton)	CO (ton)	SO₂ (ton)	PM₁₀ (ton)	PM_{2.5} (ton)	CO₂ (ton)
Construction Combustion/Evaporative	15.777	1.866	6.735	0.878	1.068	1.036	1,848.889
Construction Fugitive Dust	-	-	-	-	147.150	13.623	-
Construction Commuter	0.812	1.004	11.653	0.0132	0.033	0.015	728.836
Haul Truck On-Road	9.023	0.840	4.823	0.029	0.290	0.275	2,339.226
TOTAL	25.61	3.71	23.21	0.92	148.54	14.95	4,916.95

Annual Summary of Air Quality Emissions from Divert EIS - Modified Alternative 3B - Construction Phase (Hybrid Saipan/Tinian South)*

	Point and Area Sources Combined						
	NO_x (tpy)	VOC (tpy)	CO (tpy)	SO₂ (tpy)	PM₁₀ (tpy)	PM_{2.5} (tpy)	CO₂ (metric tons)
CY 01	8.54	1.24	7.74	0.31	49.51	4.98	1,486.86
CY 02	8.54	1.24	7.74	0.31	49.51	4.98	1,486.86
CY 03	8.54	1.24	7.74	0.31	49.51	4.98	1,486.86

* Construction duration is estimated to be 36 months and the emissions are assumed to be distributed evenly over the construction period.

Combustion Emissions - Modified Alternative 3B - Construction Phase (Hybrid Saipan/Tinian South)

Combustion Emissions of VOC, NO_x, SO₂, CO, PM_{2.5}, PM₁₀, and CO₂ due to Construction

Assumptions

When multiple options exist under the general construction activities the most conservative value will be used to quantify air emissions.

General Construction Activities

	Area Disturbed (ft ²)
Construct New Access Roads (Tinian South)	177,294 ft ²
Construct Maintenance Facility (Saipan)	6,100 ft ²
Construct Maintenance Facility (Tinian South)	7,972 ft ²
Construct Jet Fuel System and Fire Pump System (Operational, Bulk and at the Port of Tinian) (Saipan/Tinian South)	820,200 ft ²
Construct Hazardous Cargo Pad (Saipan)	250,470 ft ²
Construct Hazardous Cargo Pad (Tinian South)	230,165 ft ²
Construct Parking Apron (Tinian South)	1,508,251 ft ²

Total General Construction Area:	834,272 ft ²	19.2 acres
Total Demolition Area:	0 ft ²	0.0 acres
Total Pavement Area:	2,166,180 ft ²	49.7 acres
Total Disturbed Area:	3,000,452 ft ²	68.9 acres
Construction Duration:	36 months	
1 Yr Project Construction Activity:	240 days/yr	Assume 12 months, 4 weeks per month, 5 days per week.

Emission Factors Used for Construction Equipment

References: Guide to Air Quality Assessment, Sacramento Metropolitan Air Quality Management District (SMAQMD), 2004; and U.S. EPA NONROAD Emissions Model, Version 2005.0.0
 Emission factors are taken from the NONROAD model and were provided to e*M by Larry Landman of the Air Quality and Modeling Center (Landman.Larry@epamail.epa.gov) on 12/14/07. Factors provided are for the weighted average US fleet for CY2007.
 Assumptions regarding the type and number of equipment are from SMAQMD Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd. ^a per 10 acres	NO _x (lb/day)	VOC ^b (lb/day)	CO (lb/day)	SO ₂ ^c (lb/day)	PM ₁₀ (lb/day)	PM _{2.5} (lb/day)	CO ₂ (lb/day)
Bulldozer	1	13.60	0.96	5.50	1.02	0.89	0.87	1456.90
Motor Grader	1	9.69	0.73	3.20	0.80	0.68	0.64	1141.65
Water Truck	1	18.36	0.89	7.00	1.64	1.00	0.97	2342.98
Total per 10 acres of activity	3	41.64	2.58	15.71	0.83	2.55	2.47	4941.53

Paving

Equipment	No. Reqd. ^a per 10 acres	NO _x (lb/day)	VOC ^b (lb/day)	CO (lb/day)	SO ₂ ^c (lb/day)	PM ₁₀ (lb/day)	PM _{2.5} (lb/day)	CO ₂ (lb/day)
Paver	1	3.83	0.37	2.06	0.28	0.35	0.34	401.93
Roller	1	4.82	0.44	2.51	0.37	0.43	0.42	536.07
Truck	2	36.71	1.79	14.01	3.27	1.99	1.93	4685.95
Total per 10 acres of activity	4	45.37	2.61	18.58	0.91	2.78	2.69	5623.96

Demolition

Equipment	No. Reqd. ^a per 10 acres	NO _x (lb/day)	VOC ^b (lb/day)	CO (lb/day)	SO ₂ ^c (lb/day)	PM ₁₀ (lb/day)	PM _{2.5} (lb/day)	CO ₂ (lb/day)
Loader	1	13.45	0.99	5.58	0.95	0.93	0.90	1360.10
Haul Truck	1	18.36	0.89	7.00	1.64	1.00	0.97	2342.98
Total per 10 acres of activity	2	31.81	1.89	12.58	0.64	1.92	1.87	3703.07

Building Construction

Equipment ^d	No. Reqd. ^a per 10 acres	NO _x (lb/day)	VOC ^b (lb/day)	CO (lb/day)	SO ₂ ^c (lb/day)	PM ₁₀ (lb/day)	PM _{2.5} (lb/day)	CO ₂ (lb/day)
Stationary								
Generator Set	1	2.38	0.32	1.18	0.15	0.23	0.22	213.06
Industrial Saw	1	2.62	0.32	1.97	0.20	0.32	0.31	291.92
Welder	1	1.12	0.38	1.50	0.08	0.23	0.22	112.39
Mobile (non-road)								
Truck	1	18.36	0.89	7.00	1.64	1.00	0.97	2342.98
Forklift	1	5.34	0.56	3.33	0.40	0.55	0.54	572.24
Crane	1	9.57	0.66	2.39	0.65	0.50	0.49	931.93
Total per 10 acres of activity	6	39.40	3.13	17.38	3.12	2.83	2.74	4464.51

Architectural Coatings

Equipment	No. Reqd. ^a per 10 acres	NO _x (lb/day)	VOC ^b (lb/day)	CO (lb/day)	SO ₂ ^c (lb/day)	PM ₁₀ (lb/day)	PM _{2.5} (lb/day)	CO ₂ (lb/day)
Air Compressor	1	3.57	0.37	1.57	0.25	0.31	0.30	359.77
Total per 10 acres of activity	1	3.57	0.37	1.57	0.25	0.31	0.30	359.77

- The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.
- The SMAQMD 2004 reference lists emission factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC. The NONROAD model contains emissions factors for total HC and for VOC. The factors used here are the VOC factors.
- The NONROAD emission factors assume that the average fuel burned in nonroad trucks is 1100 ppm sulfur. Trucks that would be used for the Proposed Actions will all be fueled by highway grade diesel fuel which cannot exceed 500 ppm sulfur. These estimates therefore over-estimate SO₂ emissions by more than a factor of two.
- Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

Combustion Emissions - Modified Alternative 3B - Construction Phase (Hybrid Saipan/Tinian South)

Project-Specific Combustion and Evaporative Emission Factor Summary

Source	Equipment Multiplier*	Project-Specific Emission Factors (lb/day)						
		NO _x	VOC	CO	SO ₂ **	PM ₁₀	PM _{2.5}	CO ₂
Grading Equipment	7	291.489	18.039	109.969	5.830	17.819	17.284	34590.684
Paving Equipment	5	226.836	13.029	92.892	4.537	13.880	13.464	28119.784
Demolition Equipment	1	31.808	1.886	12.584	0.636	1.923	1.865	3703.074
Building Construction	2	78.793	6.260	34.765	6.233	5.658	5.488	8929.023
Air Compressor for Architectural Coating	2	7.148	0.746	3.131	0.502	0.619	0.600	719.547
Architectural Coating**			74.441					

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project.

**Emission factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994
 Example: SMAQMD Emission Factor for Grading Equipment NO_x = (Total Grading NO_x per 10 acre)/(Equipment Multiplier)

Summary of Input Parameters

	Total Area (ft ²)	Total Area (acres)	Total Days	
Grading:	3,000,452	68.88	6	(from "Grading" worksheet)
Paving:	2,166,180	49.73	47	
Demolition:	0	0.00	0	
Building Construction:	834,272	19.15	240	
Architectural Coating:	834,272	19.15	20	(per SMAQMD "Air Quality of Thresholds of Significance", 1994)

NOTE: The 'Total Days' estimate for paving is calculated by dividing the total number of acres by 0.21 acres/day, which is a factor derived from the 2005 MEANS Heavy Construction Cost Data, 19th Edition, for 'Asphaltic Concrete Pavement, Lots and Driveways - 6" stone base', which provides an estimate of square feet paved per day. There is also an estimate for 'Plain Cement Concrete Pavement', however the estimate for asphalt is used because it is more conservative. The 'Total Days' estimate for demolition is calculated by dividing the total number of acres by 0.02 acres/day, which is a factor also derived from the 2005 MEANS reference. This is calculated by averaging the demolition estimates from 'Building Demolition - Small Buildings, Concrete', assuming a height of 30 feet for a two-story building; from 'Building Footings and Foundations Demolition - 6" Thick, Plain Concrete'; and from 'Demolish, Remove Pavement and Curb - Concrete to 6" thick, rod reinforced'. Paving is double-weighted since projects typically involve more paving demolition. The 'Total Days' estimate for building construction is assumed to be 230 days, unless project-specific data is known.

Project Combustion and Evaporative Emissions by Activity (lbs)

	NO _x	VOC	CO	SO ₂	PM ₁₀	PM _{2.5}	CO ₂
Grading Equipment	1,748.93	108.23	659.82	34.98	106.91	103.70	207,544
Paving	10,752.05	617.56	4,403.09	215.04	657.93	638.20	1,332,878
Demolition	-	-	-	-	-	-	0
Building Construction	18,910.23	1,502.31	8,343.51	1,495.85	1,357.94	1,317.20	2,142,966
Architectural Coatings	142.96	1,503.74	62.62	10.05	12.37	12.00	14,391
Total Emissions (lbs):	31,554.17	3,731.84	13,469.03	1,755.91	2,135.16	2,071.11	3,697,778

Results: Project Annual Combustion and Evaporative Emission Rates

	NO _x	VOC	CO	SO ₂	PM ₁₀	PM _{2.5}	CO ₂
Total Project Combustion and Evaporative Emissions (lbs)	31,554.17	3,731.84	13,469.03	1,755.91	2,135.16	2,071.11	3,697,778
Total Project Combustion and Evaporative Emissions (tons)	15.78	1.87	6.73	0.88	1.07	1.04	1,848.89

Construction Fugitive Dust Emissions - Proposed Action [Modified Alternative 3B - Construction Phase (Hybrid Saipan/Tinian South)]

Construction Fugitive Dust Emission Factors

	Emission Factor	Units	Source
General Construction Activities	0.19 ton PM ₁₀ /acre-month		MRI 1996; EPA 2001; EPA 2006
New Road Construction	0.42 ton PM ₁₀ /acre-month		MRI 1996; EPA 2001; EPA 2006
PM_{2.5} Emissions			
PM _{2.5} Multiplier	0.10	(10% of PM ₁₀ emissions assumed to be PM _{2.5})	EPA 2001; EPA 2006
Control Efficiency	0.50	(assume 50% control efficiency for PM ₁₀ and PM _{2.5} emissions)	EPA 2001; EPA 2006

Project Assumptions

New Roadway Construction (0.42 ton PM₁₀/acre-month)

Duration of Construction Project	12 months
Area	49.7 acres

General Construction Activities (0.19 ton PM₁₀/acre-month)

Duration of Construction Project	12 months
Area	19.2 acres

	Project Emissions (tons/year)			
	PM₁₀ uncontrolled	PM₁₀ controlled	PM_{2.5} uncontrolled	PM_{2.5} controlled
New Roadway Construction	250.63	125.32	25.06	12.53
General Construction Activities	43.67	21.83	2.18	1.09
Total	294.30	147.15	27.25	13.62

General Construction Activities Emission Factor

0.19 ton PM₁₀/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The area-based emission factor for construction activities is based on a study completed by the Midwest Research Institute (MRI) Improvement of Specific Emission Factors (BACM Project No. 1), March 29, 1996. The MRI study evaluated seven construction projects in Nevada and California (Las Vegas, Coachella Valley, South Coast Air Basin, and the San Joaquin Valley). The study determined an average emission factor of 0.11 ton PM₁₀/acre-month for sites without large-scale cut/fill operations. A worst-case emission factor of 0.42 ton PM₁₀/acre-month was calculated for sites with active large-scale earth moving operations. The monthly emission factors are based on 168 work-hours per month (MRI 1996). A subsequent MRI Report in 1999, Estimating Particulate Matter Emissions From Construction Operations, calculated the 0.19 ton PM₁₀/acre-month emission factor by applying 25% of the large-scale earthmoving emission factor (0.42 ton PM₁₀/acre-month) and 75% of the average emission factor (0.11 ton PM₁₀/acre-month). The 0.19 ton PM₁₀/acre-month emission factor is referenced by the EPA for non-residential construction activities in recent procedures documents for the National Emission Inventory (EPA 2001; EPA 2006). The 0.19 ton PM₁₀/acre-month emission factor represents a refinement of EPA's original AP-42 area-based total suspended particulate (TSP) emission factor in Section 13.2.3 Heavy Construction Operations. In addition to the EPA, this methodology is also supported by the South Coast Air Quality Management District as well as the Western Regional Air Partnership (WRAP) which is funded by the EPA and is administered jointly by the Western Governor's Association and the National Tribal Environmental Council. The emission factor is assumed to encompass a variety of non-residential construction activities including building construction (commercial, industrial, institutional, governmental), public works, and travel on unpaved roads. The EPA National Emission Inventory documentation assumes that the emission factors are uncontrolled and recommends a control efficiency of 50% for PM₁₀ and PM_{2.5} in PM nonattainment areas.

New Road Construction Emission Factor

0.42 ton PM₁₀/acre-month Source: MRI 1996; EPA 2001; EPA 2006

The emission factor for new road construction is based on the worst-case conditions emission factor from the MRI 1996 study described above (0.42 tons PM₁₀/acre-month). It is assumed that road construction involves extensive earthmoving and heavy construction vehicle travel resulting in emissions that are higher than other general construction projects. The 0.42 ton PM₁₀/acre-month emission factor for road construction is referenced in recent procedures documents for the EPA National Emission Inventory (EPA 2001; EPA 2006).

PM_{2.5} Multiplier

0.10

PM_{2.5} emissions are estimated by applying a particle size multiplier of 0.10 to PM₁₀ emissions. This methodology is consistent with the procedures documents for the National Emission Inventory (EPA 2006).

Control Efficiency for PM₁₀ and PM_{2.5}

0.50

The EPA National Emission Inventory documentation recommends a control efficiency of 50% for PM₁₀ and PM_{2.5} in PM nonattainment areas (EPA 2006). Wetting controls will be applied during project construction.

References:

EPA 2001. *Procedures Document for National Emissions Inventory, Criteria Air Pollutants, 1985-1999*. EPA-454/R-01-006. Office of Air Quality Planning and Standards, United States Environmental Protection Agency. March 2001.

EPA 2006. *Documentation for the Final 2002 Nonpoint Sector (Feb 06 version) National Emission Inventory for Criteria and Hazardous Air Pollutants*. Prepared for: Emissions Inventory and Analysis Group (C339-02) Air Quality Assessment Division Office of Air Quality Planning and Standards, United States Environmental Protection Agency. July 2006.

MRI 1996. *Improvement of Specific Emission Factors (BACM Project No. 1)*. Midwest Research Institute (MRI). Prepared for the California South Coast Air Quality Management District, March 29, 1996.

Grading Schedule - Proposed Action [Modified Alternative 3B - Construction Phase (Hybrid Saipan/Tinian South)]

Estimate of time required to grade a specified area.

Input Parameters

Construction area: 68.9 acres/yr (from Combustion Worksheet)
 Qty Equipment: 21.0 (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions

Terrain is mostly flat.
 An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.
 200 hp bulldozers are used for site clearing.
 300 hp bulldozers are used for stripping, excavation, and backfill.
 Vibratory drum rollers are used for compacting.
 Stripping, Excavation, Backfill and Compaction require an average of two passes each.
 Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	68.88	8.61
2230 500 0300	Stripping	Topsoil & stockpiling, adverse soil	1,650	cu. yd/day	2.05	0.49	68.88	33.68
2315 432 5220	Excavation	Bulk, open site, common earth, 150' haul	800	cu. yd/day	0.99	1.01	34.44	34.73
2315 120 5220	Backfill	Structural, common earth, 150' haul	1,950	cu. yd/day	2.42	0.41	34.44	14.25
2315 310 5020	Compaction	Vibrating roller, 6" lifts, 3 passes	2,300	cu. yd/day	2.85	0.35	68.88	24.16
TOTAL								115.42

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr: 115.42
 Qty Equipment: 21.00
 Grading days/yr: 5.50

Construction/Staff Commuter Emissions - Modified Alternative 3B - Construction Phase (Hybrid Saipan/Tinian South)

Emissions from construction workers commuting to the job site are estimated in this spreadsheet.

Emission Estimation Method: Air Force Civil Engineer Center (AFCEE), Air Emissions Factor Guide to Air Force Mobile Sources, October 2014.

Assumptions:

Passenger vehicle emission factors for scenario year 2015 are used.
 The average roundtrip commute for a construction/staff worker = 40 miles
 Number of construction days = 240 days
 Number of construction/Staff workers (daily) = 125 people

Note: None

Personal Operating Vehicle (POV) On-Road Emission Factors for Year 2016 (grams/mile)

NO _x	VOC	CO	SO ₂	PM ₁₀	PM _{2.5}	CO ₂
0.614	0.759	8.810	0.010	0.025	0.011	551.000

Source: Emission factors for all pollutants are from Table 5-28: On-Road Vehicle Emission Factors - 2016 POV, Gasoline Light Duty Trucks (LDGT) at low altitude, within AFCEE Air Emissions Factor Guide to Air Force Mobile Sources, October 2014.

Construction Commuter Emissions

	NO _x	VOC	CO	SO ₂	PM ₁₀	PM _{2.5}	CO ₂
lbs	1,624.339	2,007.937	23,306.878	26.455	66.138	29.101	1,457,671.958
tons	0.812	1.004	11.653	0.013	0.033	0.015	728.836

Example Calculation: NO_x emissions (lbs) = 60 miles/day * NO_x emission factor (lb/mile) * number of construction days * number of workers

Construction/Haul Truck Emissions - Modified Alternative 3B - Construction Phase (Hybrid Saipan/Tinian South)

Emissions from hauling construction supplies, demolition debris, fill, and excavated material are estimated in this spreadsheet.

Emission Estimation Method: Air Force Center for Environmental Excellence (AFCEE) Air Emissions Factor Guide to Air Force Mobile Sources, Dec. 2009.

Concrete Mixing and Dump Truck Assumptions:

Dump trucks carry 11 cubic yards of material per trip.
Concrete mixing trucks carry 10 cubic yards of material per trip.
Saipan

The average distance from the port to Commercial Concrete Supply Company is 7 miles; therefore, dump trucks will travel 14 miles round trip.
The average distance from the Commercial Concrete Supply Company (CCSC) to the project site is 2 miles; therefore, concrete trucks will travel 4 miles round trip.
Tinian N.

The average distance from the port to Commercial Concrete Supply Company is 1.7 miles; therefore, dump trucks will travel 3.4 miles round trip.
The average distance from the Commercial Concrete Supply Company (CCSC) to the project site is 2.3 miles; therefore, concrete trucks will travel 4.6 miles round trip.

Building Materials Assumptions:

Haul trucks carry 20 cubic yards of material per trip.
The average distance from the project site to the materials source is 20 miles; therefore, building material haul trucks will travel 40 miles round trip.
Estimated number of trips required by haul trucks = total amount of material/20 cubic yards per truck

Amount of demolition debris =	0 cubic yards	No Demolition in the Proposed Action
Amount of cement transported from port to CCSC (Saipan)=	396 cubic yards	
Amount of cement transported from port to CCSC (Tinian N.)=	1,727 cubic yards	
Amount of concrete transported from CCSC to project site (Saipan) =	5,610 cubic yards	
Amount of concrete transported from CCSC to project site (Tinian N.) =	27,970 cubic yards	
Amount of Excavation Materials for New Structures/Buildings (Saipan) =	61,372 cubic yards	Construction area multiplied by depth of disturbance which is assumed to be 12 feet.
Amount of Excavation Materials for New Structures/Buildings (Tinian N.) =	309,416 cubic yards	Construction area multiplied by depth of disturbance which is assumed to be 12 feet.
Amount of Building/Structure Materials (Saipan) =	46,029 cubic yards	Construction area multiplied by 9 feet.
Amount of Building/Structure Materials (Tinian N.) =	232,062 cubic yards	Construction area multiplied by 9 feet.
Number of dump trucks required (port to CCSC) (Saipan) =	36 heavy duty diesel haul truck trips, Cells rounded up	
Number of dump trucks required (port to CCSC) (Tinian N.) =	157 heavy duty diesel haul truck trips, Cells rounded up	
Number of concrete mixing trucks required (CCSC to project site) (Saipan) =	561 heavy duty diesel haul truck trips, Cells rounded up	
Number of concrete mixing trucks required (CCSC to project site) (Tinian N.) =	2797 heavy duty diesel haul truck trips, Cells rounded up	
Number of trucks required (Building Materials) (Saipan) =	5,370 heavy duty diesel haul truck trips	
Number of trucks required (Building Materials) (Tinian N.) =	27,074 heavy duty diesel haul truck trips	
Miles per roundtrip (port to CCSC) (Saipan) =	14 miles	
Miles per roundtrip (port to CCSC) (Tinian N.) =	3.4 miles	
Miles per roundtrip (CCSC to project site) (Saipan) =	4 miles	
Miles per roundtrip (CCSC to project site) (Tinian N.) =	4.6 miles	
Miles per roundtrip (Building Materials) (Saipan) =	40.0 miles	
Miles per roundtrip (Building Materials) (Tinian N.) =	40.0 miles	

Low Altitude Heavy Duty Diesel Vehicle 8b (HDDV8b) Average Emission Factors (grams/mile)

	NO _x	VOC	CO	SO ₂	PM ₁₀	PM _{2.5}	CO ₂
HDDV8b	6.23	0.58	3.33	0.02	0.20	0.19	1615

Notes:

Emission factors for all pollutants are from Appendix A - On-Road Vehicle Emission Factors within AFCEE Air Emissions Factor Guide to Air Force Mobile Sources, Dec. 2009.
Emission factors from calendar year 2015 were used assuming the average vehicle model year is 2005.

HDDV8b Haul Truck Emissions

	NO _x	VOC	CO	SO ₂	PM ₁₀	PM _{2.5}	CO ₂
lbs	18,045.91	1,679.98	9,645.40	57.93	579.30	550.34	4,678,451.88
tons	9.02	0.84	4.82	0.03	0.29	0.28	2,339.23

Example Calculation: NO_x emissions (lbs) = 40 miles per trip * 27,074 trips * NO_x emission factor (g/mile) * lb/453.6 g

No Statistical Area Available for TNI

Row #	State	County	Tier-1	Point Source Emissions					Area Source Emissions (Non-Point and Mobile Sources)						
				CO	NO _x	PM ₁₀	PM _{2.5}	SO ₂	VOC	CO	NO _x	PM ₁₀	PM _{2.5}	SO ₂	VOC
No Data Available															
Grand Total				0	0	0	0	0	0	0	0	0	0	0	0

SOURCE:

<http://www.epa.gov/ttn/chiefeiiinformation.html>

USEPA - AirData NET Tier Report

*Net Air pollution sources (area and point) in tons per year (2002)

Site visited on 02 February 2012.

No Air Quality Control Region Identified

	CO	NO _x	PM ₁₀	PM _{2.5}	SO ₂	VOC
CNMI	0	0	0	0	0	0
CNMI DEQ	0	0	0	0	0	0

- Summary** Summarizes total emissions by calendar year for Modified Alternative 3b - Implementation Phase (Hybrid Saipan/Tinian South).
- Airfield Operations** Aircraft operations consist of taxi, take-off and landings (sorties or LTOs), touch-and-go operations (TGOs), and low flybys (LFB) by base aircraft.
- Fuel Truck and Commuter Vehicle Emissions** Estimates emissions for workers and operational vehicles commuting to the site of the Proposed Action.
- Fuel Transfer Emissions** Fuel loading operations under the Proposed Action involves the loading of fuel into tanker trucks and aircraft.
- Internal Combustion Engine (ICE) Emissions** Estimates Emissions from Internal Combustion Engines (e.g Generators)
- Fuel Storage Tanks** Estimates emissions from Above Ground Storage Tanks.

Criteria Pollutant and VOC Emissions Summary for Modified Alternative 3b - Implementation Phase (Hybrid Saipan/Tinian South) (tons/year)

Source Category	PM10	PM2.5	CO	NOx	SOx	VOCs
Airfield Operations	0.05	0.05	18.67	6.77	0.98	1.25
Fuel Truck and Commuter Vehicle Emissions	0.02	0.01	0.19	0.37	0.00	0.03
Fuel Transfer	N/A	N/A	N/A	N/A	N/A	0.01
Fuel Storage Tanks	N/A	N/A	N/A	N/A	N/A	1.32
Total Criteria and VOC Pollutant Emissions (tons/year)	0.07	0.07	18.86	7.14	0.98	2.61

Greenhouse Gas (GHG) Emissions Summary for Modified Alternative 3b - Implementation Phase (Hybrid Saipan/Tinian South) (metric tonnes/year)

Source Category	CO ₂ -equivalent (lb/year)	CO ₂ -equivalent (kg/year)	CO ₂ -equivalent (metric tonne/year)
Airfield Operations*	8,833,755	4,006,991	4,007
Fuel Truck and Commuter Vehicle Emissions	205,537	93,232	93
Fuel Transfer	0	0	0
Fuel Storage Tanks	0	0	0
Total GHG Emissions	9,039,293	4,100,223	4,100

DATA - Airfield Operations for Modified Alternative 3b - Implementation Phase (Hybrid Saipan/Tinian South)

Aircraft exercises under this alternative are based on assuming 2 to 4 KC-135R aircraft operating up to 8 weeks per year for a maximum of 720 KC-135R operations per year. Each operation is equivalent to one landing or one take-off (1 LTO Cycle = 2 operations). These 720 operations could occur at either Saipan or Tinian.

Landing and Takeoff (LTO) Cycles

Description	Quantity
# of KC-135R LTO's per year	360

Legend

Airfield Activity Data (Worst Case Scenario)

Aircraft Model	Aircraft Model Used to Match to Available Emission Factors	Engine Model	# Engines	APU Model	# APUs	Notes	LTO Cycles
KC-135R	KC-135-R	F108-CF-201	4	No data on APUs		See below	360

Note: F108-CF-201 is the military designation of the CFM56-2B-1 engine.

Emission Factors (EFs) and Constants - Airfield Operations for Modified Alternative 3b - Implementation Phase (Hybrid Saipan/Tinian South)

Aircraft Criteria Pollutant Emission Factors

Aircraft Model	Engine Model	# Engines	Reference Thrust Mode	LTO/GO Thrust Mode	Fuel Flow (lb/hr)	Emission Factors in lb Pollutant per 1000 lb Fuel Burned						
						PM10	PM2.5	CO	NO _x	SO ₂	VOCs	TIM
KC-135R	F108-CF-201	4	Idle	Idle	1016	0.06	0.06	30.70	4.00	1.06	2.10	47.7
KC-135R	F108-CF-201	4	Approach	Approach	2468	0.06	0.05	4.20	8.20	1.06	0.09	5.2
KC-135R	F108-CF-201	4	Climbout	Climbout	6500	0.05	0.05	0.90	16.00	1.06	0.06	1.6
KC-135R	F108-CF-201	4	Takeoff	Takeoff	7818	0.07	0.06	0.90	18.05	1.06	0.05	0.7

Emission factors from Air Force Civil Engineer Center (AFCEC) October 2014 Air Emissions Guide for Air Force Mobile Sources, Table 2-8

APU Emission Factors

Aircraft Model	# APU	APU Model	APU Emission Factors in lb Pollutant per hour						APU (hr)
			PM10	PM2.5	CO	NO _x	SO ₂	VOCs	
KC-135R			No Data Available						

Emission Factors (EFs) and Constants - Airfield Operations for Modified Alternative 3b - Implementation Phase (Hybrid Saipan/Tinian South)

Default Time-In-Mode

Aircraft Type	Typical Duration by Mode (minutes)					
	Taxi/Idle	Takeoff	Climbout	Approach	Taxi/Idle-in	Total
KC-135R	32.8	0.7	1.6	5.2	14.9	55.2

Default Time-In-Mode rates are from AFCEC October 2014 Air Emissions Guide for Air Force Mobile Sources, Table 2-4

Emission Factors (EFs) and Constants - Airfield Operations for Modified Alternative 3b - Implementation Phase (Hybrid Saipan/Tinian South)

Greenhouse Gas Emission Factors

Units	CO ₂	CH ₄	N ₂ O
kg/gal fuel	9.80	---	---
g/gal fuel	---	0.27	0.31

Reference: Footnote 2, from Table 2-8 of the AFCEC October 2014 Air Emissions Guide for Air Force Mobile Sources.

Calculations - Airfield Operations for Modified Alternative 2a - Implementation Phase (Tinian North)

Criteria Pollutant and VOC Emissions per LTO by Aircraft Type

Calculated as the sum of the products of [(minutes) * (fuel flow/minute) * (lbs pollutant/lb fuel)] for each of the thrust modes.

Reported Aircraft Model	APU	Fuel (lb)	Emission in lb Pollutant per LTO					APU	
			PM10 (lb)	PM2.5 (lb)	CO (lb)	NOx (lb)	SOx (lb)		VOCs (lb)
KC-135R	0	5144.6	0.3	0.3	103.7	37.6	5.5	6.9	0

Total Criteria Pollutant and VOC Emissions for maximum LTO's by Aircraft Type

Reported Aircraft Model	APU	Total LTO's	Fuel (lb)	PM10 (tons)	PM2.5 (tons)	CO (tons)	NOx (tons)	SOx (tons)	VOCs (tons)	APU
			KC-135R	0	360	1,852,065.6	0.05	0.05	18.67	6.77
Worst Case Scenario			1,852,065.60	0.05	0.05	18.67	6.77	0.98	1.25	0

Total gallons of fuel used for LTOs (277,671 gal.) is based on the 6.67 lb/gal density of JP-8 as provided in footnote 2. of Table 2-6 of the AFCEC October 2014 Air Emissions Guide for Air Force Mobile Sources.

Calculations - Airfield Operations for Modified Alternative 2a - Implementation Phase (Tinian North)

Greenhouse Gas Emissions

Assume aircraft will use 7,500 pounds of fuel per LTO cycle, which is from the ground to 10,000 feet and from 10,000 feet back to a landing. This estimated fuel use was obtained from Hqs. Travis Miyashiro, HIANG, PACAF ASXP. Fuel use and associated emissions above 10,000 feet are accounted for in the MIRC EIS.

Quantity (gallons)	Fuel Type	CH ₄ (kg)	N ₂ O (kg)	CO ₂ (kg)	CO ₂ -equivalent (kg)	CO ₂ -equivalent (metric tonne)
404,798	JP-8	109	125	3,967,016	4,006,991	4,007

The CH₄ and N₂O Global Warming Potential multipliers are 25 and 298, respectively from EPA's Climate Leadership, Emission Factors for Greenhouse Gas Inventories, Last Modified 4 April 2014.

DATA - Fuel Truck and Commuter Vehicle Emissions for Modified Alternative 3b - Implementation Phase (Hybrid Saipan/Tinian South)

Given:

Saipan

Six 10,000 gal Fuel Trucks will take 14 days at 10hrs/day to provide initial fill from Saipan seaport to Saipan Airport (Site of Proposed Action). The six 10,000 gallon Fuel trucks will operate 10hrs/day for the duration of the exercises. The total exercise time is 8 weeks (56 days), therefore the fuel trucks will operate an additional 42 days after the initial fill.

Tinian North

Six 10,000 gal Fuel Trucks will take 17 days at 10hrs/day to provide initial fill from Tinian seaport to Tinian Airport (Site of Proposed Action). The six 10,000 gallon Fuel trucks will operate 10hrs/day for the duration of the exercises. The total exercise time is 8 weeks (56 days), therefore the fuel trucks will operate an additional 39 days after the initial fill.

Under the commercial lodging option at Saipan, six busses will transport a total of 256 personnel 4 roundtrips/day for a total of 24 roundtrips/day for 8 weeks. This same number of personnel, busses, and roundtrips could also occur at Tinian.

Assumptions:

A Gross Vehicle Weight (GVW) of 36,200 lbs will be used, based off of an 84 passenger Blue Bird bus.

Assume fuel truck GVW > 60,000 lbs since fuel load alone is 83,400 lbs.

Assume fuel trucks travel at 55 miles per hour

Assume 40 miles per roundtrip for busses.

Vehicle Weight Classes for Which Emission Factors are Published

Vehicle Category	Description	SCC
LDGV	Light-Duty Gasoline Vehicles (i.e., passenger cars) does not include SUVs, vans or pickups	A2201001000
LDGT1	Light-Duty Gasoline Trucks 1 (0-6,000 lbs GVW - includes pickup trucks, sport utility vehicles and vans)	A2201020000
LDGT3	Light-Duty Gasoline Trucks 3 (6,001-8,500 lbs. GVW - includes pickup trucks, sport utility vehicles and vans)	A2201040000
HDBGV2B	Class 2b Heavy-Duty Gasoline Vehicles (8501-10,000 lbs GVW)	A2201070000
HDBGV5	Class 5 Heavy-Duty Gasoline Vehicles (16,001-19,500 lbs GVW)	A2201070000
HDBGV8A	Class 8a Heavy-Duty Gasoline Vehicles (33,001-60,000 lbs GVW)	A2201070000
LDDV	Light-Duty Diesel Vehicles (Passenger Cars)	
LDDT34	Light-Duty Diesel Trucks 3 and 4 (6,001-8,500 lbs GVW)	A2230002000
HDDV2B	Class 2b Heavy-Duty Diesel Vehicles (8501-10,000 lbs GVW - includes pickup trucks)	A2230070000
HDDV5	Class 5 Heavy-Duty Diesel Vehicles (16,001-19,500 lbs GVW)	A2230070000
HDDV8A	Class 8a Heavy-Duty Diesel Vehicles (33,001-60,000 lbs GVW)	A2230070000
HDDV8B	Class 8b Heavy-Duty Diesel Vehicles (>60,000 lbs GVW)	A2230070000
MC	Motorcycles	A2201080000

Emission Factors - Fuel Truck and Commuter Vehicle Emissions for Modified Alternative 3b - Implementation Phase (Hybrid Saipan/Tinian South)

Emission Factors for Calendar Year 2015

Vehicle Class	Model Year	Emission Factors in grams per Mile ^a								
		PM ₁₀	PM _{2.5}	CO	NO _x	NO _x	NOCs	CO ₂	Fugitive PM ₁₀	Fugitive PM _{2.5}
HDDVSA*	2005	0.2	0.19	2.8	5.47	0.01	0.48	1544.1	0.05	0.01
HDDVSB**	2005	0.2	0.19	3.33	6.23	0.02	0.58	1615.2	0.05	0.01

* Low Altitude Emission Factors for Heavy Duty Diesel Vehicles Class 8a

**Low Altitude Emission Factors for Heavy Duty Diesel Vehicles Class 8b

a) Emission factors from Appendix A of Air Emissions Factor Guide to Air Force Mobile Sources, AFCEE, December 2009

Greenhouse Gas Emission Factors for Calendar Year 2015

Vehicle Class	CH ₄ (g/mile)	N ₂ O (g/mile)
HDDV	0.0051	0.0048

g/mile = grams per mile

CH₄ = Methane; N₂O = Nitrous Oxide

b) Emission Factors from EPA's Climate Leadership, Emission Factors for Greenhouse Gas Inventories, Last Modified 4 April 2014 (<http://www.epa.gov/climateleadership/documents/emission-factors.pdf>).

Emission Calculations - Fuel Truck and Commuter Vehicle Emissions for Modified Alternative 3b - Implementation Phase (Hybrid Saipan/Tinian South)

Miles for Commuter Emissions for 8 week training exercises

Vehicle Class	Speed Miles/hour	Miles/Trip	Total Trips/Day	Hours/Day	Total Days	Total Miles
HDDV8A - Class 8a Heavy-Duty Diesel Vehicles (33,001-60,000 lbs GVW)		40	24		56	53,760
HDDV8B - Class 8b Heavy-Duty Diesel Vehicles (>60,000 lbs GVW)	55			48	2.375	6,270

Criteria and VOC Emissions for Commuters

Vehicle Class	Model Year	Annual Miles	Criteria Pollutant Emissions (tons/year)					
			PM ₁₀	PM _{2.5}	CO	NOx	SOx	VOCs
HDDV8A - Class 8a Heavy-Duty Diesel Vehicles (33,001-60,000 lbs GVW)	2005	53,760	0.015	0.012	0.166	0.324	0.001	0.028
HDDV8B - Class 8b Heavy-Duty Diesel Vehicles (>60,000 lbs GVW)	2005	6,270	0.002	0.001	0.023	0.043	0.000	0.004
Total			0.017	0.013	0.189	0.367	0.001	0.032

Particulate emissions include exhaust, brake wear, tire wear. Assume paved road.

Greenhouse Gas Emissions for Commuters

Vehicle Class	Annual Miles	CO ₂ (lb/year)	CH ₄ (lb/year)	N ₂ O (lb/year)	CH ₄ GWP Multiplier	N ₂ O GWP Multiplier	CO ₂ Equivalent (lb/year)	CO ₂ Equivalent (metric tonnes/year)
HDDV8A - Class 8a Heavy-Duty Diesel Vehicles (33,001-60,000 lbs GVW)	53,760	183,004.44	0.60	0.57	25	298	183,189.08	83.09
HDDV8B - Class 8b Heavy-Duty Diesel Vehicles (>60,000 lbs GVW)	6,270	22,326.51	0.07	0.07	25	298	22,348.04	10.14
Total		205,330.95	0.67	0.64	---	---	205,537.13	93.23

GWP = Global Warming Potential; 100-year GWP values obtained from EPA's Climate Leadership, Emission Factors for Greenhouse Gas Inventories, Last Modified 4 April 2014 (<http://www.epa.gov/climateleadership/documents/emission-factors.pdf>)

Emission Calculations Method - Fuel Truck and Commuter Vehicle Emissions for Modified Alternative 3b - Implementation Phase (Hybrid Saipan/Tinian South)

Calculation Method: Equation 4-1, AFCEE 2009, Mobile Emissions Guide

$$EP = VMTVehCat * EFPolVehCat * 0.002205$$

Where,

EP = Emissions of each individual pollutant (lb/yr)

VMTVehCat = Annual vehicle miles traveled by each vehicle category (LDGV, LDGT1, LDDV, etc.) (mi/yr)

EFPolVehCat = Emission factor of each pollutant for each vehicle category (g/mi)

0.002205 = Factor for converting grams to pounds (g/lb).

DATA - Fuel Loading Emissions for Modified Alternative 3b - Implementation Phase (Hybrid Saipan/Tinian South)

Given:		Saipan
Total Exercise Days (8 weeks)		56
Initial Fuel Fill Days		2.333333333
Remaining Fuel Fill Days		0
Total # of Fuel Trucks		6
Total Gallons per Fuel Truck		10,000
Trips per day per Fuel Truck		3
1 bbl conversion to gallons		42
Total Fuel (gal) during Initial Fill		420,000
Total Fuel (gal) during Remaining Exercise		0
Total Fuel (gal) during Exercise (8 Weeks)		420,000

Proposed Action Fuel Loading Operations

Location	Description	Fuel Type	Fuel Transferred (gal)	Category
Saipan Airport Flightline	Loading Aircraft from Truck Fill Stands	JP-8	420,000	Loading
Saipan Seaport, Loading Racks (50,000 bbl tank 1)	Loading Refueler Trucks	JP-8	210,000	Loading
Saipan Seaport, Loading Racks (50,000 bbl tank 2)	Loading Refueler Trucks	JP-8	210,000	Loading

Given:		Tinian North
Total Exercise Days (8 weeks)		56
Initial Fuel Fill Days		2.333333333
Remaining Fuel Fill Days		0
Total # of Fuel Trucks		6
Total Gallons per Fuel Truck		10,000
Trips per day per Fuel Truck		3
1 bbl conversion to gallons		42
Total Fuel (gal) during Initial Fill		420,000
Total Fuel (gal) during Remaining Exercise		0
Total Fuel (gal) during Exercise (8 Weeks)		420,000

Proposed Action Fuel Loading Operations

Location	Description	Fuel Type	Fuel Transferred (gal)	Category
Tinian South Flightline	Loading Aircraft from Truck Fill Stands	JP-8	420,000	Loading
Tinian Seaport, Loading Racks (50,000 bbl tank 1)	Loading Refueler Trucks	JP-8	210,000	Loading
Tinian Seaport, Loading Racks (50,000 bbl tank 2)	Loading Refueler Trucks	JP-8	210,000	Loading

Emission Factors - Fuel Loading Emissions for Modified Alternative 3b - Implementation Phase (Hybrid Saipan/Tinian South)

JP-8 emission factors (lb/Mgal)	Dispensing	Loading
	Splash	Bottom fill
Molecular Weight =	130	0.020
True Vapor Pressure (psia) =	0.011	
Dispensing Displacement losses =	0.0487	
Spillage =	0.7	
Total =	0.749	

AP-42 Table 7.1-2 dated 11/06
 AP-42 Table 7.1-2 dated 11/06 @ 70F (annual avg.)
 AP-42 Section 5.2 dated 6/08 Equation (1)
 AP-42 Table 5.2-7 dated 6/08

Emission Calculations - Fuel Loading Emissions for Modified Alternative 3b - Implementation Phase (Hybrid Saipan/Tinian South)

Saipan

Location	Description	Fuel Type	Fuel Transferred	Displaced Vapor	Spillage	Total VOC	Total VOC
			(gal)	(lb)	(lb)	(lb)	(tons)
Saipan Airport Flightline	Loading Aircraft from Truck Fill Stands	JP-8	420,000	8.5	0	8.5	0.004
Saipan Seaport, Loading Racks (50,000 bbl tank 1)	Loading Refueler Trucks	JP-8	210,000	4.2	0	4.2	0.002
Saipan Seaport, Loading Racks (50,000 bbl tank 2)	Loading Refueler Trucks	JP-8	210,000	4.2	0	4.2	0.002
Total			840,000	17	0	16.94	0.01

Tinian

Location	Description	Fuel Type	Fuel Transferred	Displaced Vapor	Spillage	Total VOC	Total VOC
			(gal)	(lb)	(lb)	(lb)	(tons)
Tinian South Flightline	Loading Aircraft from Truck Fill Stands	JP-8	420,000	8.5	0	8.5	0.004
Tinian Seaport, Loading Racks (50,000 bbl tank 1)	Loading Refueler Trucks	JP-8	210,000	4.2	0	4.2	0.002
Tinian Seaport, Loading Racks (50,000 bbl tank 2)	Loading Refueler Trucks	JP-8	210,000	4.2	0	4.2	0.002
Total			840,000	17	0	16.94	0.01

Maximum Emissions **16.94** **0.01**

Emission Calculations Method - Fuel Loading Emissions for Modified Alternative 3b - Implementation Phase (Hybrid Saipan/Tinian South)

Displacement emissions for Diesel and JP-8 were estimated using Equation (1) from AP-42 Section 5.2, Transportation and Marketing of Petroleum Liquids, dated 6/08

$$L_L = 12.46 \text{ (SPM)/T}$$

Where

L_L = Loading loss in lb/10³ gal

S = Saturation Factor 1.45 for splash loading, 0.6 for bottom loading

M = molecular weight,

T = temperature of bulk liquid (assume average annual ambient temperature)

DATA - Fuel Storage Tank Emissions for Modified Alternative 3b - Implementation Phase (Hybrid Saipan/Tinian South)

Fuel storage tank emissions were estimated using the U.S. EPA TANKS storage tank emissions calculation software (Version 4.0.9d). The emissions calculations algorithms in the TANKS program are based on Chapter 7 of EPA's AP-42. Honolulu, Hawaii was used as a surrogate location for the tanks as meteorological data does not exist in TANKS for CNMI. Jet Kerosene fuel was used as the surrogate for JP-8 in the TANKS model as it is the closest in characteristics to JP-8.

Emission Calculations Summary from TANKS* - Saipan

Tank Type	Throughput (gal.)	Working Loss (lbs)	Breathing Loss (lbs)	VOC Total (lbs)	VOC Total (tons)
Tank 1 (Saipan Seaport) - 50,000 bbl, cut and cover or AST	210,000	9.63	585.39	595.02	0.30
Tank 2 (Saipan Seaport) - 50,000 bbl, cut and cover or AST	210,000	9.63	585.39	595.02	0.30
Tank 3 (Saipan Airport) - 50,000 bbl, cut and cover or AST	210,000	9.63	585.39	595.02	0.30
Tank 4 (Saipan Airport) - 50,000 bbl, cut and cover or AST	210,000	9.63	585.39	595.02	0.30
Total		38.52	2,341.56	2,380.08	1.19

*See the following references for TANKS printouts. (SM12 - TANKS) & (SM13 - TANKS)

Emission Calculations Summary from TANKS* - Tinian North

Tank Type	Throughput (gal.)	Working Loss (lbs)	Breathing Loss (lbs)	VOC Total (lbs)	VOC Total (tons)
Tank 1 (Tinian Seaport) - 50,000 bbl, cut and cover or AST	210,000	9.63	585.39	595.02	0.30
Tank 2 (Tinian Seaport) - 50,000 bbl, cut and cover or AST	210,000	9.63	585.39	595.02	0.30
Tank 3 (Tinian Airport) - 60,000 bbl, cut and cover or AST	210,000	9.63	714.88	724.51	0.36
Tank 4 (Tinian Airport) - 60,000 bbl, cut and cover or AST	210,000	9.63	714.88	724.51	0.36
Total		38.52	2,600.54	2,639.06	1.32

*See the following references for TANKS printouts. (SM12 - TANKS) & (SM13 - TANKS)

Maximum Emissions	2,639.06	1.32
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APPENDIX F

Aeronautical Study in the Commonwealth of the Northern Mariana Islands



Revised Final

Aeronautical Study

in the Commonwealth of the Northern Mariana Islands (CNMI)

Prepared for

Air Force Center for Engineering and the Environment (AFCEE) and Headquarters Pacific Air Forces (PACAF)

Prepared by

HDR, Inc.

Contract No. FA8903-08-D-8771,
Task Order 0159

January
2016



ABBREVIATIONS AND ACRONYMS

AFFF	aqueous film-forming foam	RPZ	Runway Protection Zone
AGL	above ground level	RSA	Runway Safety Area
ALP	Airport Layout Plan	RWY	Runway
AMSL	above mean sea level	SAR	Search and Rescue
ARFF	Aircraft Rescue and Fire Fighting	SMS	Safety Management System
ARTCC	Air Route Traffic Control Center	TERPS	Terminal Instrument Procedures
ATADS	Air Traffic Activity System	TNI	Tinian International Airport
ATC	Air Traffic Control	USAF	United States Air Force
BASH	Bird Aircraft Strike Hazard	USMC	United States Marine Corps
CFR	Code of Federal Regulation	VFR	Visual Flight Rule
CNMI	Commonwealth of the Northern Mariana Islands		
CPA	Commonwealth Port Authority		
CTAF	Common Traffic Advisory Frequency		
DOD	Department of Defense		
DME	Distance Measuring Equipment		
DNE	Does Not Exceed		
EIS	Environmental Impact Statement		
EMI	Electromagnetic Interference		
FAA	Federal Aviation Administration		
FAR	Federal Aviation Regulation		
FIR	Flight Information Region		
FL	Flight Level		
FOD	Foreign Object Debris		
GPS	Global Positioning Satellite		
GSN	Saipan International Airport		
IFR	Instrument Flight Rule		
IR	Instrument Route		
JO	Joint Order		
LMM	Locator Middle Marker		
MOCA	Minimum Obstacle Clearance Altitude		
MSL	mean sea level		
MTR	Military Training Route		
NAVAID	Navigational Aid		
NDB	Non-Directional Beacon		
NM	Nautical Mile		
NNR	No Notice Required		
OFA	Object Free Area		
OFZ	Obstacle Free Zone		
PACAF	Pacific Air Force		
PNR	Possible Notice Required		
RNAV	Area Navigation		

1 Executive Summary

2 This aeronautical study was developed in response to a request from the Federal Aviation
3 Administration (FAA) to the United States Air Force (USAF) Pacific Air Forces (PACAF) as part
4 of the ongoing development of the PACAF Divert Activities and Exercises, Commonwealth of
5 the Northern Mariana Islands (CNMI) planning efforts (Divert). This study, in conjunction with
6 the Divert Activities and Exercises, CNMI Environmental Impact Statement (Divert EIS), will
7 provide PACAF and Headquarters Air Force with the information required to make a decision on
8 where and how to develop and implement the required airfield improvements and activities
9 needed to fulfill the PACAF requirements as stated herein and in the EIS. An aeronautical study
10 is conducted to identify the impact of an aeronautical proposal on the safe and efficient use of
11 airspace, air traffic control, and airfield procedures. This aeronautical study was requested by
12 FAA Honolulu Airports Division Office personnel in response to FAA's role as a cooperating
13 agency of the Divert EIS. This document analyzes the impact to commercial air operations in
14 the vicinity of the CNMI should PACAF develop and implement the required airfield
15 improvements to support divert landings, joint military exercises, and humanitarian assistance
16 and disaster relief efforts at Saipan International Airport (GSN) and/or Tinian International
17 Airport (TNI).

18 This aeronautical study analyzes six areas: Instrument Flight Rules/Visual Flight Rules and
19 Terminal Area; Civilian Air Traffic (Public Use and Charter) Services; Instrument Flight Rules
20 En-route Operations; Federal Aviation Regulation Part 77 Obstacle Evaluations; Saipan and
21 Tinian Pending Proposals; and Air Traffic Control and Airfield Facilities Services Assessment.
22 Each area of study is its own chapter and includes the impacts of the United States Air Force
23 proposals to civilian air traffic. The final chapter provides potential mitigation measures and
24 recommendations to avoid or lessen impacts.

25 Alterations or changes to an airfield, including construction or increased air traffic, could result in
26 impacts to existing air operations. Potential impacts from implementing proposed divert
27 activities and exercises at GSN or TNI include:

- 28 • Aircraft Rescue and Firefighting (ARFF) department line-of-sight obstruction.

29 Impacts could be minimized or negated through cooperation and collaboration with the
30 stakeholder agencies. Under this proposal, agreements should be established with FAA and
31 Commonwealth Port Authority (CPA) officials. The following possible mitigation measures and
32 recommendations would avoid or lessen impacts:

- 33 • Adhere to aircraft number and operations written within the Divert EIS.
- 34 • File FAA Form 7460-1, Notice of Proposed Construction or Alteration for all proposed
35 construction.
- 36 • Install a tower on the ARFF facility, or add surveillance cameras on airfield, or request a
37 waiver for ARFF line-of-sight.;

- 1 • Assist CPA with modifications to the Airport Layout Plan and securing FAA approval
- 2 prior to construction.
- 3 • Assist CPA with a Safety Management System evaluation for each proposed
- 4 construction.

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1 1. Francisco C. Ada/Saipan International
2 Airport (GSN) Existing Environment and
3 Proposed Construction

4 1.1 GSN Existing Conditions

5 GSN is a public airport located on the Island of Saipan within the Commonwealth of the
6 Northern Mariana Islands (CNMI) (see **Figure 1-1**) and is owned and operated by the
7 Commonwealth Port Authority (CPA). Though the islands of Rota, Tinian, and Saipan are all
8 considered immigration ports of entry into the United States, Saipan is considered the gateway
9 to the CNMI because of its infrastructure. GSN is also designated as the commercial aviation
10 divert airfield location for eastbound flights originating in western Asia and for all flights bound
11 for Guam. The GSN main terminal accommodates international passengers with six jetways
12 that lead to immigration and customs processing. There are seven major airlines operating at
13 Saipan International Airport: Delta Airlines, Asiana Airlines, Shanghai Airlines, Sichuan Airlines,
14 China Eastern, United Airlines, and Fly Guam. Saipan International Airport has scheduled
15 flights from cities in Russia, Japan, Korea, China, and Guam with the capability to increase
16 direct flights to the Republic of Palau, the Federated States of Micronesia, Australia, and other
17 oceanic destinations. The commuter terminal at GSN serves as a general aviation terminal and
18 as the terminal for one feeder or air taxi service, Star Marianas. Star Marianas services Tinian
19 and Rota using single-engine aircraft and dual-engine, short take-off aircraft. Artic Circle Air
20 provides charter and cargo between Saipan and Rota (CPA 2005).



21
22 **Figure 1-1. Aerial View of GSN**

1 **Runway (RWY) 07/25.** Saipan has one Instrument Flight Rule (IFR) runway, RWY 07/25 which
2 is surfaced with asphalt. RWY 07/25 is 8,700 feet long and 150 feet wide. RWY 07/25 has four
3 taxiways on which aircraft can transit to and from the parking aprons. RWY 07/25 is also
4 equipped with High Intensity Runway Edge Lights that outline the edges of runways during
5 periods of darkness or restricted visibility conditions. A structure parallel to RWY 07/25,
6 formerly called RWY 06/24 was used as a temporary runway that was 7,001 feet long and 100
7 feet wide but has been turned into a parallel taxiway.

8 RWY 07 has runway end identifier lights, which consists of two lighting units that flash
9 simultaneously. RWY 25 is also equipped with a medium-intensity approach light system, which
10 consists of a combination of threshold lamps, and steady burning light bars and flashers. The
11 medium-intensity approach light system provides visual information to pilots on runway
12 alignment, height perception, role guidance, and horizontal references for Category I Precision
13 Approaches (FAA 2012). RWY 07/25 has a visual approach slope indicator at each runway
14 end, which is a system of lights arranged to provide visual descent guidance information during
15 the approach to a runway (FAA 2012).

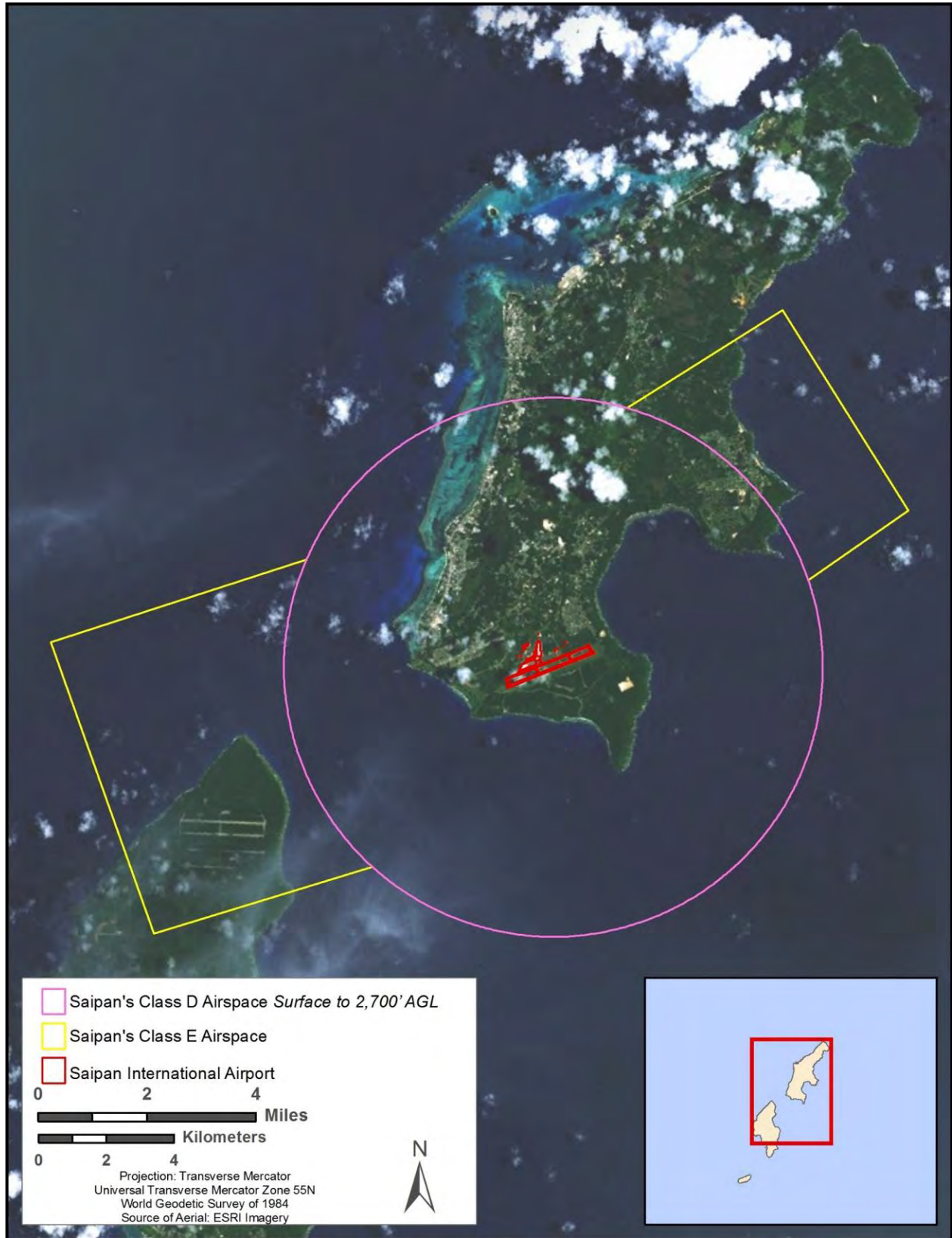
16 **Airfield Obstructions.** There are no obstructions within GSN's approach surfaces. According
17 to Federal Aviation Regulation (FAR) § 77.25(d), the approach surface is longitudinally centered
18 on the extended runway centerline and extending outward and upward from each end of the
19 primary surface. An approach surface is applied to each end of each runway based upon the
20 type of approach available or planned for that runway end.

21 **Hours of Operation.** RWY 07/25 is the primary runway and open 24 hours per day, 7 days per
22 week.

23 **Instrument Flight Rules Capabilities.** There are two navigational aids (NAVAIDS) located on
24 GSN's airfield, a non-directional beacon (NDB) and an instrument landing system. The
25 following instrument approach procedures are published to RWY 07/25: instrument landing
26 system or Localizer (LOC)/Distance Measuring Equipment (DME) RWY 07; Area Navigation
27 (RNAV) (GPS) RWY 07; NDB/DME RWY 07; NDB RWY 07; RNAV (GPS) RWY 25; and
28 NDB/DME RWY 25 (see **Appendix A**).

29 **Aircraft Fueling.** All fueling and defueling of aircraft is conducted from fuel systems and fuel
30 trucks approved by the CPA. Due to 14 Code of Federal Regulations § 139 requirements, only
31 airlines, the fuel system operator, and fixed-base operators are authorized to perform into-plane
32 fueling services. Fueling and refueling operators are responsible for compliance with all Federal
33 Aviation Administration (FAA) codes, regulations and laws associated with the process. GSN
34 provides three types of aviation fuel: Avgas 100 (green), Avgas 100LL (blue), and Jet A-1+.
35 Avgas 100 (green) and 100LL (blue) is gasoline fuel for reciprocating piston engine aircraft.
36 Jet-A-1 is a kerosene grade of fuel suitable for most turbine engine aircraft.

37 **Air Traffic Control (ATC) Services.** FAA operates the ATC tower at GSN. The ATC tower is
38 responsible for the separation and efficient movement of aircraft and vehicles operating on the
39 taxiways and runways of the airport itself, and the aircraft within Saipan's Class D and Class E
40 extension airspace as shown in **Figure 1-2**. Class D Airspace is generally a 5-nautical mile
41 (NM) radius from the airport reference point, surface to 2,500 feet above ground level (AGL).



1

2 Figure 1-2. GSN Class D and E extension Airspace

1 However, Class D airspace is also tailored to meet the needs of the airport. GSN's Class D
2 Airspace encompasses a 4.3-mile radius, surface to 2,700 feet AGL. Class D airspace only
3 surrounds airports that have an operational control tower such as GSN. Class E airspace
4 extends upward from either the surface or a designated altitude to the overlying or adjacent
5 controlled airspace and is used by aircraft transiting to and from the terminal or en-route
6 environment. GSN Class E Airspace extends upward from the surface within a 4.3-mile radius
7 of GSN and within 2.6 miles each side of the Saipan NDB 264 degree bearing, extending from
8 the 4.3-mile radius to 7.4 miles west of the Saipan NDB and within 1.8 mile each side of the
9 Saipan NDB 248 degree radial, extending from the 4.3-mile radius to 7.4 miles west of the
10 Saipan NDB and within 1.8 mile each side of the Saipan NDB 068 degree radial, extending from
11 the 4.3-mile radius to 6.5 miles east of GSN (SERCO 2012). Pilots are required to establish
12 and maintain two-way radio communications with GSN's ATC tower prior to entering their Class
13 D/E airspace.

14 The Island of Saipan is within FAA's Guam Center Air Route Traffic Control Center (ARTCC)
15 Flight Information Region (FIR). Guam ARTCC is responsible for controlling aircraft en route to,
16 transiting within, and arriving at or departing from the airports within their FIR. Guam ARTCC
17 radar coverage and service begins at 3,500 feet above mean sea level (AMSL) above the
18 airport. Guam ARTCC provides approach and departure service for GSN. Between Saipan's
19 Class D Airspace and Guam ARTCC FIR is Class G Airspace. Class G Airspace is uncontrolled
20 airspace.

21 **Commonwealth Port Authority Services.** GSN has an Aircraft Rescue and Firefighting
22 (ARFF) department with approximately 35 personnel as shown in **Figure 1-3**. The department
23 manages two 24-hour shifts with approximately 15 personnel assigned to each shift, and an
24 average of 8 personnel on duty per shift daily. A fire captain is in charge of each shift. The fire
25 department has six vehicles; a Striker 1500, an Oshkosh 1500, an Oshkosh 3000, a Rapid
26 Intervention Vehicle, a Tanker, and a Command Vehicle. Saipan's ARFF possesses a 500,000-
27 gallon water tank on their premises. The CPA Police Department is responsible for airport
28 security.



29
30 **Figure 1-3. GSN Aircraft Rescue and Firefighting Department**

1.2 GSN FAA Runway Clearance Criteria

Safe and efficient operations at an airport require that certain areas on and near the airport are clear of objects or restricted to objects with a certain function, composition, or height. To ensure safe operations, FAA developed four areas or zones for airport runways: the Runway Safety Area (RSA), Obstacle Free Zone (OFZ), Runway Protection Zone (RPZ), and Obstacle Free Area (OFA). The existing and proposed areas and zones are depicted in **Figure 1-4** and the dimensions are provided in **Table 1-1**.

Table 1-1. GSN Clearance Area Dimensions

Zone	Width	Length
RSA	500 feet wide (250 feet from centerline)	Extends 1,000 feet from end of runway
OFZ	400 feet wide (200 feet from centerline)	Extends 200 feet from end of runway
RPZ	400 feet wide (200 feet from centerline)	Starts 200 feet from end of runway and extends 1,700 feet based on CAT C/D 1-mile visibility
OFA	400 feet wide (200 feet from centerline)	Extends 1,000 feet from end of runway

Runway Safety Area (RSA). The RSA is centered on the runway centerline. The runway safety area will be:

- (1) Cleared and graded and have no potentially hazardous ruts, humps, depressions, or other surface variations. Drained by grading or storm sewers to prevent water accumulation
- (2) Capable, under dry conditions, of supporting snow removal equipment, aircraft rescue and firefighting equipment, and the occasional passage of aircraft without causing structural damage to the aircraft
- (3) Free of objects, except for objects that need to be located in the RSA because of their function. Objects higher than 3 inches above grade should be constructed, to the extent practicable, on low impact resistant supports (frangible mounted structures) of the lowest practical height with the frangible point no higher than 3 inches above grade. Other objects, such as manholes, should be constructed at grade. In no case should their height exceed 3 inches above grade (FAA 1989).

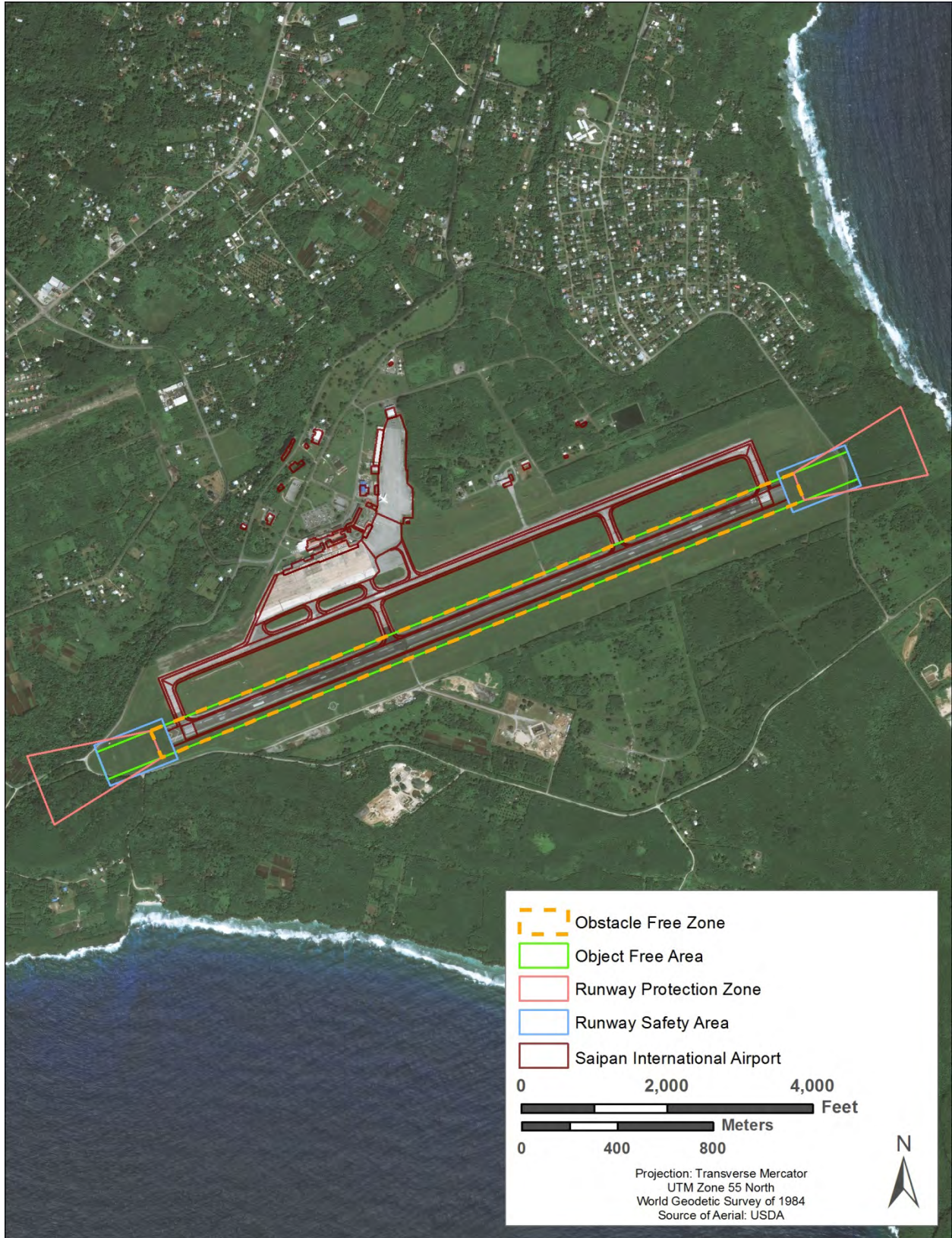


Figure 1-4. GSN FAA Clearance Zones

1 **Obstacle Free Zone (OFZ).** The OFZ clearing standard precludes taxiing and parked airplanes
2 and object penetrations, except for frangible visual NAVAIDs that need to be located in the OFZ
3 because of their function. The runway OFZ and, when applicable, the precision OFZ, the inner-
4 approach OFZ, and the inner-transitional OFZ comprise the OFZ. The runway OFZ is a defined
5 volume of airspace centered above the runway centerline. The runway OFZ is the airspace
6 above a surface whose elevation at any point is the same as the elevation of the nearest point
7 on the runway centerline. The runway OFZ extends 200 feet beyond each end of the runway.
8 Its width is as follows:

- 9 (1) For runways serving small airplanes exclusively:
- 10 (a) 300 feet for runways with lower than 3/4-statute mile (approach visibility
11 minimums.
- 12 (b) 250 feet for other runways serving small airplanes with approach speeds of 50
13 knots or more.
- 14 (c) 120 feet for other runways serving small airplanes with approach speeds of less
15 than 50 knots.
- 16 (2) For runways serving large airplanes, 400 feet (FAA 1989).

17 **Runway Protection Zone (RPZ).** The RPZ enhances the protection of people and property on
18 the ground. This is achieved through airport owner control over RPZs. Such control includes
19 clearing RPZ areas (and maintaining them clear) of incompatible objects and activities. Control
20 is preferably exercised through the acquisition of sufficient property interest in the RPZ.

- 21 (1) RPZ Configuration and Location. The RPZ is trapezoidal in shape and centered above
22 the runway centerline. The central portion and controlled activity area are the two
23 components of the RPZ. The RPZ dimension for a particular runway end is a function of
24 the type of aircraft and approach visibility minimum associated with that runway end.
25 Other than with a special application of declared distances, the RPZ begins 200 feet
26 beyond the end of the area usable for takeoff or landing (FAA 1989).

27 **Object Free Area (OFA).** The runway OFA is centered on the runway centerline. The runway
28 OFA clearing standard requires clearing the OFA of above ground objects protruding above the
29 runway safety area edge elevation. Except where precluded by other clearing standards, it is
30 acceptable to place objects that need to be located in the OFA for air navigation or aircraft
31 ground maneuvering purposes and to taxi and hold aircraft in the OFA. Objects non-essential
32 for air navigation or aircraft ground maneuvering purposes must not to be placed in the OFA.
33 This includes parked airplanes and agricultural operations (FAA 1989).

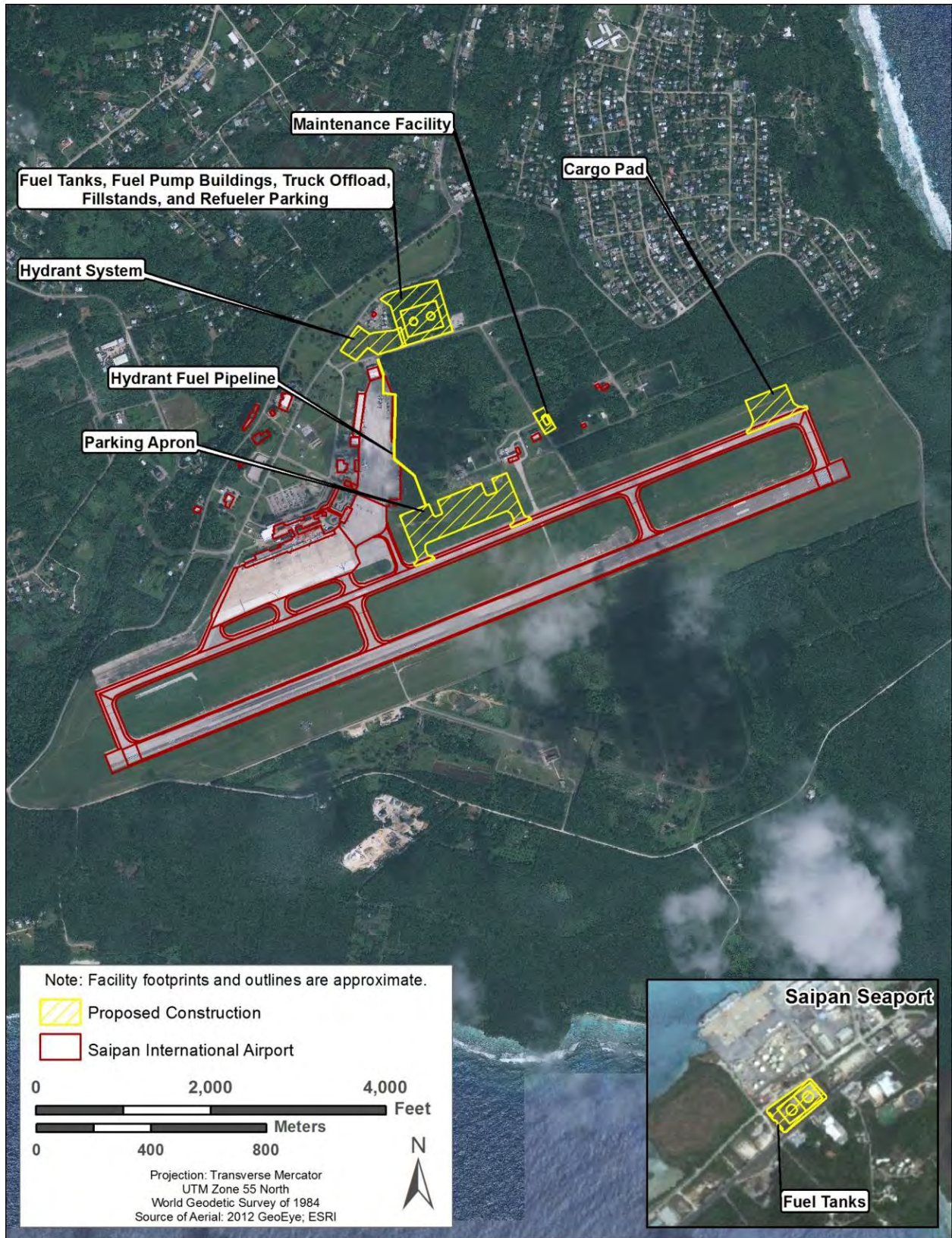
34 The OFA dimensions are based on the category of aircraft which utilize the runway. RWY 07/25
35 OFA dimensions are: 800 feet wide; 400 feet from the runway centerline; and 1,000 feet long
36 from the end of the runway as shown in **Figure 1-4**.

1 1.3 GSN Proposed Construction

2 Pacific Air Force's (PACAF's) proposed construction is based on accommodating a combination
3 of joint military cargo, tanker, or similar aircraft and associated support personnel. In order to
4 accommodate these aircraft and achieve the necessary divert capabilities, supporting
5 infrastructure would be needed to meet airfield operational requirements. There are two
6 proposed alternatives for construction on Saipan: Alternative 1 (Saipan Alternative) and
7 Alternative 3 (Saipan Hybrid Alternative).

8 Proposed infrastructure at GSN under Alternative 1 includes one parking apron, one cargo pad,
9 one maintenance facility, fuel tanks and supporting infrastructure, and a fuel hydrant system
10 including a hydrant fuel pipeline from the hydrant system to the parking apron. The parking
11 apron would be able to accommodate six KC-135 and the cargo pad could accommodate up to
12 three KC-135. Alternative 1 at GSN is shown in **Figure 1-5**.

13 Proposed infrastructure at GSN under Alternative 3 includes one cargo pad, one maintenance
14 facility, and fuel tanks and supporting infrastructure. The United States Air Force (USAF) would
15 not build a parking apron, a fuel hydrant system, or hydrant fuel pipeline at GSN under
16 Alternative 3. Alternative 3 at GSN is shown in **Figure 1-6**. Alternative 3 also includes
17 construction at the Tinian International Airport (TNI) and is addressed in **Section 2.3**.



1
 2 **Figure 1-5. Alternative 1 GSN Proposed Construction**



1

2 Figure 1-6. Alternative 3 GSN Proposed Construction

2. Tinian International Airport (TNI) Existing Environment and Proposed Construction

2.1 TNI Existing Conditions

TNI, as shown in **Figure 2-1**, is primarily used for inter-island passenger traffic between the islands of Saipan, Rota, and Guam. The airport is equipped for night operation, and are chartered night flights from Saipan and Guam primarily service the Tinian Dynasty hotel and casino. Charter flights are available through Star Marianas.

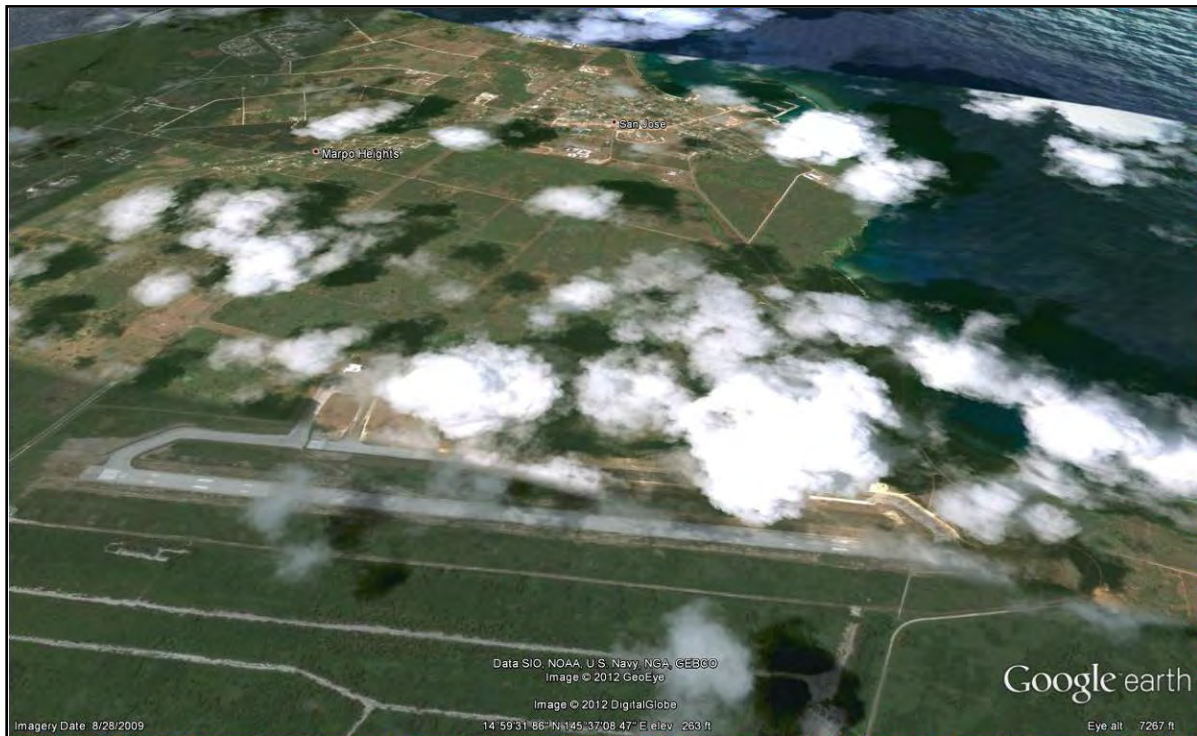


Figure 2-1. Aerial View of TNI

RWY 08/26. TNI has one runway, RWY 08/26, which is 8,600 feet long and 150 feet wide. RWY 08/26 has two taxiways, one at each end of the runway, in which aircraft can transit to and from the parking aprons. RWY 08/26 is equipped with medium-intensity runway lights, which are used to outline the edges of runways during periods of darkness or restricted visibility conditions. TNI also uses a precision approach path indicator system on each runway end to provide visual descent information to pilots. This system is similar to the visual approach slope indicator but is installed in a single row of either two or four light units. In addition, TNI uses a runway end identifier lights on each runway end, which consists of two light units flashing simultaneously (FAA 2012).

Airfield Obstructions. There is a 30-foot hill at the west end of the CPA property approximately 1,300 feet from the end of RWY 08 within the approach surface. Broadway Avenue, the main north-south thoroughfare on Tinian, is at the east end of CPA property

1 approximately 1,500 feet from the end of the runway. According to FAR Part 77.25(d), the
2 approach surface is longitudinally centered on the extended runway centerline and extends
3 outward and upward from each end of the primary surface. The approach surface is applied to
4 each end of each runway based upon the type of approach available or planned for that runway
5 end. There are no existing obstructions within approach surfaces with the existing conditions at
6 TNI.

7 **Hours of Operations.** RWY 08/26 is open between the hours of 0600–2000 Chamorro
8 Standard Time. Aircraft operating outside of the designated hours require prior permission from
9 the CPA.

10 **Instrument Flight Rules Capabilities.** Navigation guidance approaching TNI is based on
11 GSN's NDB. The following instrument approach procedures are published to RWY 08/26: Area
12 navigation (RNAV) (GPS) RWY 08; 10 RNAV (GPS) RWY 26; and NDB/DME A (see **Appendix**
13 **B**).

14 **Air Traffic Control Services.** The airspace surrounding TNI is designated Class G Airspace.
15 Class G Airspace is uncontrolled airspace when the weather is at or above visual
16 meteorological conditions. It becomes controlled airspace when the weather is below visual
17 meteorological conditions to protect aircraft using the instrument approaches to the airport. TNI
18 operates without an ATC tower, Class D Airspace, or ground control. Aircraft provide courtesy
19 notification to CPA operations and ATC in Saipan for approach and departure clearance. TNI is
20 considered an uncontrolled or non-towered airfield and pilots are responsible for their own
21 separation for takeoffs and landings. Uncontrolled airports use a universal communication
22 system or Common Traffic Advisory Frequency (CTAF) that pilots can use to transmit their
23 intentions to other aircraft using the airport (FAA 2010). Like Saipan, the Island of Tinian is
24 within FAA's Guam ARTCC FIR. Guam ARTCC is responsible for controlling aircraft operating
25 under IFR en-route to, transiting within, and arriving or departing airports within their FIR. FIR is
26 a region of airspace with specific dimensions, in which air traffic control and flight information
27 services are provided. Guam ARTCC radar coverage and service begins 3,500 feet AMSL
28 above the Island of Tinian. Air taxi service to and from Saipan and Tinian generally remain
29 under 3,000 feet.

30 **Commonwealth Port Authority Services.** The TNI ARFF department consists of
31 approximately 10 personnel (see **Figure 2-2**). Personnel have dual roles as ARFF and port
32 police officers. The ARFF operations run three 8-hour shifts per day with an average of two to
33 three personnel on duty per shift daily. A fire and police captain runs the daily operations for
34 both law enforcement and ARFF protection for the airport. The fire department has three
35 vehicles: an Oshkosh 1500, a Striker 1500, and a HAZMAT full-size pickup. Tinian's ARFF
36 possesses a 60,000-gallon reserve water tank on their premises. For military operations, the
37 deploying unit is required to provide their own expeditionary airfield support, including bulk water
38 carriers and tankers and crash-and-rescue equipment.



1

2 **Figure 2-2. TNI Aircraft Rescue and Firefighting Department**

3 **2.2 TNI FAA Runway Clearance Criteria.**

4 Safe and efficient operations at an airport require that certain areas on and near the airport are
5 clear of objects or restricted to objects with a certain function, composition, or height. The FAA
6 has developed four areas and zones for airport runways to ensure safe operations: RSA, OFZ,
7 RPZ, and OFA. The existing and proposed areas and zones at TNI are depicted in **Figure 2-3**
8 and the dimensions are provided in **Table 2-1**.

9 **Runway Safety Area (RSA).** The RSA is centered on the runway centerline. The RSA will be:

- 10 (1) Cleared and graded and have no potentially hazardous ruts, humps, depressions, or
11 other surface variations
- 12 (2) Drained by grading or storm sewers to prevent water accumulation
- 13 (3) Capable, under dry conditions, of supporting snow removal equipment, aircraft rescue
14 and firefighting equipment, and the occasional passage of aircraft without causing
15 structural damage to the aircraft

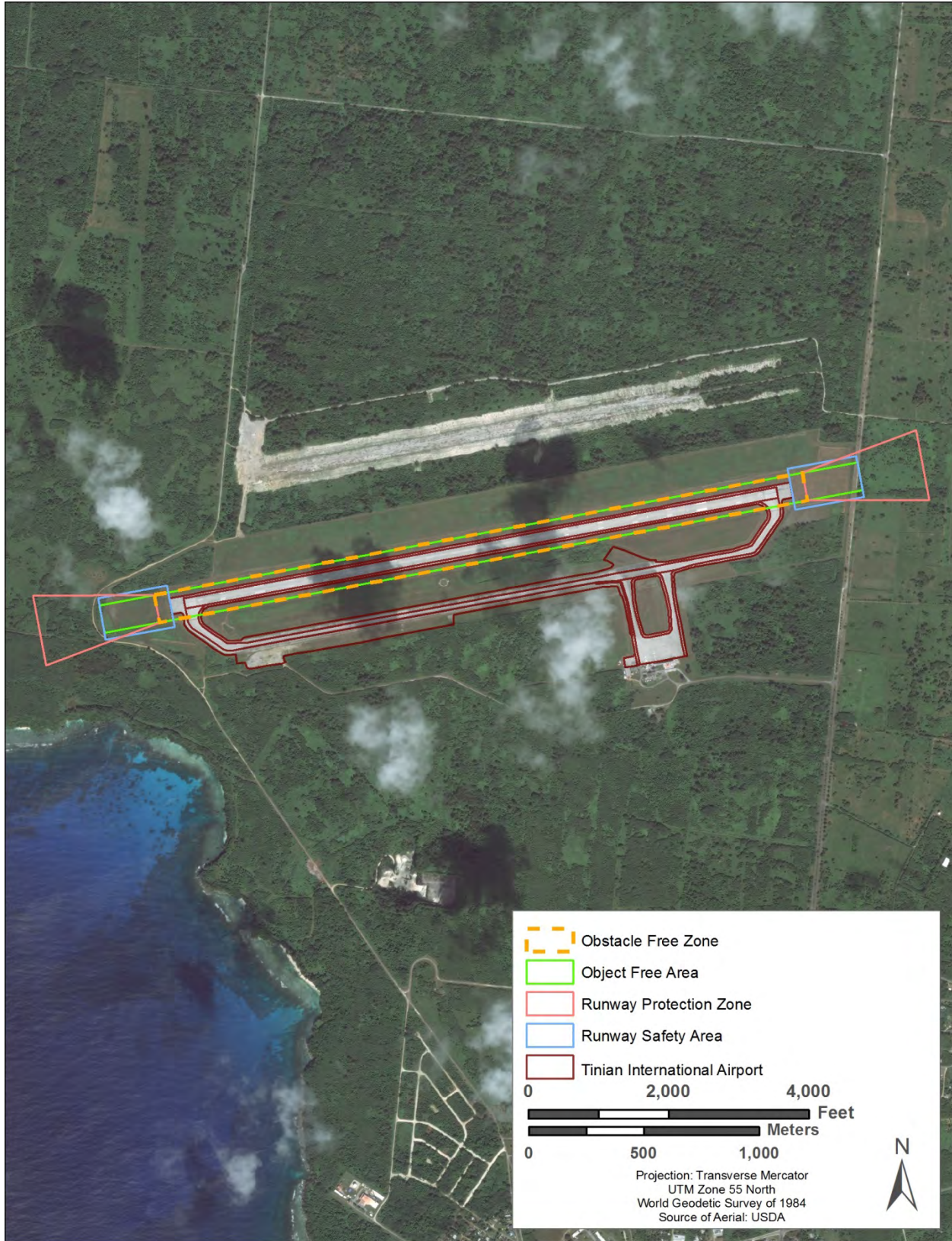


Figure 2-3. TNI FAA Clearance Zones

1 **Table 2-1. TNI Clearance Area Dimensions**

Zone	Width	Length
RSA	500 feet wide (250 feet from centerline)	Extends 1,000 feet from end of runway
OFZ	400 feet wide (200 feet from centerline)	Extends 200 feet from end of runway
RPZ	400 feet wide (200 feet from centerline)	Starts 200 feet from end of runway and extends 1,700 feet based on CAT C/D 1-mile visibility
OFA	400 feet wide (200 feet from centerline)	Extends 1,000 feet from end of runway

2 (4) Free of objects, except for objects that need to be located in the RSA because of their
 3 function. Objects higher than 3 inches above grade should be constructed, to the extent
 4 practicable, on low impact resistant supports (frangible mounted structures) of the lowest
 5 practical height with the frangible point no higher than 3 inches above grade. Other
 6 objects, such as manholes, should be constructed at grade. In no case should their
 7 height exceed 3 inches above grade (FAA 1989).

8 **Obstacle Free Zone (OFZ).** The OFZ clearing standard precludes taxiing and parked airplanes
 9 and object penetrations, except for frangible visual NAVAIDs that need to be located in the OFZ
 10 because of their function. The runway OFZ and, when applicable, the precision OFZ, the inner-
 11 approach OFZ, and the inner-transitional OFZ comprise all aspects of the total OFZ. The
 12 runway OFZ is a defined volume of airspace centered above the runway centerline. The
 13 runway OFZ is the airspace above a surface whose elevation at any point is the same as the
 14 elevation of the nearest point on the runway centerline. The runway OFZ extends 200 feet
 15 beyond each end of the runway. Its width is as follows:

- 16 (1) For runways serving small airplanes exclusively:
- 17 a. 300 feet for runways with lower than 3/4-statute mile approach visibility
 - 18 minimums.
 - 19 b. 250 feet for other runways serving small airplanes with approach speeds of 50
 - 20 knots or more.
 - 21 c. 120 feet for other runways serving small airplanes with approach speeds of less
 - 22 than 50 knots.

23 (2) For runways serving large airplanes, 400 feet. [FAA 1989]

24 **Runway Protection Zone (RPZ).** The RPZ enhances the protection of people and property on
 25 the ground. This is achieved through airport owner control over RPZs. Such control includes
 26 clearing RPZ areas (and maintaining them) of incompatible objects and activities. Control is
 27 preferably exercised through the acquisition of sufficient property interest in the RPZ.

1 (1) RPZ Configuration and Location. The RPZ is trapezoidal in shape and centered above
2 the extended runway centerline. The central portion and controlled activity area are the
3 two components of the RPZ. The RPZ dimension for a particular runway end is a
4 function of the type of aircraft and approach visibility minimum associated with that
5 runway end. Other than with a special application of declared distances, the RPZ begins
6 200 feet beyond the end of the area usable for takeoff or landing (FAA 1989).

7 **Object Free Area.** The runway OFA is centered on the runway centerline. The runway OFA
8 clearing standard requires clearing the OFA of above ground objects protruding above the
9 runway safety area edge elevation. Except where precluded by other clearing standards, it is
10 acceptable to place objects that need to be located in the OFA for air navigation or aircraft
11 ground maneuvering purposes and to taxi and hold aircraft in the OFA. Objects non-essential
12 for air navigation or aircraft ground maneuvering purposes must not be placed in the OFA.
13 This includes parked airplanes and agricultural operations (FAA 1989).

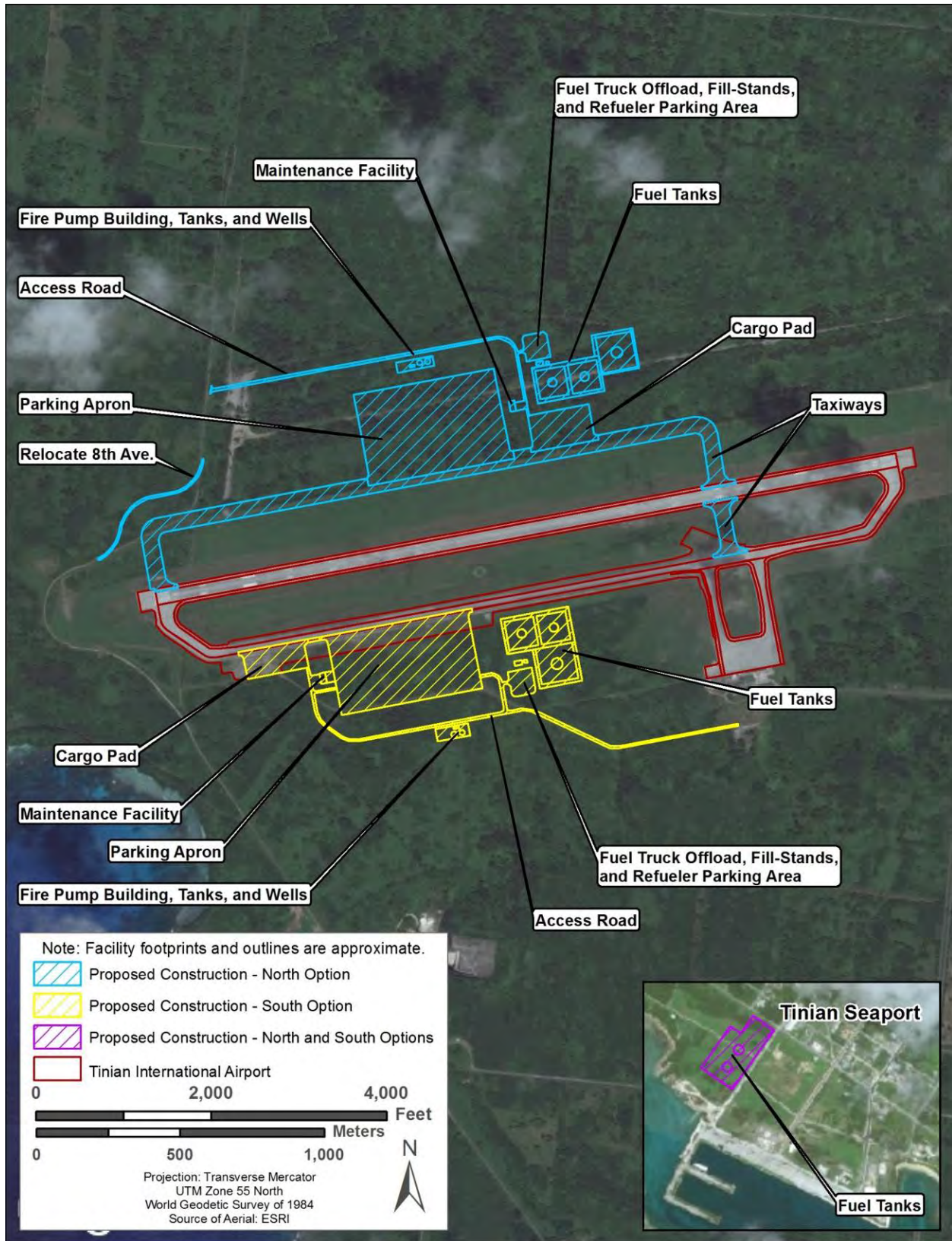
14 OFA dimensions are based on the category of aircraft which utilize the runway. RWY 08/26
15 OFA dimensions are: 800 feet wide; 400 feet from the runway centerline; and 1,000 feet long
16 from the end of the runway as shown in **Figure 2-4**.

17 2.3 TNI Proposed Construction

18 PACAF's proposed construction is based on accommodating a combination of joint military
19 cargo, tanker, or similar aircraft and associated support personnel. In order to accommodate
20 these aircraft and achieve the necessary divert capabilities, supporting infrastructure would be
21 needed to meet airfield operational requirements. There are two proposed alternatives for
22 construction on Tinian: Alternative 2 (Tinian Alternative) and Alternative 3 (Tinian Hybrid
23 Alternative).

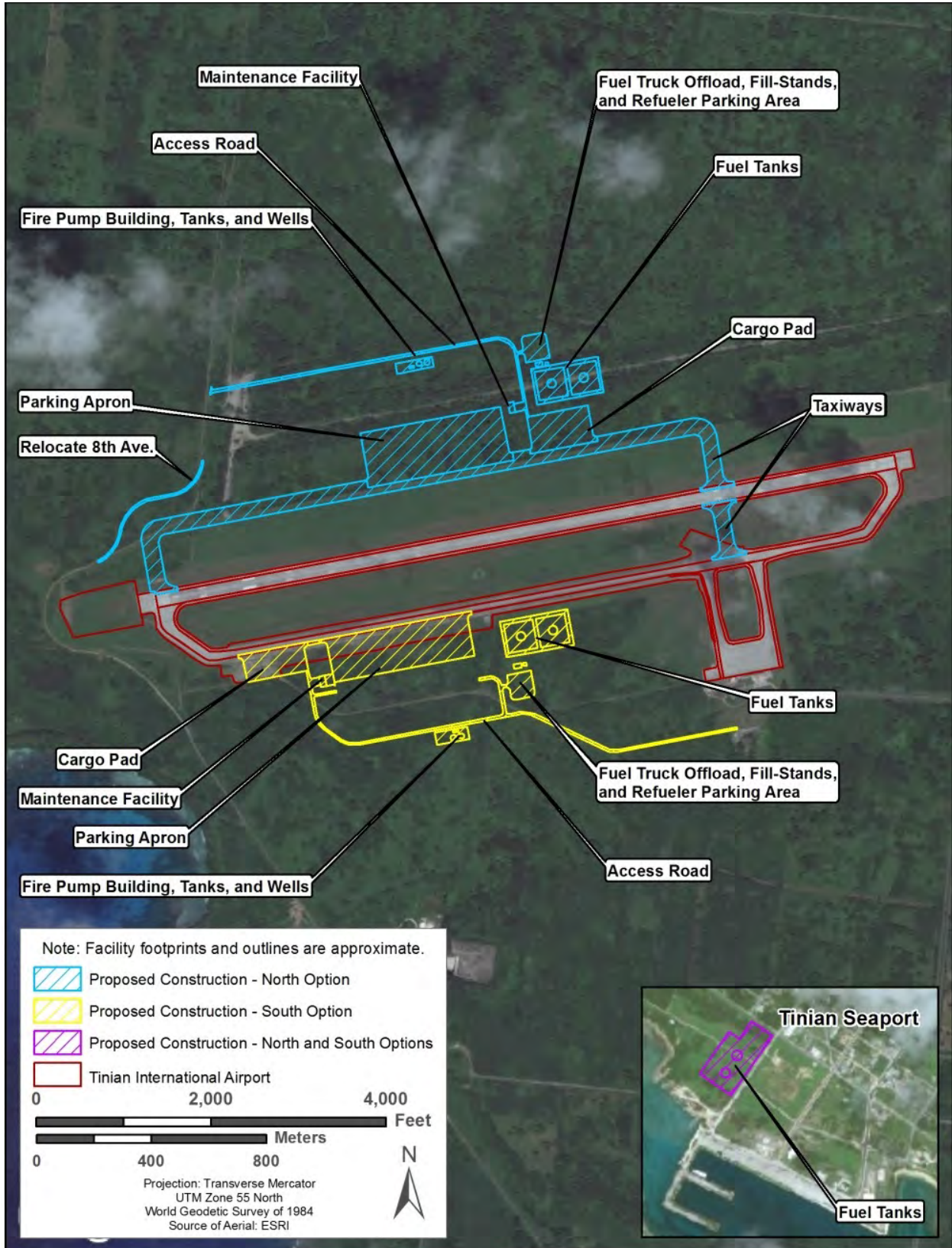
24 Proposed infrastructure at TNI under Alternative 2 could be constructed on the north side of the
25 airport (North Option) or the south side of the airport (South Option). Construction on both the
26 north and south sides would include one parking apron, one cargo pad, one maintenance
27 facility, fuel tanks and supporting infrastructure, a fuel hydrant system, a fire suppression
28 system (containing water only), and an access road. On the north side of the runway, USAF
29 would also build taxiways to connect the cargo pad and parking apron to the runway and reroute
30 8th Avenue on the western side of the runway to avoid the proposed taxiway. The Alternative 2
31 North and South Options on TNI are shown in **Figure 2-4**.

32 Proposed infrastructure at TNI under Alternative 3 could be constructed on the north side of the
33 airport (North Option) or the south side of the airport (South Option). Construction on both the
34 north and south sides would include one parking apron, one cargo pad, one maintenance
35 facility, fuel tanks and supporting infrastructure, a fuel hydrant system, a fire suppression
36 system, and an access road. The parking apron and fuel storage capacity on TNI under
37 Alternative 3 would be smaller than that proposed under Alternative 2. On the north side of the
38 runway, USAF would also build a taxiway to connect the cargo pad and parking apron to the
39 runway and reroute 8th Avenue on the western side of the runway. Alternative 3 at TNI is
40 shown in **Figure 2-5**. Alternative 3 also includes construction at the GSN and is addressed in
41 **Section 1.3**.



1
 2 **Figure 2-4. Alternative 2 TNI Proposed Construction**

1



2

3 Figure 2-5. Alternative 3 TNI Proposed Construction

1 3. Impacts to GSN/TNI IFR, VFR, and Airport 2 Terminal Area

3 3.1 Background

4 This chapter analyzes the potential impact on IFR, VFR, and the airport's terminal area at GSN
5 or TNI from PACAF's proposed construction and implementation of divert activities and
6 exercises. The terminal area includes the airspace and airfield immediately surrounding the
7 airport in which ATC service or airport ground traffic services are provided.

8 3.2 GSN Arrival and Departure Flows

9 Potential minor impacts could occur on arrival and departure flows at GSN from the proposed
10 divert activities and exercises.

11 GSN possesses an FAA-certified ATC tower which manages their Class D airspace.
12 Department of Defense (DOD) aircraft will not have priority over current civilian aircraft
13 operating within Saipan's Class D airspace. Per FAA Joint Order (JO) 7110.65T, Air Traffic
14 Control paragraph 2-1-4, Operational Priority, ATC service should be provided to aircraft on a
15 "first come, first served" basis as circumstances permit. However, wake turbulence separation
16 standards may cause minor delays to small aircraft. Wake turbulence is the phenomena
17 resulting from the passage of an aircraft through the atmosphere. The term includes vortices,
18 thrust stream turbulence, jet blast, jet wash, propeller wash, and rotor wash both on the ground
19 and in the air (FAA JO 2010). For aircraft departures, FAA JO 7110.65T paragraph 2-1-19
20 states "Apply wake turbulence procedures to aircraft operating behind heavy jets/B757s and,
21 where indicated, to small aircraft behind large aircraft. The separation minima shall continue to
22 touchdown for all IFR aircraft not making a visual approach or maintaining visual separation."
23 Small commuter aircraft may experience minor delays due to wake turbulence criteria when
24 arriving or departing behind baseline KC-135 aircraft.

25 3.3 GSN Airport Terminal Area

26 Potential impacts could occur to the GSN terminal area from the proposed divert activities and
27 exercises.

28 The construction of the proposed aircraft parking apron could impede the GSN ARFF line-of-
29 sight to the runway. Per FAA AC 150/5210-15A, future expansions should not attempt to limit or
30 reduce ARFF airport surveillance. KC-135s parked on the proposed apron could limit GSN
31 ARFF line-of-sight to the approach end of RWY 25.

32 3.4 GSN Limiting Factors

33 Several limiting factors would need to be addressed prior to the commencement of construction
34 at GSN.

1 **ATC Services.** The airfield does possess ATC services. The primary purpose of ATC is to
2 separate aircraft to prevent collisions, organize and expedite the flow of traffic, and provide
3 information and other support for pilots. The contracted ATC tower only possesses five air
4 traffic controllers and their schedules are arranged to ensure at least two air traffic controllers
5 are on duty during their peak air traffic hours.

6 **Bird Aircraft Strike Hazard (BASH) Program.** GSN Airport Authority has the civilian
7 equivalent of a BASH program however numerous birds (black noddy) were located on or near
8 the runways during a site visit in June 2012. CPA airport personnel stated the bird population
9 on or near the airfield increases from October to January. BASH information is located in
10 PACAF's Divert EIS Chapter 3, paragraph 3.3.2.1.

11 **Runway Sweeper Truck.** The sweeper truck has been inoperable for an extended period due
12 to the lack of parts to repair the truck. The sweeper truck gives airfield personnel the ability to
13 collect foreign object debris (FOD). FOD is defined as any foreign object external to the aircraft
14 that can cause damage. Examples of FOD include nuts, bolts, misplaced tools, sand, rocks,
15 asphalt chunks, birds, snakes, and rodents. However, Saipan CPA personnel personally check
16 the runway three times a day during each shift change for FOD.

17 3.5 TNI Arrival and Departure Flows

18 Potential minor impacts due to wake turbulence could occur on arrival and departure flows at
19 TNI from proposed divert activities and exercises under the North and South Options.
20 Construction and use of the taxiways proposed under the North Option would have no impact
21 on the aircraft arrivals and departures at TNI.

22 Aircraft arrivals and departures at TNI occur on a first come, first served basis. Pilots notify
23 each other of intentions via the CTAF. A CTAF is employed at many airports where there is no
24 control tower present. A CTAF uses a single communications frequency where aircraft make
25 announcements of their intentions.

26 Even with first come, first serve procedures there could be minor delays due to wake
27 turbulence. Wake turbulence is the phenomena resulting from the passage of an aircraft
28 through the atmosphere. The term includes vortices, thrust stream turbulence, jet blast, jet
29 wash, propeller wash, and rotor wash both on the ground and in the air (FAA JO 2010). Small
30 commuter aircraft could experience minor delays due to wake turbulence criteria when arriving
31 or departing behind baseline KC-135 aircraft.

32 3.6 TNI Limiting Factors

33 Several limiting factors that need to be addressed prior to the commencement of construction at
34 TNI. The TNI ARFF is rated Index A and has 60,000 gallons of water available. It does not
35 meet USAF requirements for the proposed divert activities and exercises. PACAF's proposal
36 would require an "ARFF Index D" to support their proposed operations in accordance with FAR
37 Part 139 Section 137 Aircraft Rescue and Firefighting: Equipment and Agents. USAF proposes
38 to install a fire suppression system and supporting wells at TNI to support proposed exercises.

1 However, until the system is operational, current TNI ARFF capabilities would be considered a
2 limiting factor. Unless otherwise authorized by the Administrator, the following rescue and
3 firefighting equipment and agents are the minimum required for the each Index:

4 (a) *Index A.* One vehicle carrying at least:

5 (1) 500 pounds of sodium-based dry chemical, halon 1211, or clean agent; or

6 (2) 450 pounds of potassium-based dry chemical and water with a
7 commensurate quantity of aqueous film-forming foam (AFFF) to total 100 gallons
8 for simultaneous dry chemical and AFFF application.

9 (b) *Index B.* Either of the following:

10 (1) One vehicle carrying at least 500 pounds of sodium-based dry chemical,
11 halon 1211, or clean agent and 1,500 gallons of water and the commensurate
12 quantity of AFFF for foam production.

13 (2) Two vehicles:

14 (i) One vehicle carrying the extinguishing agents as specified in
15 paragraphs (a)(1) or (a)(2) of this section; and

16 (ii) One vehicle carrying an amount of water and the commensurate
17 quantity of AFFF so the total quantity of water for foam production carried
18 by both vehicles is at least 1,500 gallons.

19 (c) *Index C.* Either of the following:

20 (1) Three vehicles:

21 (i) One vehicle carrying the extinguishing agents as specified in
22 paragraph (a)(1) or (a)(2) of this section; and

23 (ii) Two vehicles carrying an amount of water and the commensurate
24 quantity of AFFF so the total quantity of water for foam production carried
25 by all three vehicles is at least 3,000 gallons.

26 (2) Two vehicles:

27 (i) One vehicle carrying the extinguishing agents as specified in
28 paragraph (b)(1) of this section; and

29 (ii) One vehicle carrying water and the commensurate quantity of AFFF
30 so the total quantity of water for foam production carried by both vehicles
31 is at least 3,000 gallons.

32 (d) *Index D.* Three vehicles:

33 (1) One vehicle carrying the extinguishing agents as specified in paragraphs
34 (a)(1) or (a)(2) of this section; and

1 (2) Two vehicles carrying an amount of water and the commensurate quantity of
2 AFFF so the total quantity of water for foam production carried by all three
3 vehicles is at least 4,000 gallons.

4 (e) *Index E*. Three vehicles:

5 (1) One vehicle carrying the extinguishing agents as specified in paragraphs
6 (a)(1) or (a)(2) of this section; and

7 (2) Two vehicles carrying an amount of water and the commensurate quantity of
8 AFFF so the total quantity of water for foam production carried by all three
9 vehicles is at least 6,000 gallons.

10 **ATC Services.** The airfield does not possess ATC services. The primary purpose of ATC is to
11 separate aircraft to prevent collisions, to organize and expedite the flow of traffic, and to provide
12 information and other support for pilots. USAF could install a mobile ATC tower at Tinian to
13 support proposed exercises.

14 **NAVAIDs.** The airfield does not possess any NAVAIDS. A NAVAID is an electronic device
15 which provides point-to-point guidance information or position data to aircrafts.

16 **BASH Program.** Tinian CPA possesses the civilian equivalent of a BASH program; however,
17 numerous birds were located on or near the runways during a site visit in June 2012.
18 Additionally, the landscaping equipment was inoperative and had been inoperative for over a
19 month due to a lack of parts. Maintaining the grass height is a viable part of all BASH
20 programs. BASH information is located in PACAF's Divert EIS Chapter 3, paragraph 3.3.2.2.

21 **Runway Sweeper Truck.** The sweeper truck has been inoperable for an extended period due
22 to the lack of parts to repair. The sweeper truck gives airfield personnel the ability collect FOD.
23 FOD is defined as any foreign object external to the aircraft that can cause damage. Examples
24 of FOD include nuts, bolts, misplaced tools, sand, rocks, asphalt chunks, birds, snakes, and
25 rodents. However, Tinian CPA personnel personally check the runway twice a day for FOD.

26 3.7 Aircraft Noise

27 Aircraft noise is noise pollution produced by any aircraft or its components, during various
28 phases of a flight: on the ground while parked; while taxiing; on run-up from propeller and jet
29 exhaust; during takeoff; over-flying while en route; or during landing. FAA Order 1050.1f states,
30 "For aviation noise analyses, the FAA has determined that the cumulative noise energy
31 exposure of individuals to noise resulting from aviation activities must be established in
32 terms of Yearly Day Night Average Sound Level, the FAA's primary noise metric." Aircraft
33 noise analyses in terms of Yearly Day Night Average Sound Level is located in PACAF's
34 Divert EIS Section 3.1 and 4.1.

35

1 3.8 Impacts to IFR, VFR, and Terminal Area

2 Potential impacts could occur on the GSN and TNI IFR, VFR and Terminal Area if either airport
3 is selected for the proposed divert activities and exercises. Impacts include:

- 4 • **ARFF Line-of-Sight.** Per FAA AC 150/5210-15A, future expansions should not attempt
5 to limit or reduce ARFF airport surveillance. KC-135s parked on the proposed apron
6 could limit ARFF line-of-sight to the approach end of the runways.
- 7 ○ **GSN:** The proposed parking apron could impede line-of-sight to the approach
8 end of RWY 25.

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4. Civilian Air Traffic (Public Use and Charter) Services

4.1 Background

This chapter analyzes the potential impact of PACAF’s proposed divert activities and exercises at GSN or TNI on civilian air traffic public use and charter services. Public use aircraft refers to an aircraft operated by or on behalf of the United States government, a state, the District of Columbia, or a territory or possession of the United States. Charter aircraft refers to a company or individually owned aircraft that leases seats or whole aircraft to another individual or group for transportation. Commercial air carriers are certificated in accordance with FAR Part 121 or 127 to conduct scheduled services on specified routes. Commercial air carriers may also provide non-scheduled or charter services as a secondary operation.

4.2 GSN Air Traffic Activity

The air traffic activity below is based on information derived from the FAA Air Traffic Activity System (ATADS). Because TNI does not possess an FAA facility on its airfield, the air traffic activity is not included within ATADS. **Table 4-1** shows the 2011 ATADS information for GSN.

Table 4-1. GSN ATADs: Standard Report from January through December 2014 (FAA 2015)

Itinerant Air Carrier	Itinerant Air Taxi	Itinerant General Aviation	Itinerant Military	Local Civil	Local Military	Total Operations
5,095	37,984	26,540	324	18	17	69,978

4.3 GSN and TNI Airlines

There are six airlines that utilize GSN and TNI daily transiting personnel and cargo:

- *Artic Circle Air (GSN)*. Artic Circle Air is located on Saipan and provides charter and cargo between Saipan and Rota.
- *Asiana Airlines (GSN)*. Headquartered in Seoul, South Korea, Asiana Airlines is the second largest major airline in South Korea. It has 67 planes, traveling to 14 domestic and 45 international cities.
- *Cape Air (GSN)*. Cape Air is headquartered in Barnstable, Massachusetts. They have scheduled services in Micronesia, the Northeast United States, Florida, the Mid-Atlantic United States, the Midwest United States, and the Caribbean. Flights in Micronesia are accomplished through a joint venture with United Airlines. In 2004, Cape Air began service in Micronesia and added ATR 42s to their fleet. These aircraft seat 46 passengers and serve routes between Guam, Rota and Saipan.

- 1 • *Delta Airlines (GSN)*. Delta Airlines serves more than 160 million customers each year.
2 Headquartered in Atlanta, Georgia, Delta employs more than 80,000 employees
3 worldwide and operates a fleet of more than 700 aircraft.
- 4 • *Sichuan Airlines (GSN)*. Sichuan Airlines is an airline based in Chengdu, Sichuan in the
5 People's Republic of China. Sichuan Airlines operates over 130 flights daily connecting
6 over 90 destinations all over the world.
- 7 • *Star Marianas (GSN and TNI)*. Star Marianas is a Tinian-based airline which operates
8 scheduled passenger and cargo services between Saipan and Tinian. Star Marianas
9 utilizes Piper Cherokee aircraft between Saipan and Tinian. They also provide sight-
10 seeing tours from Saipan.

11 4.4 Aircraft Priorities

12 DOD aircraft would not have priority over current aircraft operating from GSN and TNI. FAA JO
13 7110.65T, Air Traffic Control paragraph 2-1-4, Operational Priority states that air traffic control
14 will provide service to aircraft on a first come, first served basis as circumstances permit,
15 although certain circumstances may apply which will alter priority. These include the following
16 situations:

- 17 a. An aircraft in distress has the right of way over all other air traffic.
- 18 b. Give priority to civilian air ambulance flights. Air carrier/taxi usage of the "LIFEGUARD"
19 call sign, indicates that operational priority is requested. When verbally requested,
20 provide priority to military air evacuation flights and scheduled air carrier/air taxi flights.
- 21 c. Provide maximum assistance to search and rescue aircraft performing a search and
22 rescue mission.
- 23 d. Expedite the movement of presidential aircraft and entourage and any rescue support
24 aircraft as well as related control messages when traffic conditions and communications
25 facilities permit.
- 26 e. Provide special handling, as required to expedite Flight Check aircraft.
- 27 f. Expedite movement of NIGHT WATCH aircraft when National Airborne Operations
28 Center is indicated in the remarks section of the flight plan or in air/ground
29 communications.
- 30 g. Provide expeditious handling for any civil or military aircraft using the code name
31 "FLYNET."
- 32 h. Provide expeditious handling of aircraft using the code name "Garden Plot" only when
33 Central Altitude Reservation Function notifies you that such priority is authorized.
- 34 i. Provide special handling for USAF aircraft engaged in aerial sampling missions using
35 the code name "SAMP."
- 36 j. Provide maximum assistance to expedite the movement of interceptor aircraft on active
37 air defense missions until the unknown aircraft is identified.

- 1 k. Expedite movement of Special Air Mission aircraft when “SCOOT” is indicated in the
2 remarks section of the flight plan or in air/ground communications.
- 3 l. When requested, provide priority handling to TEAL¹ and National Oceanic and
4 Atmospheric Administration mission aircraft.
- 5 m. IFR aircraft must have priority over SVFR aircraft.
- 6 n. Providing priority and special handling to expedite the movement of OPEN SKIES
7 observation and demonstration flights.
- 8 o. Aircraft operating under the North American Route Program and in airspace identified in
9 the High Altitude Redesign program are not subject to route limiting restrictions (e.g.,
10 published preferred IFR routes, letter of agreement requirements, standard operating
11 procedures).
- 12 p. If able, provide priority handling to diverted flights. Priority handling may be requested
13 via use of “DVRSN” in the remarks section of the flight plan or by the flight being placed
14 on the Diversion Recovery Tool.

15 In addition to the requirements in the ATC order, the CNMI was issued FAA grant assurances
16 when they accepted FAA grant money. These grant assurances may further affect the activity
17 of military aircraft on these civilian airports. Grant Assurance 27 states in part that government
18 aircraft (including military) can use the facilities on the airport constructed with Federal money in
19 common with other aircraft at all times, except when the substantial use of the airport by
20 government aircraft unduly interferes with use of the airport by other authorized aircraft.

21 4.5 Wake Turbulence

22 Wake turbulence is the phenomena resulting from the passage of an aircraft through the
23 atmosphere. The term includes vortices, thrust stream turbulence, jet blast, jet wash, propeller
24 wash, and rotor wash both on the ground and in the air (FAA JO 2010). For aircraft departures,
25 FAA JO 7110.65T paragraph 2-1-19 states, “Apply wake turbulence procedures to aircraft
26 operating behind heavy jets/B757s and, where indicated, to small aircraft behind large aircraft.
27 The separation minima shall continue to touchdown for all IFR aircraft not making a visual
28 approach or maintaining visual separation.” For same runway departure separation, paragraph
29 3-9-6 states, “Separate IFR/VFR aircraft taking off behind a heavy jet/B757 departure by 2
30 minutes, when departing.” For same runway arrival separation, paragraph 3-10-3 states, “Issue
31 wake turbulence advisories, and the position, altitude if known, and the direction of flight. The
32 large aircraft to a small aircraft landing behind a departing/arriving large aircraft on the same or
33 parallel runways separated by less than 2,500 feet.”

1 TEAL is the call sign used for the USAF unit of the 53d Weather Reconnaissance Squadron

1 4.6 Impact on Civilian Air Traffic (Public Use and Charter)
2 Services

3 The proposed divert activities and exercises could have minor impacts on small commuter air
4 traffic utilizing GSN or TNI.

5 Potential impacts on small commuter air traffic include:

- 6 • **Aircraft priorities.** Per FAA JO 7110.65T, aircraft operating on IFR flight plans receive
7 priority over VFR aircraft. DOD aircraft would file IFR flight plans. Commuter aircraft
8 transiting between GSN and TNI operate VFR.
- 9 • **Wake Turbulence.** Per FAA JO 7100.65T, small aircraft departing or arriving behind
10 large aircraft i.e. KC-135s, could be delayed for safety precautions (wake turbulence).
11 However, this would be considered a minor impact because current civilian air carriers
12 that operate at GSN utilize large aircraft which cause the same impacts.

5. IFR En-route Operations

5.1 Background

This chapter analyzes the impact that PACAF’s proposed construction and implementation of divert activities and exercises may have on Guam’s ARTCC FIR. Guam ARTCC provides en-route air traffic control service to aircraft operating between departure and destination terminal areas on airways using IFR flight plans within their region. Airways are Class E airspace area established in the form of a corridor, the centerline of which is defined by NAVAIDS. There are several types of airways, but they are normally classified as jet routes or victor airways. A jet route is designed to serve aircraft operations from 18,000 feet mean sea level (MSL) up to and including flight level (FL) 450. Victor airways are Class E airspace from 1,200 feet AGL to 18,000 feet MSL.

5.2 Guam ARTCC

Guam ARTCC is one of 22 FAA en-route air traffic control facilities that support an area comprised of nearly 200,000 square miles of airspace. Guam ARTCC FIR is a 250-NM circle with Guam as its center. The area is based on the radar coverage from the radar site on the northern tip of Guam. Besides providing air traffic services for Guam, the facility’s airspace also encompasses the Northern Mariana Islands of Rota, Saipan, and Tinian. The facility supports approximately 71,000 aircraft operations each year, which includes civilian air traffic and military aircraft. The facility is unique in that it supports a number of large-scale military exercises and special training missions (Guam 2008). The air traffic activity shown in **Table 5-1** is based on information derived from the FAA ATADS.

Table 5-1. Guam ATADs: Standard Report from January through December 2014 (FAA 2015)

Air Carrier	Air Taxi	General Aviation	Military	Local	Total
22,641	3,332	21,106	646	23,503	71,228

Proposed construction and implementation of divert activities and exercises would not impact GUAM ARTCC’s manning, airways within their FIR, nor would it impose any stress on their system. Air traffic within their FIR is down 15 percent due to fuel prices and the economy. Normally aircraft transiting between Guam, Saipan and Tinian utilize airway A221. Aircraft generally had to stay on airways or remain within the standard NAVAID service volumes, but Guam ARTCC supports direct routing when filed. Direct routing occurs when one or both of the route segment endpoints are at a latitude/longitude which is not located at a NAVAID. Also, when equipment, capabilities, and controller workload permit, certain advisory/assistance services may be provided to VFR aircraft.

5.3 Military Training Route (MTR) IR-983

MTRs are aerial corridors across the United States in which military aircraft can operate below 10,000 feet faster than the maximum safe speed of 250 knots to which all other aircraft are

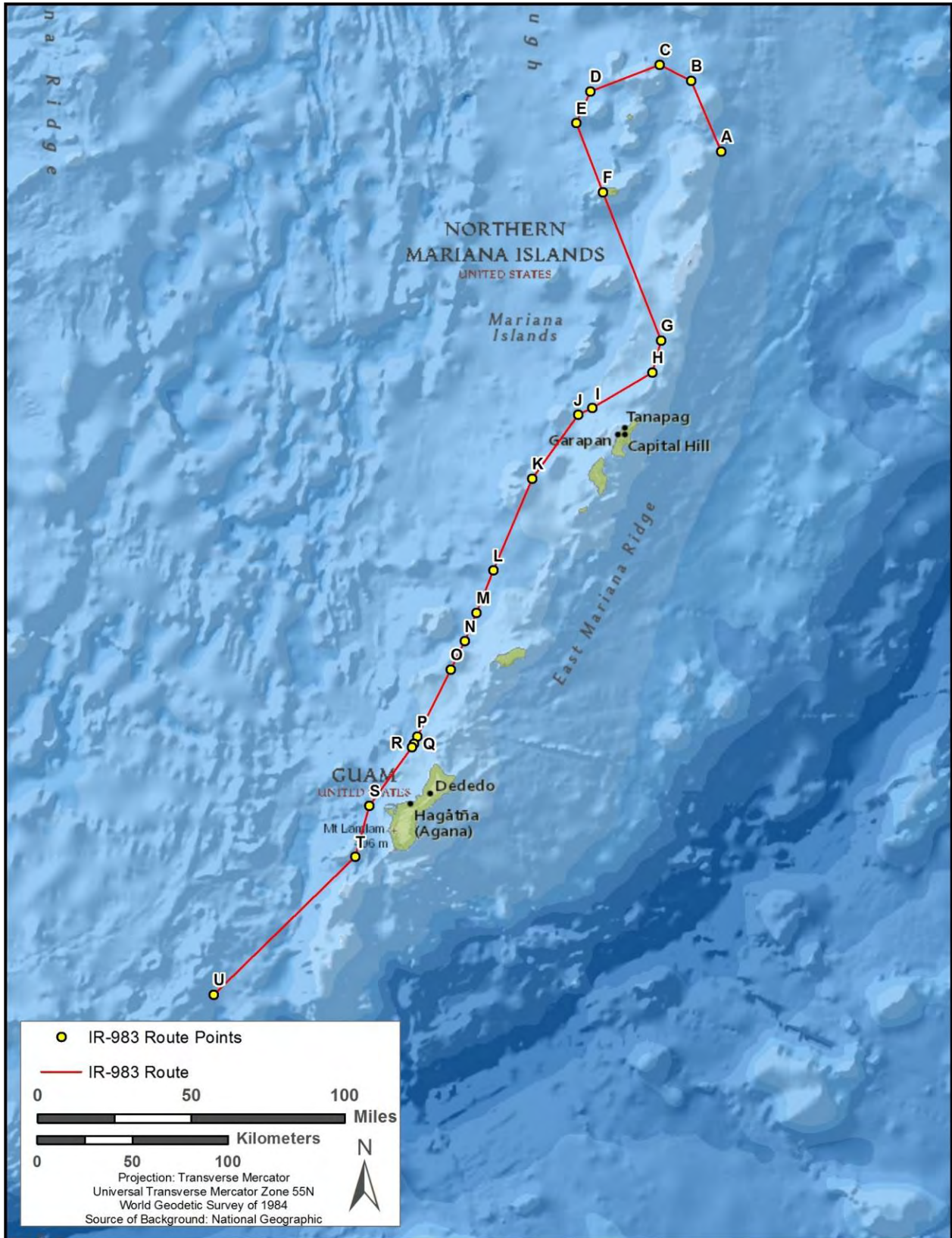
1 restricted (FAA 2012). The routes are the result of a joint venture between the FAA and DOD to
2 provide for high-speed, low-level military activities. MTR IR-983 is aligned west of Guam and
3 the Northern Mariana Islands as shown in **Figure 5-2**. The width is 4 NM either side of
4 centerline from A to O; 9 NM left and 4 NM right of centerline from O to P; 4 NM either side of
5 centerline from P to Q; 2.5 NM left and 4 NM right of centerline from Q to S; and 4 NM either
6 side of centerline from S to U. Aircraft operating within IR-983 are considered MARSAs (Military
7 Assume Responsibility for Separation of Aircraft). Andersen Air Force Base 36th Operations
8 Support Squadron is responsible for scheduling operations within IR – 983 (DOD 2011).

9 5.4 Limiting Factors

10 Guam ARTCC radar coverage is not available below 3,500 feet MSL above Saipan and Tinian.
11 The DOD, its service components, and the FAA radar program office have initiated
12 communications to determine the possibility of adding a radar surveillance system on Saipan
13 which would increase coverage in the area. Currently when an aircraft descends below radar
14 coverage, non-radar procedures are implemented to ensure separation of IFR aircraft.

15 5.5 Impact on IFR En-route Operations

16 Proposed construction and implementation of divert activities and exercises will not impact
17 Guam ARTCC nor IR-983 operations as long as PACAF adheres to the number of aircraft and
18 operations addressed within this document.



1
2 **Figure 5-2. Military Training Route IR-983**

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6. Federal Aviation Regulation (FAR) 49 CFR § 77 Obstacle Evaluations

6.1 Background

This chapter evaluates the impact proposed structures may have on navigable airspace at GSN and TNI. FAR Part 77, titled "Objects Affecting Navigable Airspace," establishes standards for determining obstructions and their potential effects on aircraft operations. Objects are considered to be obstructions to air navigation according to FAR Part 77 if they exceed certain heights or penetrate certain imaginary surfaces established in relation to airport features such as a runway. Objects classified as obstructions are subject to an FAA aeronautical analysis to determine their potential effects on aircraft operations. This evaluation is required on any structure proposed or modified that meets the definition of Part 77.9 (b). FAR Part 77 evaluations were conducted utilizing AIRSPACE® and TERPS® software. This software is registered by trademarks of Federal Airways & Airspace, Copyright © 1989 – 2011. Software outputs described in **Section 6.2** and **6.3** are defined by the following terms:

DNE = Does Not Exceed

NR = Notice Required

NNR = Notice Not Required

PNR = Possible Notice Required

6.2 GSN

The proposed structures are based on accommodating a combination of cargo, tanker, and similar aircraft and associated support personnel and would include periodic flight operations at the airport. The FAR evaluation presented in this section for GSN is for Alternative 1 as shown in **Figure 1-6**. The analysis for Alternative 3 at GSN in **Figure 1-7** would be the same, except it would not include the fuel hydrant system. Proposed structures evaluated include: a maintenance facility, fuel tanks and supporting infrastructure, and a fuel hydrant system as shown in **Figure 1-6**. Also evaluated were four ball-park lighting poles tentatively proposed on the parking apron as shown in **Figure 6-1**, which also portrays the proposed construction at GSN under Alternative 1 in reference to the GSN clearance zones.

6.2.1 Maintenance Facility

PACAF's proposed maintenance facility would be located at latitude 15° 7' 28.8"/longitude 145° 45' 53.4". The site elevation is 211 feet AMSL, and the structure height at the apex of the roof is 25 feet AGL with an overall height of 236 feet AMSL. Below is the evaluation:

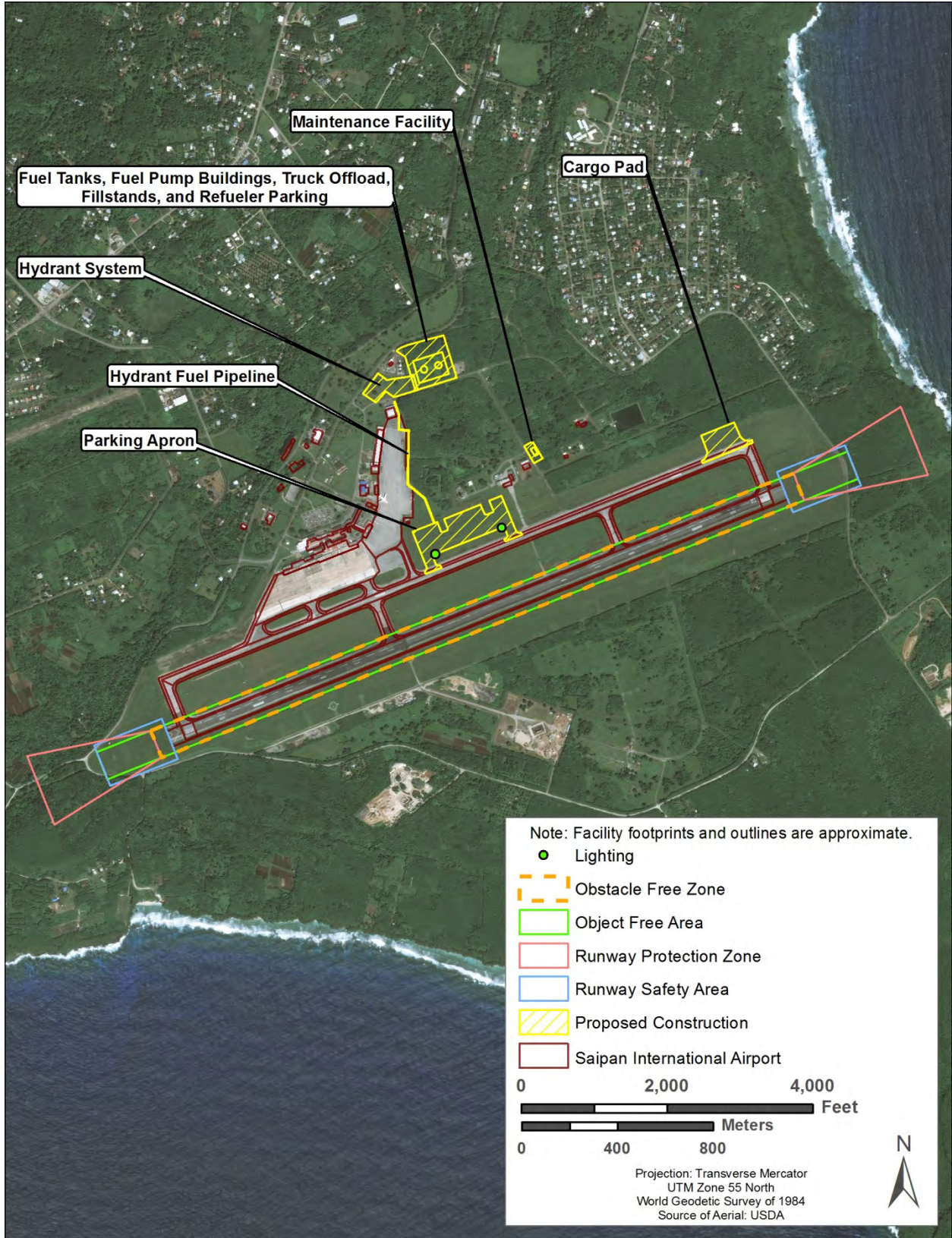
Notice Criteria

FAR 77.9(a): NNR (DNE 200 feet AGL)

FAR 77.9(b): NNR (DNE Notice Slope)

FAR 77.9(c): NNR (Not a Traverse Way)

FAR 77.9: NNR FAR 77.9 IFR Notice Criteria for GSN



1

2 Figure 6-1. GSN Proposed Construction and Primary Surfaces

- 1 FAR 77.9: NNR FAR 77.9 IFR Notice Criteria for TNI
2 FAR 77.9(d): NNR (Off Airport Construction)

3 **Obstruction Standards**

- 4 FAR 77.17(a)(1): DNE 499 feet AGL
5 FAR 77.17(a)(2): DNE - Airport Surface
6 FAR 77.19(a): DNE - Horizontal Surface
7 FAR 77.19(b): DNE - Conical Surface
8 FAR 77.19(c): DNE - Primary Surface
9 FAR 77.19(d): DNE - Approach Surface
10 FAR 77.19(e): DNE - Transitional Surface

11 **VFR Traffic Pattern Airspace**

- 12 FAR 77.17(a)(1): DNE
13 FAR 77.17(a)(2): PNR - Exceeds by 10 feet AGL
14 VFR Horizontal Surface: DNE
15 VFR Conical Surface: DNE
16 VFR Approach Slope: DNE
17 VFR Transitional Slope: DNE

18 The structure is within VFR - Traffic Pattern Airspace Climb/Descent Area. However, the VFR
19 traffic pattern is not authorized on the terminal side of the airport.

20 **Terminal Instrument Procedures (TERPS) FAA Order 8260.3**

- 21 Approach Surface: DNE
22 Departure Surface: DNE

23 **Minimum Obstacle Clearance Altitude (MOCA)**

- 24 FAR 77.17(a)(4): DNE - No impact to airways.

25 **Private Landing Facilities**

- 26 There is no impact to HI63, Coral Ocean Point Pro-Shop Heliport.
27 There is no impact to TT04, Gualo Ral Heliport.

28 **Air Navigation Electronic Facilities**

- 29 No impact to the Saipan locator middle marker (LMM)/NDB. Does Not Exceed Electromagnetic
30 Interference (EMI) Notice Height Criteria. Maximum height in this area is 311 feet AMSL.

31 **6.2.2 Hydrant System**

- 32 PACAF's proposed hydrant system would be located at latitude 15° 7' 38.2"/longitude: 145° 43'
33 35.4". The site elevation is 211 feet AMSL, and the structure height at the apex is 20 feet AGL
34 with an overall height of 231 feet AMSL. Below is the evaluation:

35 **Notice Criteria**

- 36 FAR 77.9(a): NNR (DNE 200 feet AGL)
37 FAR 77.9(b): NNR (DNE Notice Slope)

- 1 FAR 77.9(c): NNR (Not a Traverse Way)
- 2 FAR 77.9: NNR FAR 77.9 IFR Notice Criteria for GSN
- 3 FAR 77.9: NNR FAR 77.9 IFR Notice Criteria for TNI
- 4 FAR 77.9(d): NNR (Off Airport Construction)

5 **Obstruction Standards**

- 6 FAR 77.17(a)(1): DNE 499 feet AGL
- 7 FAR 77.17(a)(2): DNE - Airport Surface
- 8 FAR 77.19(a): DNE - Horizontal Surface
- 9 FAR 77.19(b): DNE - Conical Surface
- 10 FAR 77.19(c): DNE - Primary Surface
- 11 FAR 77.19(d): DNE - Approach Surface
- 12 FAR 77.19(e): DNE - Transitional Surface

13 **VFR Traffic Pattern Airspace**

- 14 FAR 77.17(a)(1): DNE
- 15 FAR 77.17(a)(2): DNE - Height less than 200 feet AGL
- 16 VFR Horizontal Surface: DNE
- 17 VFR Conical Surface: DNE
- 18 VFR Approach Slope: DNE
- 19 VFR Transitional Slope: DNE

20 **TERPS FAA Order 8260.3**

- 21 Approach Surface: DNE
- 22 Departure Surface: DNE

23 **MOCA**

- 24 FAR 77.17(a)(4): DNE - No impact to airways.

25 **Private Landing Facilities**

- 26 There is no impact to HI63, Coral Ocean Point Pro-Shop Heliport.
- 27 There is no impact to TT04, Gualo Rai Heliport.

28 **Air Navigation Electronic Facilities**

- 29 No impact to the Saipan LMM/NDB. Does Not Exceed EMI Notice Height Criteria. Maximum
- 30 height in this area is 311 feet AMSL.

31 **6.2.3 Fuel Tanks**

- 32 PACAF's proposed fuel tanks would be located at latitude 15° 7' 40.4"/longitude: 145° 43' 42.5".
- 33 The site elevation is 211 feet AMSL, and the structure height at the apex is 30 feet AGL with an
- 34 overall height of 241 feet AMSL. Below is the evaluation:

35 **Notice Criteria**

- 36 FAR 77.9(a): NNR (DNE 200 feet AGL)
- 37 FAR 77.9(b): NNR (DNE Notice Slope)
- 38 FAR 77.9(c): NNR (Not a Traverse Way)

- 1 FAR 77.9: NNR FAR 77.9 IFR Notice Criteria for GSN
- 2 FAR 77.9: NNR FAR 77.9 IFR Notice Criteria for TNI
- 3 FAR 77.9(d): NNR (Off Airport Construction)

4 **Obstruction Standards**

- 5 FAR 77.17(a)(1): DNE 499 feet AGL
- 6 FAR 77.17(a)(2): DNE - Airport Surface
- 7 FAR 77.19(a): DNE - Horizontal Surface
- 8 FAR 77.19(b): DNE - Conical Surface
- 9 FAR 77.19(c): DNE - Primary Surface
- 10 FAR 77.19(d): DNE - Approach Surface
- 11 FAR 77.19(e): DNE - Transitional Surface

12 **VFR Traffic Pattern Airspace**

- 13 FAR 77.17(a)(1): DNE
- 14 FAR 77.17(a)(2): PNR- Height exceeds by 10 feet AGL
- 15 VFR Horizontal Surface: DNE
- 16 VFR Conical Surface: DNE
- 17 VFR Approach Slope: DNE
- 18 VFR Transitional Slope: DNE

19 The structure is within VFR - Traffic Pattern Airspace Climb/Descent Area. However VFR traffic
20 pattern is not authorized on terminal side of airport.

21 **TERPS FAA Order 8260.3**

- 22 Approach Surface: DNE
- 23 Departure Surface: DNE

24 **MOCA**

- 25 FAR 77.17(a)(4): DNE - No impact to Airways

26 **Private Landing Facilities**

- 27 There is no impact to HI63, Coral Ocean Point Pro-Shop Heliport.
- 28 There is no impact to TT04, Gualo Ral Heliport.

29 **Air Navigation Electronic Facilities**

- 30 No impact to the Saipan LMM/NDB. Does Not Exceed EMI Notice Height Criteria. Maximum
31 height in this area is 311 feet AMSL.

32 **6.2.4 Apron Ball-Park Lighting**

- 33 PACAF's proposed apron would have ball-park lighting (see **Figure 6-1**). Two poles located the
34 closest to the active runway for the apron were evaluated. These poles will be located at
35 latitude 15° 7' 16.4"/longitude 145° 43' 39.7"; and latitude 15° 7' 20"/longitude 145° 43' 48.9".
36 The site elevation is 211 feet AMSL, and the structure height at the apex is 40 feet AGL with an
37 overall height of 251 feet AMSL. Below is the evaluation:

1 **Notice Criteria**

- 2 FAR 77.9(a): NNR (DNE 200 feet AGL)
3 FAR 77.9(b): NR (Exceeds Notice Slope, Maximum: 231 feet)
4 FAR 77.9(c): NNR (Not a Traverse Way)
5 FAR 77.9: NNR FAR 77.9 IFR Notice Criteria for GSN
6 FAR 77.9: NNR FAR 77.9 IFR Notice Criteria for TNI
7 FAR 77.9(d): NNR (Off Airport Construction)

8 Notice to the FAA is required because height exceeds Notice Slope criteria. The maximum
9 height to avoid notice is 235 ft AMSL.

10 **Obstruction Standards**

- 11 FAR 77.17(a)(1): DNE 499 feet AGL
12 FAR 77.17(a)(2): DNE - Airport Surface
13 FAR 77.19(a): DNE - Horizontal Surface
14 FAR 77.19(b): DNE - Conical Surface
15 FAR 77.19(c): NR
16 FAR 77.19(d): DNE - Approach Surface
17 FAR 77.19(e): DNE - Transitional Surface

18 **VFR Traffic Pattern Airspace**

- 19 FAR 77.17(a)(1): DNE
20 FAR 77.17(a)(2): DNE
21 VFR Horizontal Surface: DNE
22 VFR Conical Surface: DNE
23 VFR Approach Slope: DNE
24 VFR Transitional Slope: DNE

25 **TERPS FAA Order 8260.3**

- 26 Approach Surface: DNE
27 Departure Surface: DNE

28 **MOCA**

29 FAR 77.17(a)(4): DNE - No impact to airways.

30 **Private Landing Facilities**

31 There is no impact to HI63, Coral Ocean Point Pro-Shop Heliport.
32 There is no impact to TT04, Gualo Ral Heliport.

33 **Air Navigation Electronic Facilities**

34 No impact to the Saipan LMM/NDB. Does not exceed EMI Notice Height Criteria. Maximum
35 height in this area is 311 feet AMSL.

36 **6.3 TNI**

37 The proposed structures are based on accommodating a combination of cargo, tanker, and
38 similar aircraft and associated support personnel and would include periodic flight operations at

1 the airport. The FAR evaluation presented in this section for TNI is for Alternative 2 North
2 Option and South Option as shown in **Figure 2-3**. The analysis for Alternative 3 at TNI in
3 **Figure 2-4** would be the same, except the fuel storage location would be smaller. Proposed
4 structures evaluated include: maintenance facility, fuel tanks and supporting infrastructure, a
5 fuel hydrant system, and a fire suppression system (containing water only) as shown in **Figure**
6 **2-3**. Also evaluated were four ball-park lighting poles tentatively proposed on the parking apron
7 as shown in **Figure 6-2**, which also portrays the proposed construction at TNI under Alternative
8 2 in reference to the TNI clearance zones.

9 6.3.1 North Option

10 6.3.1.1 Maintenance Facility

11 PACAF's proposed maintenance facility under the North Option would be located at latitude 15°
12 0' 10.41"/longitude 145° 37' 7.65". The site elevation is 160 feet AMSL, and the structure height
13 at the apex of the roof is 25 feet AGL with an overall height of 185 feet AMSL. Below is the
14 evaluation:

15 **Notice Criteria**

16 FAR 77.9(a):	NNR (DNE 200 feet AGL)
17 FAR 77.9(b):	NNR (DNE Notice Slope)
18 FAR 77.9(c):	NNR (Not a Traverse Way)
19 FAR 77.9:	NNR FAR 77.9 IFR Notice Criteria for TNI
20 FAR 77.9:	NNR FAR 77.9 IFR Notice Criteria for GSN
21 FAR 77.9(d):	NNR (Off Airport Construction)

22 **Obstruction Standards**

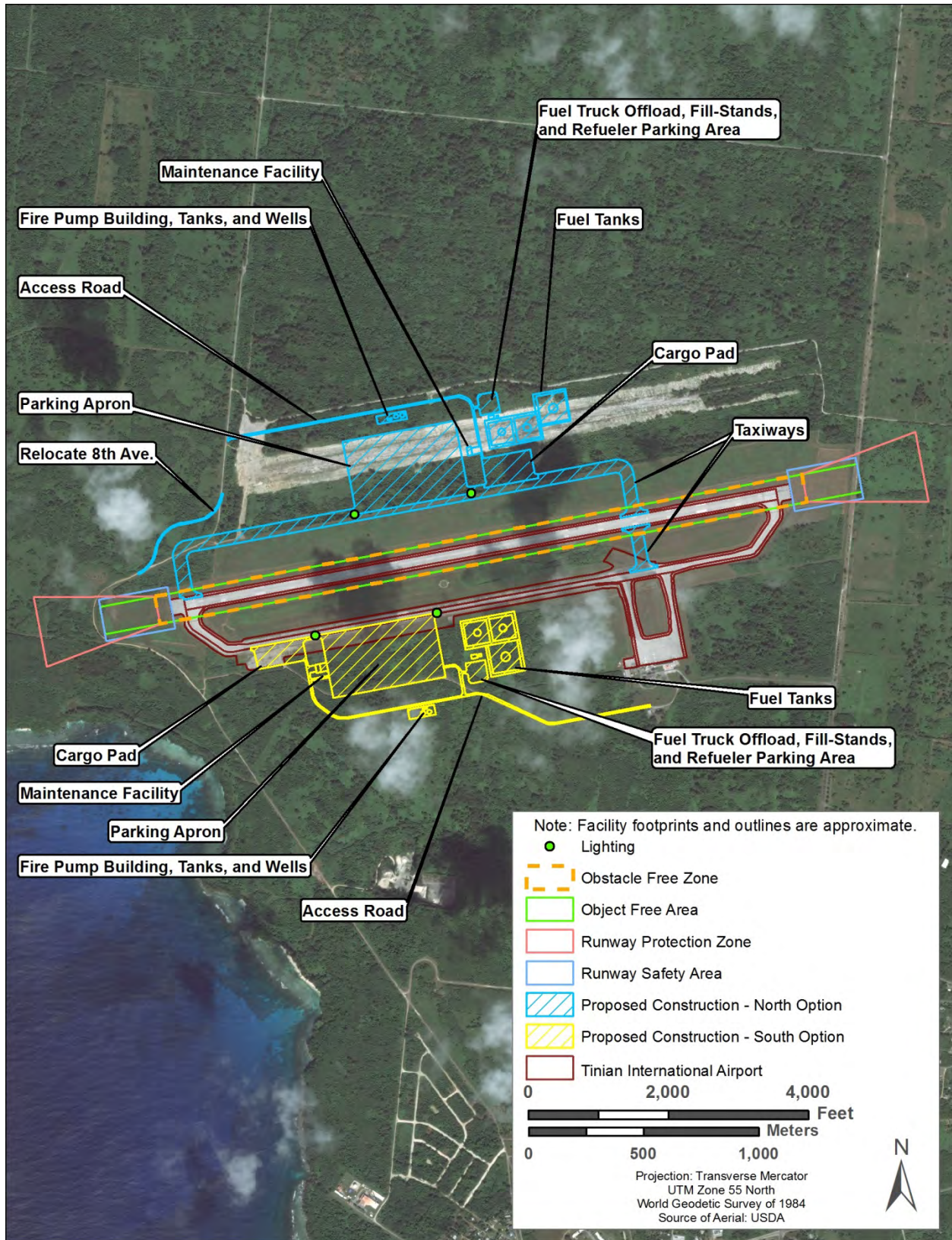
23 FAR 77.17(a)(1):	DNE 499 feet AGL
24 FAR 77.17(a)(2):	DNE - Airport Surface
25 FAR 77.19(a):	DNE - Horizontal Surface
26 FAR 77.19(b):	DNE - Conical Surface
27 FAR 77.19(c):	DNE - Primary Surface
28 FAR 77.19(d):	DNE - Approach Surface
29 FAR 77.19(e):	DNE - Transitional Surface

30 **VFR Traffic Pattern Airspace**

31 FAR 77.17(a)(1):	DNE
32 FAR 77.17(a)(2):	DNE - Height less than 200 feet AGL
33 VFR Horizontal Surface:	DNE
34 VFR Conical Surface:	DNE
35 VFR Approach Slope:	DNE
36 VFR Transitional Slope:	DNE

37 **TERPS FAA Order 8260.3**

38 Approach Surface:	DNE
39 Departure Surface:	DNE



1

2 Figure 6-2. TNI Proposed Construction and Primary Surfaces

1 **MOCA**

2 FAR 77.17(a) (4): DNE - No impact to airways.

3 **Private Landing Facilities**

4 There is no impact to HI63, Coral Ocean Point Pro-Shop Heliport.

5 There is no impact to TT04, Gualo Ral Heliport.

6 **Air Navigation Electronic Facilities**

7 Nearest NAVAID is Saipan's (LMM/NDB). No impact to facility.

8 6.3.1.2 Fuel Tanks

9 PACAF's proposed fuel tanks under the North Option would be located at latitude 15° 0'
10 11.3"/longitude 145° 37' 10.8". The site elevation is 160 feet AMSL, and the structure height at
11 the apex is 30 feet AGL with an overall height of 190 feet AMSL. Below is the evaluation:

12 **Notice Criteria**

13 FAR 77.9(a): NNR (DNE 200 feet AGL)
14 FAR 77.9(b): NNR (DNE Notice Slope)
15 FAR 77.9(c): NNR (Not a Traverse Way)
16 FAR 77.9: NNR FAR 77.9 IFR Notice Criteria for TNI
17 FAR 77.9: NNR FAR 77.9 IFR Notice Criteria for GSN
18 FAR 77.9(d): NNR (Off Airport Construction)

19 **Obstruction Standards**

20 FAR 77.17(a) (1): DNE 499 feet AGL
21 FAR 77.17(a) (2): DNE - Airport Surface
22 FAR 77.19(a): DNE - Horizontal Surface
23 FAR 77.19(b): DNE - Conical Surface
24 FAR 77.19(c): DNE - Primary Surface
25 FAR 77.19(d): DNE - Approach Surface
26 FAR 77.19(e): DNE - Transitional Surface

27 **VFR Traffic Pattern Airspace**

28 FAR 77.17(a)(1): DNE
29 FAR 77.17(a)(2): DNE - Height less than 200 feet AGL
30 VFR Horizontal Surface: DNE
31 VFR Conical Surface: DNE
32 VFR Approach Slope: DNE
33 VFR Transitional Slope: DNE

34 **TERPS FAA Order 8260.3**

35 Approach Surface: DNE
36 Departure Surface: DNE

37 **MOCA**

38 FAR 77.17(a) (4): DNE - No impact to airways

1 **Private Landing Facilities**

2 There is no impact to HI63, Coral Ocean Point Pro-Shop Heliport.

3 There is no impact to TT04, Gualo Ral Heliport.

4 **Air Navigation Electronic Facilities**

5 Nearest NAVAID is Saipan's (LMM/NDB). No impact to facility.

6 6.3.1.3 Fire Suppression System

7 PACAF's proposed fire suppression system under the North Option would be located at latitude
8 15° 0' 15.5"/longitude 145° 36' 58.7". The site elevation is 160 feet AMSL, and the structure
9 height at the apex is 20 feet AGL with an overall height of 180 feet AMSL. Below is the
10 evaluation:

11 **Notice Criteria**

12 FAR 77.9(a): NNR (DNE 200 feet AGL)
13 FAR 77.9(b): NNR (DNE Notice Slope)
14 FAR 77.9(c): NNR (Not a Traverse Way)
15 FAR 77.9: NNR FAR 77.9 IFR Notice Criteria for TNI
16 FAR 77.9: NNR FAR 77.9 IFR Notice Criteria for GSN
17 FAR 77.9(d): NNR (Off Airport Construction)

18 **Obstruction Standards**

19 FAR 77.17(a)(1): DNE 499 feet AGL
20 FAR 77.17(a)(2): DNE - Airport Surface
21 FAR 77.19(a): DNE - Horizontal Surface
22 FAR 77.19(b): DNE - Conical Surface
23 FAR 77.19(c): DNE - Primary Surface
24 FAR 77.19(d): DNE - Approach Surface
25 FAR 77.19(e): DNE - Transitional Surface

26 **VFR Traffic Pattern Airspace**

27 FAR 77.17(a) (1): DNE
28 FAR 77.17(a) (2): DNE - Height less than 200 feet AGL
29 VFR Horizontal Surface: DNE
30 VFR Conical Surface: DNE
31 VFR Approach Slope: DNE
32 VFR Transitional Slope: DNE

33 **TERPS FAA Order 8260.3**

34 Approach Surface: DNE
35 Departure Surface: DNE

36 **MOCA**

37 FAR 77.17(a)(4): DNE - No impact to airways.

38

1 **Private Landing Facilities**

2 There is no impact to HI63, Coral Ocean Point Pro-Shop Heliport.

3 There is no impact to TT04, Gualo Rai Heliport.

4 **Air Navigation Electronic Facilities**

5 Nearest NAVAID is Saipan's (LMM/NDB). There is no impact to the facility.

6 6.3.1.4 Apron Ball-Park Lighting

7 PACAF's proposed North Option parking apron would possess ball-park lighting (see **Figure 6-**
8 **2**). Two poles located the closest to the active runway were evaluated. These poles will be
9 located at latitude 15° 0' 1.9"/longitude 145° 36' 51.1" and latitude 15° 0' 5"/longitude: 145° 37'
10 8.1". The site elevation is 160 feet AMSL, and the structure height at the apex is 40 feet AGL
11 with an overall height of 200 feet AMSL. Below is the evaluation:

12 **Notice Criteria**

13 FAR 77.9(a):	NNR (DNE 200 feet AGL)
14 FAR 77.9(b):	NNR (DNE Notice Slope)
15 FAR 77.9(c):	NNR (Not a Traverse Way)
16 FAR 77.9:	NNR FAR 77.9 IFR Notice Criteria for GSN
17 FAR 77.9(d):	NR (On Airport Construction)

18 **Obstruction Standards**

19 FAR 77.17(a)(1):	DNE - 499 feet AGL
20 FAR 77.17(a)(2):	DNE - Airport Surface
21 FAR 77.19(a):	DNE - Horizontal Surface
22 FAR 77.19(b):	DNE - Conical Surface
23 FAR 77.19(c):	DNE - Primary Surface
24 FAR 77.19(d):	DNE - Approach Surface
25 FAR 77.19(e):	DNE - Transitional Surface

26 **VFR Traffic Pattern Airspace**

27 FAR 77.17(a)(1):	DNE
28 FAR 77.17(a)(2):	DNE - Height less than 200 feet AGL
29 VFR Horizontal Surface:	DNE
30 VFR Conical Surface:	DNE
31 VFR Approach Slope:	DNE
32 VFR Transitional Slope:	DNE

33 **TERPS FAA Order 8260.3**

34 Approach Surface:	DNE
35 Departure Surface:	DNE

36 **MOCA**

37 FAR 77.17(a)(4): DNE - No impact to airways.

38

1 **Private Landing Facilities**

2 There is no impact to 0TT8, Dynasty Casino Heliport.

3 **6.3.2 South Option**

4 **6.3.2.1 Maintenance Facility**

5 PACAF's proposed maintenance facility under the South Option would be located at latitude 14°
6 59' 40.7"/longitude 145° 36' 46.24". The site elevation is 160 feet AMSL, and the structure
7 height at the apex of the roof is 25 feet AGL with an overall height of 185 feet AMSL. Below is
8 the evaluation:

9 **Notice Criteria**

10 FAR 77.9(a):	NNR (DNE 200 feet AGL)
11 FAR 77.9(b):	NNR (DNE Notice Slope)
12 FAR 77.9(c):	NNR (Not a Traverse Way)
13 FAR 77.9:	NNR FAR 77.9 IFR Notice Criteria for TNI
14 FAR 77.9:	NNR FAR 77.9 IFR Notice Criteria for GSN
15 FAR 77.9(d):	NNR (Off Airport Construction)

16 **Obstruction Standards**

17 FAR 77.17(a)(1):	DNE 499 feet AGL
18 FAR 77.17(a)(2):	DNE - Airport Surface
19 FAR 77.19(a):	DNE - Horizontal Surface
20 FAR 77.19(b):	DNE - Conical Surface
21 FAR 77.19(c):	DNE - Primary Surface
22 FAR 77.19(d):	DNE - Approach Surface
23 FAR 77.19(e):	DNE - Transitional Surface

24 **VFR Traffic Pattern Airspace**

25 FAR 77.17(a)(1):	DNE
26 FAR 77.17(a)(2):	DNE - Height less than 200 feet AGL
27 VFR Horizontal Surface:	DNE
28 VFR Conical Surface:	DNE
29 VFR Approach Slope:	DNE
30 VFR Transitional Slope:	DNE

31 **TERPS FAA Order 8260.3**

32 Approach Surface:	DNE
33 Departure Surface:	DNE

34 **MOCA**

35 FAR 77.17(a) (4): DNE - No impact to airways.

36 **Private Landing Facilities**

37 There is no impact to HI63, Coral Ocean Point Pro-Shop Heliport.

38 There is no impact to TT04, Gualo Ral Heliport.

1 **Air Navigation Electronic Facilities**

2 Nearest NAVAID is Saipan's (LMM/NDB). There is no impact to the facility.

3 6.3.2.2 Fuel Tanks

4 PACAF's proposed fuel tanks under the South Option would be located at latitude 14° 59'
5 46.9"/longitude 145° 37' 6.64". The site elevation is 160 feet AMSL, and the structure height at
6 the apex is 30 feet AGL with an overall height of 190 feet AMSL. Below is the evaluation:

7 **Notice Criteria**

8 FAR 77.9(a):	NNR (DNE 200 feet AGL)
9 FAR 77.9(b):	NNR (DNE Notice Slope)
10 FAR 77.9(c):	NNR (Not a Traverse Way)
11 FAR 77.9:	NNR FAR 77.9 IFR Notice Criteria for TNI
12 FAR 77.9:	NNR FAR 77.9 IFR Notice Criteria for GSN
13 FAR 77.9(d):	NNR (Off Airport Construction)

14 **Obstruction Standards**

15 FAR 77.17(a) (1):	DNE - 499 feet AGL
16 FAR 77.17(a) (2):	DNE - Airport Surface
17 FAR 77.19(a):	DNE - Horizontal Surface
18 FAR 77.19(b):	DNE - Conical Surface
19 FAR 77.19(c):	DNE - Primary Surface
20 FAR 77.19(d):	DNE - Approach Surface
21 FAR 77.19(e):	DNE - Transitional Surface

22 **VFR Traffic Pattern Airspace**

23 FAR 77.17(a)(1):	DNE
24 FAR 77.17(a)(2):	DNE - Height less than 200 feet AGL
25 VFR Horizontal Surface:	DNE
26 VFR Conical Surface:	DNE
27 VFR Approach Slope:	DNE
28 VFR Transitional Slope:	DNE

29 **TERPS FAA Order 8260.3**

30 Approach Surface:	DNE
31 Departure Surface:	DNE

32 **MOCA**

33 FAR 77.17(a) (4): DNE - No impact to airways

34 **Private Landing Facilities**

35 There is no impact to HI63, Coral Ocean Point Pro-Shop Heliport.

36 There is no impact to TT04, Gualo Rai Heliport.

37 **Air Navigation Electronic Facilities**

38 Nearest NAVAID is Saipan's (LMM/NDB). There is no impact to the facility.

1 6.3.2.3 Fire Suppression System

2 PACAF's proposed fire suppression system under the South Option would be located at latitude
3 14° 59' 35.1"/longitude 145° 37' 2.9". The site elevation is 160 feet AMSL, and the structure
4 height at the apex is 20 feet AGL with an overall height of 180 feet AMSL. Below is the
5 evaluation:

6 **Notice Criteria**

7 FAR 77.9(a):	NNR (DNE 200 feet AGL)
8 FAR 77.9(b):	NNR (DNE Notice Slope)
9 FAR 77.9(c):	NNR (Not a Traverse Way)
10 FAR 77.9:	NNR FAR 77.9 IFR Notice Criteria for TNI
11 FAR 77.9:	NNR FAR 77.9 IFR Notice Criteria for GSN
12 FAR 77.9(d):	NNR (Off Airport Construction)

13 **Obstruction Standards**

14 FAR 77.17(a)(1):	DNE 499 feet AGL
15 FAR 77.17(a)(2):	DNE - Airport Surface
16 FAR 77.19(a):	DNE - Horizontal Surface
17 FAR 77.19(b):	DNE - Conical Surface
18 FAR 77.19(c):	DNE - Primary Surface
19 FAR 77.19(d):	DNE - Approach Surface
20 FAR 77.19(e):	DNE - Transitional Surface

21 **VFR Traffic Pattern Airspace**

22 FAR 77.17(a) (1):	DNE
23 FAR 77.17(a) (2):	DNE - Height less than 200 feet AGL
24 VFR Horizontal Surface:	DNE
25 VFR Conical Surface:	DNE
26 VFR Approach Slope:	DNE
27 VFR Transitional Slope:	DNE

28 **TERPS FAA Order 8260.3**

29 Approach Surface:	DNE
30 Departure Surface:	DNE

31 **MOCA**

32 FAR 77.17(a)(4): DNE - No impact to airways.

33 **Private Landing Facilities**

34 There is no impact to HI63, Coral Ocean Point Pro-Shop Heliport.
35 There is no impact to TT04, Gualo Rai Heliport.

36 **Air Navigation Electronic Facilities**

37 Nearest NAVAID is Saipan's (LMM/NDB). There is no impact to the facility.

1 6.3.2.4 Apron Ball-Park Lighting

2 PACAF's proposed South Option parking apron would have ball-park lighting (see **Figure 6-2**).
3 Two poles located the closest to the active runway were evaluated. These poles will be located
4 at latitude 14° 59' 48.1"/longitude 145° 37' 3.2" and latitude 14° 59' 44.7"/longitude: 145° 36'
5 45.5". The site elevation is 160 feet AMSL, and the structure height at the apex is 40 feet AGL
6 with an overall height of 200 feet AMSL. Below is the evaluation:

7 **Notice Criteria**

8 FAR 77.9(a):	NNR (DNE 200 feet AGL)
9 FAR 77.9(b):	NNR (DNE Notice Slope)
10 FAR 77.9(c):	NNR (Not a Traverse Way)
11 FAR 77.9:	NNR FAR 77.9 IFR Notice Criteria for GSN
12 FAR 77.9(d):	NR (On Airport Construction)

13 **Obstruction Standards**

14 FAR 77.17(a)(1):	DNE - 499 feet AGL
15 FAR 77.17(a)(2):	DNE - Airport Surface
16 FAR 77.19(a):	DNE - Horizontal Surface
17 FAR 77.19(b):	DNE - Conical Surface
18 FAR 77.19(c):	DNE - Primary Surface
19 FAR 77.19(d):	DNE - Approach Surface
20 FAR 77.19(e):	DNE - Transitional Surface

21 **VFR Traffic Pattern Airspace**

22 FAR 77.17(a)(1):	DNE
23 FAR 77.17(a)(2):	DNE - Height less than 200 feet AGL
24 VFR Horizontal Surface:	DNE
25 VFR Conical Surface:	DNE
26 VFR Approach Slope:	DNE
27 VFR Transitional Slope:	DNE

28 **TERPS FAA Order 8260.3**

29 Approach Surface:	DNE
30 Departure Surface:	DNE

31 **MOCA**

32 FAR 77.17(a)(4): DNE - No impact to airways.

33 **Private Landing Facilities**

34 There is no impact to OTT8, Dynasty Casino Heliport.

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1 7. Saipan/Tinian Pending Proposals

2 7.1 Background

3 This chapter assesses the aeronautical impact pending proposals will have on PACAF's
4 proposed construction and implementation of divert activities and exercises.

5 7.2 Saipan Proposed Aircraft Parking Aprons

6 CPA has two proposed aprons in the same location as the PACAF's proposed parking apron. .

7 ***Impact.*** The proposed aircraft parking apron project may have a beneficial impact on Saipan's
8 proposed master plan if Saipan is chosen. PACAF's proposed parking apron may provide CPA
9 their desired additional parking aprons and could be utilized when DOD divert activities and/or
10 exercises are not occurring. In the Divert Revised Draft EIS, USAF developed revisions to the
11 proposed infrastructure at Saipan International Airport in coordination with CPA and FAA,
12 specifically considering proposed future development at the GSN.

13 7.3 Proposed Surveillance Radar on Saipan

14 Guam ARTCC radar coverage is not available below 3,500 feet MSL above Saipan and Tinian.
15 The DOD, and its service components, and the FAA radar program office have initiated
16 communications to determine the possibility of adding a radar system on Saipan (Cleveland
17 2012).

18 ***Impact.*** The surveillance radar project, if completed may have a beneficial impact on PACAF's
19 proposal. The addition of radar on Saipan means positive control measures by air traffic control
20 personnel can be implemented at GSN and TNI. Positive controls include safety alerts (air
21 traffic advisories) and reduce separation standards which assist in eliminating delays.

22 7.4 Commonwealth of the Northern Mariana Islands Joint 23 Military Training on Tinian

24 The Marine Corps Forces Pacific proposed project, CNMI Joint Military Trainig (CJMT) includes
25 establishing live-fire range and training areas in Tinian. To accommodate the anticipated
26 aircraft training tempo and equipment/cargo needs, taxiways, directly north and adjacent to the
27 runway of TNI, would be constructed to include: (1) one tactical aircraft parking ramp; (2) one
28 cargo aircraft parking ramp; (3) connecting taxiways; (4) ordnance arming and de-arming pads;
29 (5) one hot cargo (i.e., munitions) pad/combat aircraft loading area; (6) fuel tanks and an
30 expeditionary/temporary refueling area; (7) arresting gear pads; (8) munitions holding pads; (9)
31 taxiway crossings; and (10) access roads connecting to the airfield. Construction could also
32 include a fuel pipeline along 8th Avenue to transfer fuel to the bulk storage facility at the airfield.
33 Additionally, approximately 920 rotary aircraft landing zone operations are also planned to occur
34 annually on Tinian (DON 2015).

1 **Impact.** Because USAF Divert and the Marine Corps Forces Pacific CJMT missions have
2 overlapping requirements in the use of the airport at Tinian, the airfield improvement designs for
3 both programs would be coordinated to maximize common use of infrastructure requirements,
4 such as the fuel pipeline and to minimize conflicting operations. Therefore, beneficial impacts
5 on Divert could be expected.

6 7.5 US Navy's Proposed Ground Based Electronic Emitter 7 in CNMI

8 Military training operations often employ emitters to create a realistic electromagnetic
9 environment in which to train (see **Figure 7-1**). Ground-based emitters are proposed for use on
10 Guam and Saipan to train aircrew to detect and respond to simulated threats. The use of these
11 emitters will not impact civil air traffic or ATC systems on Tinian or Saipan as they transmit at
12 specific pre-approved frequencies only. Daily coordination with FAA prior to commencing
13 emitter operations is standard operating procedure (Lynch 2012).



14
15 **Figure 7-1. Ground Based Electronic Emitter System [Lynch 2012]**

16 **Impact.** The U.S. Navy project has the possibility of having a negative impact on PACAF's
17 proposal. The proposed ground-based electronic emitter could cause electromagnetic
18 interference also known as radio frequency interference. The interference may interrupt,
19 obstruct, degrade, or limit the performance of radio transmission on Saipan and Tinian. The
20 impact could range from a simple degradation to a total loss.

1 8. ATC and Airfield Facilities Services 2 Assessment

3 8.1 Background

4 This chapter addresses the FAA, CPA, Saipan's Contracted Air Traffic Control Tower, and Star
5 Marianas Airlines assessment and professional opinion of the impact PACAF's proposed
6 construction and implementation of divert activities and exercises will have on their existing
7 facility operations. This information was obtained during the Data Background Collection
8 meetings in Hawaii, Guam, Saipan, and Tinian.

9 8.2 FAA Airport District Office, Honolulu, Hawaii

10 The FAA Safety Management System (SMS) will be used for full coordination of all phases of
11 proposed construction within the airfield boundaries before construction can begin. An SMS is
12 the formal, top-down business approach to managing safety risk, which includes a systemic
13 approach to managing safety, including the necessary organizational structures,
14 accountabilities, policies and procedures (FAA 2011). An SMS is recommended for each
15 project; if SMS' are combined and one project does not meet the criteria, then all projects may
16 be disapproved. FAA recommends reviewing FAAO 5200.11 for guidance.

17 All grant assurances between FAA and CPA for their airports must meet compliance. CPA
18 receives funds from FAA-administered airport financial assistance programs and they accepted
19 certain obligations (or assurances). These assurances require CPA to maintain and operate
20 their facilities safely and efficiently and in accordance with specified conditions.

21 An Airport Layout Plan (ALP) is a scaled drawing of existing and proposed land and facilities
22 necessary for the operation and development of the airport. The ALP must be updated to show
23 the location of proposed capital investments. The ALP will require FAA internal coordination
24 prior to approval by the Airports Division Office. FAA internal approval will coordinate with the
25 other FAA divisions with input to the proposals such as Flight Standards, facilities, ATC, and
26 others as required. The updated ALP must be coordinated and approved by the CPA prior to
27 FAA approval; the CPA is responsible for keeping the ALP updated.

28 8.3 FAA ARTCC, Guam

29 Guam ARTCC stated that PACAF's proposed activities and exercises would not impact the air
30 route center's manning or airways within their FIR, and not impose any stress on their system
31 as long as it adheres to the information published within the *"Proposed Divert Activities and
32 Exercises, Guam and Commonwealth of the Northern Mariana Islands (CNMI)."* Air traffic within
33 their FIR is down 15 percent due to fuel prices and the economy.

34 DOD air traffic will not receive preferential treatment but will be sequenced per FAA 7110.65
35 along with commercial air traffic. DOD air traffic can expect to transit airway A221 to the initial
36 approach fix for GSN or TNI. However, DOD aircraft may receive direct routing when filed.

1 Guam ARTCC is concerned about the multiple DOD proposed projects in Guam and CNMI.
2 Guam ARTCC has requested that FAA Western Service Area initiate an internal working group
3 to ensure collaborations among all projects.

4 8.4 CPA Leadership

5 The CPA has two proposed aprons in the same location as PACAF's parking apron. These
6 aprons are unfunded proposals and do not expect to receive funding.

7 GSN Fire/Rescue Department is rated Index D and has 500,000 gallons of water available. It
8 meets USAF requirements of the proposal. TNI Fire/Rescue Department is rated Index A and
9 has 60,000 gallons of water available. Tinian ARFF does not meet FAA Index D requirements
10 to support the baseline aircraft in the proposal.

11 8.5 CPA GSN

12 The airfield has ponding (standing water) issues after rainfalls. There were multiple birds on the
13 airfield during our tour; the most obvious were the black noddies. CPA airfield operations
14 personnel stated there is a Wildlife Hazard Mitigation program in-place; however, the bird
15 population increases from October to January.

16 8.6 CPA TNI

17 TNI personnel fear that USAF aircraft operations on Tinian could cause delays to their civilian
18 commercial air traffic and de-certification of their FAA credentials. The necessity to assure the
19 FAA, CPA and the military are all in agreement on necessary procedures and requirements
20 manifested itself during the United States Marine Corps (USMC) exercise at TNI in May 2012.
21 Some examples of miscommunications included the following:

- 22 • The original operation plan as communicated to CPA was that up to four FA-18s and
23 one C-130 would utilize the airport; however, six FA-18s and two C-130s landed for
24 refueling.
- 25 • No set approach and departure routing was agreed upon among the parties resulting in
26 noise complaints from the surrounding housing areas.
- 27 • The USMC airfield coordinator failed to manage ground operations effectively resulting
28 in the delay of civilian aircraft. The delay was caused due to two C-130 aircraft blocking
29 the taxiway because one aircraft did not follow the one-way taxi procedures as agreed to
30 between CPA and USMC. Spill and hazardous material containment had not been
31 coordinated for the event resulting in a C-130 fuel spill. Though it was contained with
32 available portable spill containment kits, there was an obvious residual fuel stain on their
33 parking apron.
- 34 • Two C-130s were nose-to-nose blocking the taxiway.

35 TNI personnel welcomes USAF operations to the airfield as long as they comply with CPA and
36 FAA agreements/regulations and the appropriate operating agreements are executed.

1 8.7 Saipan Air Traffic Control Tower, SERCO Contract

2 The airfield is extremely busy from 0800 until 1100 and 0000 until 0300. During these periods,
3 there are normally two controllers on duty. The airport averages 200 flights daily. A majority of
4 the traffic consists of commuter flights among the Mariana Islands.

5 8.8 Star Marianas Airlines

6 Star Marianas has flights daily between Saipan/Tinian. These flights increase or decrease
7 depending on demand. Occasionally, they provide sightseeing tours around both islands when
8 requested, but can increase with demand. During the May 2012 USMC exercise on Tinian,
9 Freedom Airline and Star Marianas received arrival and departure delays. Star Marianas is
10 concerned that USAF arrival at Saipan and/or Tinian will impact their operations (delays).

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1 9. Proposed Mitigation/Recommendations

2 9.1 Background

3 This chapter provides mitigations and recommendations to successfully implement PACAF's
4 proposed construction and operations. Airport operations in Saipan and Tinian will be impacted;
5 however, the mitigations and recommendations listed below would minimize those impacts.

6 9.2 GSN Proposed Mitigation/Recommendations

7 Below are the impacts and proposed mitigation/recommendations for GSN.

8 **Aircraft Rescue Firefighting (ARFF) Department Line-of-Sight.** Visual line-of-sight is
9 determined by the ability of the average human eye to view an object unimpeded. The parking
10 apron may impede GSN ARFF line-of-sight to the runway. If line-of-sight is impeded,
11 recommendations include: (1) installing a tower on the ARFF facility to increase visibility, (2)
12 adding surveillance cameras on the airfield, (3) requesting a waiver for line-of-sight criteria, or
13 (4) relocating the proposed parking apron.

14 **FAR Part 77.** Any organization intent to sponsor construction or alterations on the airfield must
15 notify the FAA. There are no perceived violations to FAR Part 77 criteria for the proposed
16 constructions. The USAF should file a FAA Form 7460-1, Notice of Proposed Construction or
17 Alteration with the FAA for all proposed construction.

18 **Airport Layout Plan (ALP).** An ALP is a scaled drawing of existing and proposed land and
19 facilities necessary for the operation and development of the airport. The ALP must be updated
20 and approved by CPA and FAA. Approval of modifications to the ALP must be received prior to
21 the issuance of leases and construction commencing.

22 **FAA Safety Management System (SMS).** SMS is the formal, top-down business approach to
23 managing safety risk, which includes a systemic approach to managing safety, including the
24 necessary organizational structures, accountabilities, policies and procedures (FAA 2011). The
25 SMS will be used for full coordination of all phases of construction within the airfield boundaries.
26 The recommendation is to complete a Construction Safety Plan for each construction site which
27 may or may not trigger FAA to conduct an SMS review.

28 9.3 TNI Proposed Mitigations/Recommendations

29 Below are the proposed mitigations/recommendations for TNI.

30 **Airport Layout Plan (ALP).** An ALP is a scaled drawing of existing and proposed land and
31 facilities necessary for the operation and development of the airport. The ALP must be updated
32 and approved by CPA and FAA. USAF should accomplish and receive approval to the ALP
33 prior to construction commencing.

34 **FAR Part 77.** Any organization intent to sponsor construction or alterations on the airfield must
35 notify the FAA. There are no perceived violations to FAR Part 77 criteria for the proposed

- 1 constructions. USAF should file a FAA Form 7460-1, Notice of Proposed Construction or
- 2 Alteration with FAA for all proposed construction.

- 3 **FAA Safety Management System (SMS).** An SMS is the formal, top-down business approach
- 4 to managing safety risk, which includes a systemic approach to managing safety, including the
- 5 necessary organizational structures, accountabilities, policies and procedures (FAA 2011). The
- 6 SMS will be used for full coordination of all phases of construction within the airfield boundaries.
- 7 USAF should complete an SMS for each construction site.

10. REFERENCES

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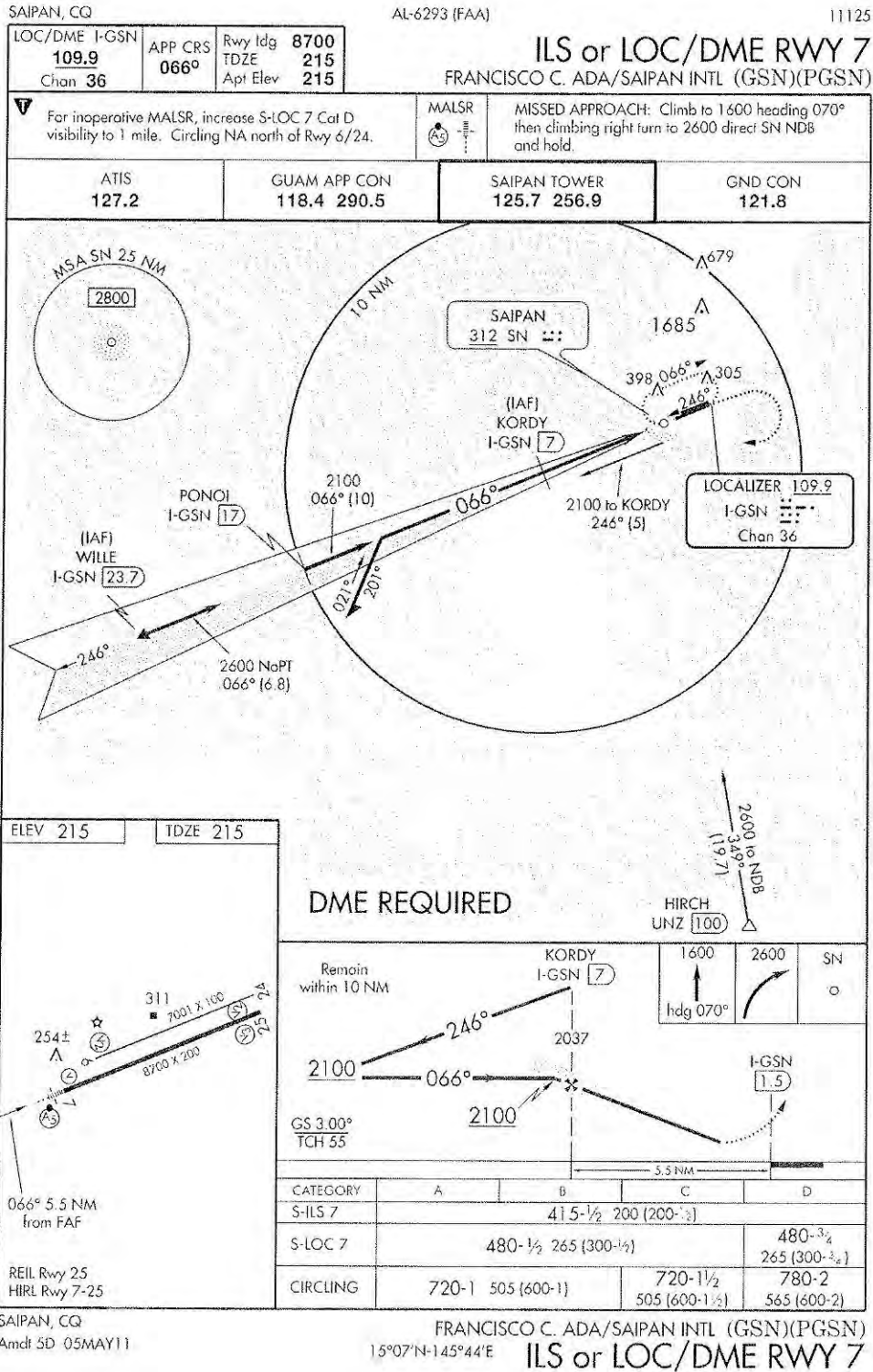


A

GSN Terminal Instrument Approach Procedures



Appendix A: GSN Terminal Instrument Approach Procedures



PAC, 09 FEB 2012 to 05 APR 2012

PAC, 09 FEB 2012 to 05 APR 2012

SAIPAN, CQ FRANCISCO C. ADA/SAIPAN INTL (GSN)(PGSN)
 Amdt 5D 05MAY11 15°07'N-145°44'E **ILS or LOC/DME RWY 7**

SAIPAN, CQ

AL-6293 (FAA)

11125

APP CRS	Rwy Idg	8700
066°	THRE	210
	Apt Elev	215

RNAV (GPS) RWY 7

FRANCISCO C. ADA/SAIPAN INTL (GSN)(PGSN)

▼ For inoperative MALSR, increase LNAV Cats C and D visibility to 7/8. When local altimeter setting not received, procedure NA. DME/DME RNP-0.3 NA. Circling NA north of Rwy 6-24.

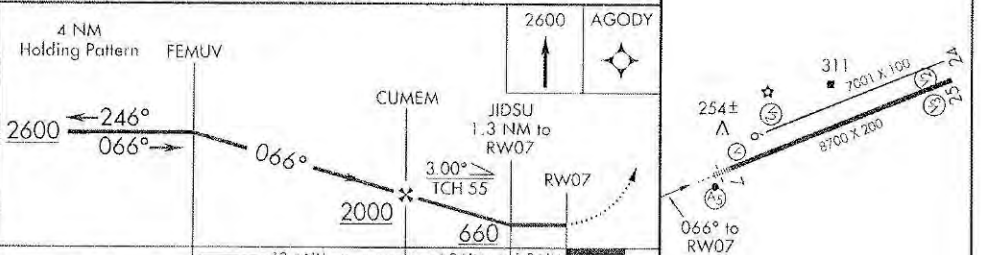
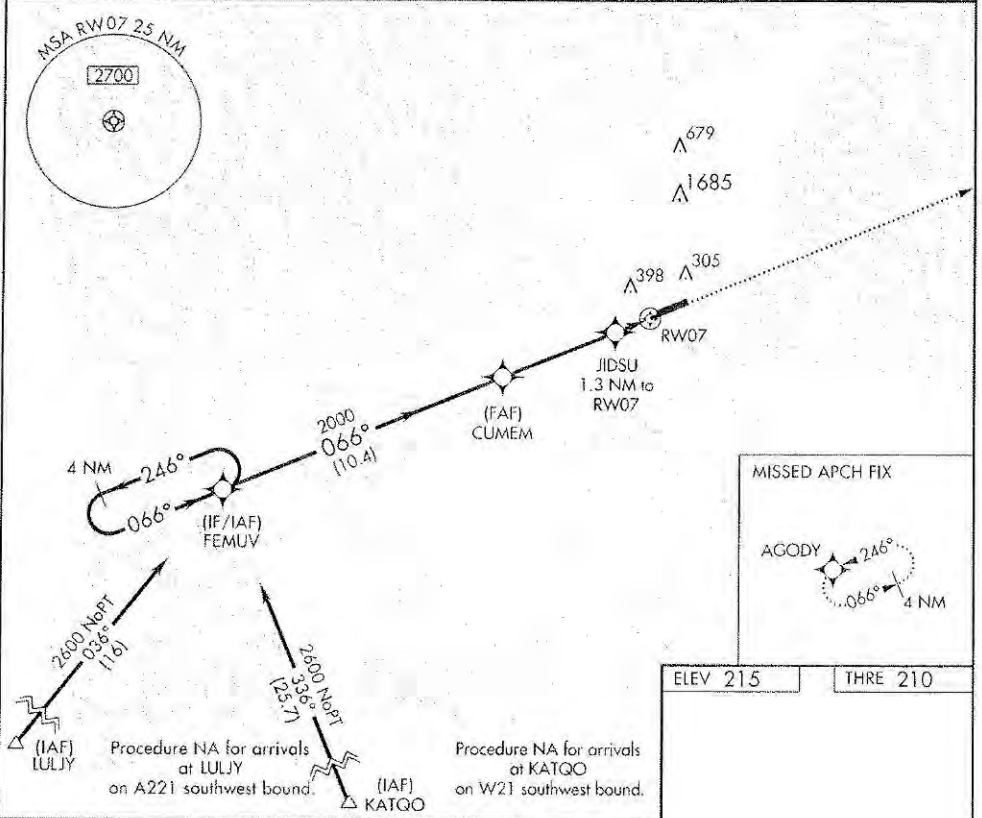


MISSED APPROACH:
Climb 2600 direct AGODY and hold.

ATIS 127.2	GUAM APP CON 118.4 290.5	SAIPAN TOWER 125.7 256.9	GND CON 121.8
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PAC, 09 FEB 2012 to 05 APR 2012

PAC, 09 FEB 2012 to 05 APR 2012



CATEGORY	A	B	C	D
LNAV MDA	520-1/2 310 (400-1/2)			
CIRCLING	720-1 505 (600-1)	720-1 1/2 505 (600-1 1/2)	780-2 565 (600-2)	

SAIPAN, CQ
Orig-A 05MAY11

FRANCISCO C. ADA/SAIPAN INTL (GSN)(PGSN)
15°07'N-145°44'E
RNAV (GPS) RWY 7

SAIPAN, CQ

AI-6293 (FAA)

11125

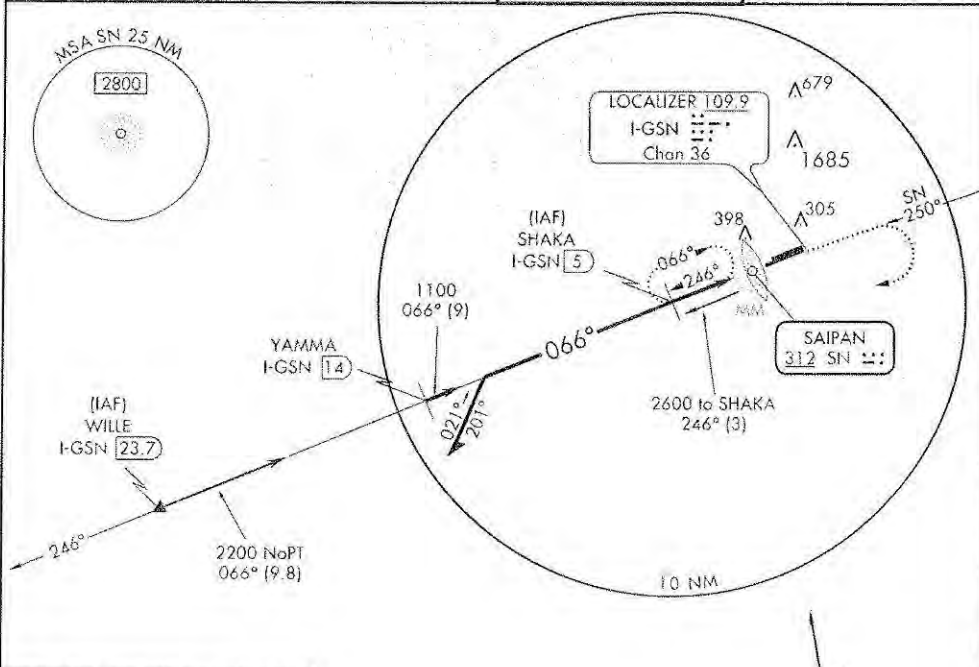
NDB SN 312	APP CRS 066°	Rwy ldg TDZE Apt Elev	8700 215 215
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NDB/DME RWY 7
FRANCISCO C. ADA/SAIPAN INTL (GSN)(PGSN)

▼ Cat C S-7 visibility increased 1/2 mile for inoperative MALS. Circling NA north of Rwy 6-24.

MALS R: MISSED APPROACH: Climb to 1600 via 070° bearing from SN NDB then climbing right turn to 2600 direct SN NDB then 246° bearing from SN NDB to Shaka 5 DME and hold.

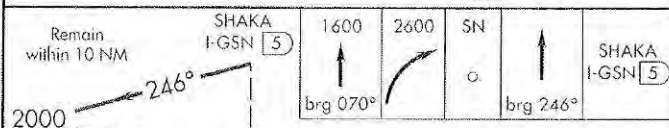
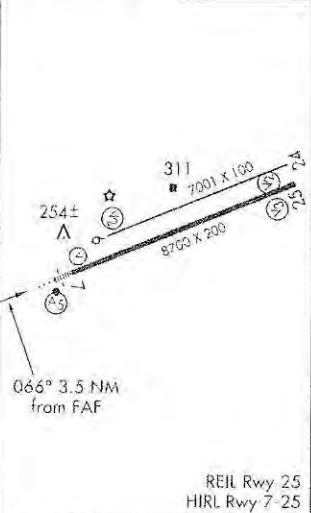
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PAC, 09 FEB 2012 to 05 APR 2012

PAC, 09 FEB 2012 to 05 APR 2012

ELEV 215	TDZE 215
----------	----------



CATEGORY	A	B	C	D
S-7	560-3/4	345 (400-3/4)		560-1 345 (400-1)
CIRCLING	720-1	505 (600-1)	720-1 1/2 505 (600-1/2)	780-2 565 (600-2)

SAIPAN, CQ
Amdt 3C 05MAY11

FRANCISCO C. ADA/SAIPAN INTL (GSN)(PGSN)
15°07'N-145°44'E
NDB/DME RWY 7

SAIPAN, CQ

AL-6293 (FAA)

11125

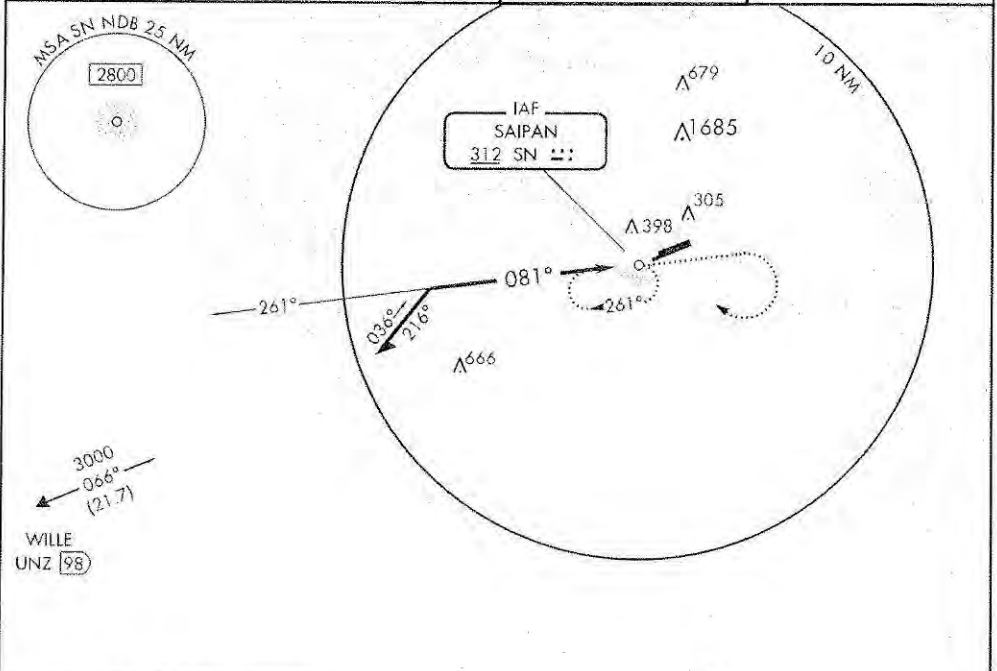
NDB SN 312	APP CRS 081°	Rwy Idg 8700
		TDZE 215
		Apt Elev 215

NDB RWY 7

FRANCISCO C. ADA/SAIPAN INTL (GSN)(PGSN)

For inoperative MALSR, increase S-7 Cats A and B visibility 1/2 mile, inoperative table does not apply to S-7 cat C and D. Circling NA north of Rwy 6-24.
 MALSR
 MISSED APPROACH: Climb to 2400 then climbing right turn to 3000 direct SN NDB and hold, continue climb-in-hold to 3000.

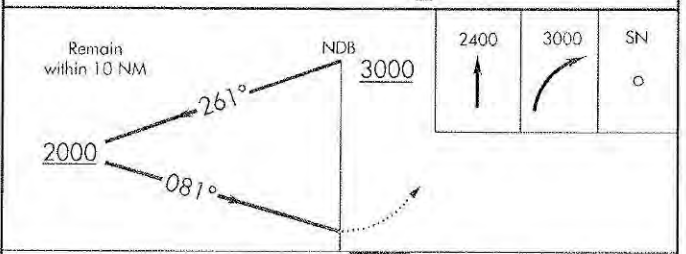
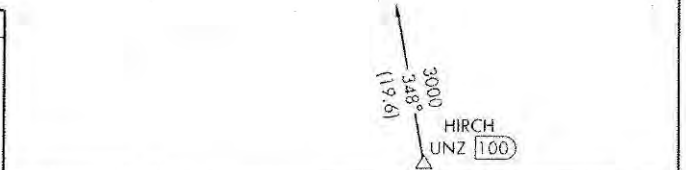
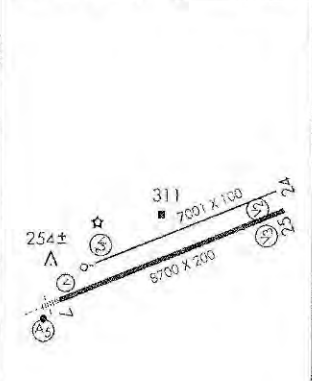
ATIS 127.2	GUAM APP CON 118.4 290.5	SAIPAN TOWER 125.7 256.9	GND CON 121.8
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PAC, 09 FEB 2012 to 05 APR 2012

PAC, 09 FEB 2012 to 05 APR 2012

ELEV 215	TDZE 215
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CATEGORY	A	B	C	D
S-7	900-3/4 685 (700-3/4)		900-2 685 (700-2)	900-2 1/2 685 (700-2 1/4)
CIRCLING	900-1 685 (700-1)		900-2 685 (700-2)	900-2 1/2 685 (700-2 1/4)

SAIPAN, CQ
Amdt 5A 05MAY11

FRANCISCO C. ADA/SAIPAN INTL (GSN)(PGSN)
15°07'N-145°44'E
NDB RWY 7

SAIPAN, CG

AL-6293 (FAA)

11125

APP CRS	Rwy Idg	8700
246°	THRE	210
	Apt Elev	215

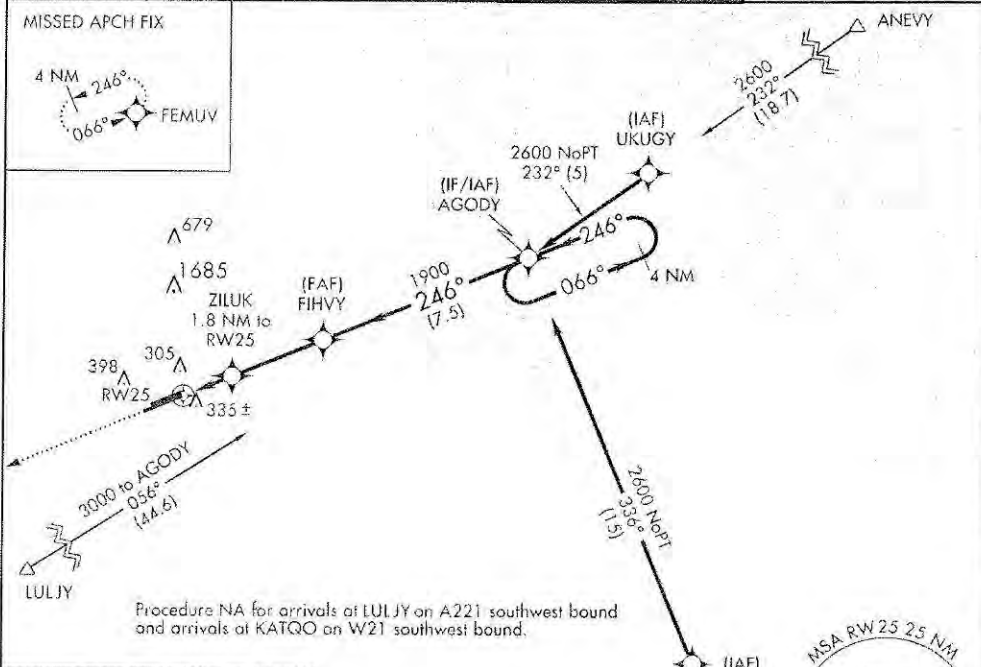
RNAV (GPS) RWY 25

FRANCISCO C. ADA/SAIPAN INTL (GSN)(PGSN)

When local altimeter setting not received, procedure NA.
 DME/DME RNP-0.3 NA. Visibility reduction by helicopters NA.
 Circling NA north of Rwy 6-24.

MISSED APPROACH:
 Climb to 2600 direct FEMUV and hold.

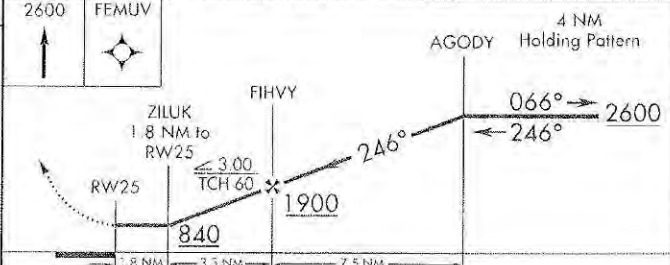
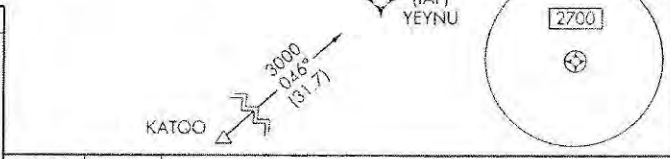
ATIS 127.2	GUAM APP CON 118.4 290.5	SAIPAN TOWER 125.7 256.9	GND CON 121.8
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PAC, 09 FEB 2012 to 05 APR 2012

PAC, 09 FEB 2012 to 05 APR 2012

ELEV 215	THRE 210
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CATEGORY	A	B	C	D
LNAV MDA	600-1	390 (400-1)	600-1½	390 (400-1½)
CIRCLING	720-1	505 (600-1)	720-1½	565 (600-2)

SAIPAN, CG
 Orig-A 05MAY11

FRANCISCO C. ADA/SAIPAN INTL (GSN)(PGSN)
 15°07'N-145°44'E
RNAV (GPS) RWY 25

SAIPAN, CQ

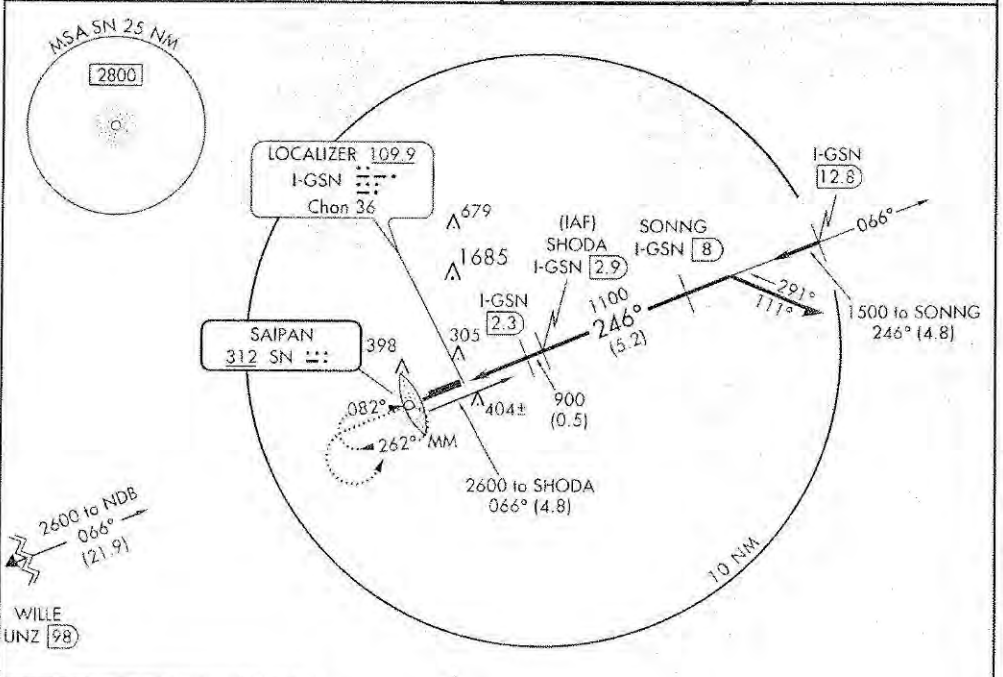
AL-6293 (FAA)

11125

NDB SN 312	APP CRS 246°	Rwy Idg 8700	TDZE 210
		Apt Elev 215	

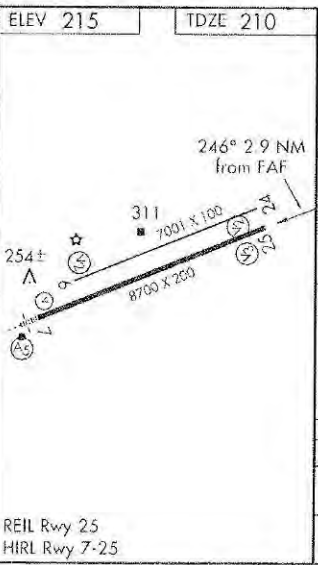
NDB/DME RWY 25
FRANCISCO C. ADA/SAIPAN INTL (GSN)(PGSN)

<p>▼ ACTIVATE MALSR Rwy 7-1 23.6. Circling NA north of Rwy 6-24.</p>		<p>MISSED APPROACH: Climb runway heading to 1500 then climbing left turn to 2600 direct SN NDB and hold.</p>	
ATIS 127.2	GUAM APP CON 118.4 290.5	SAIPAN TOWER 125.7 256.9	GND CON 121.8



PAC, 09 FEB 2012 to 05 APR 2012

PAC, 09 FEB 2012 to 05 APR 2012



REIL Rwy 25	SAIPAN, CQ	FRANCISCO C. ADA/SAIPAN INTL (GSN)(PGSN)
HIRL Rwy 7-25	Amdt 2C 05MAY11	15°07'N-145°44'E

NDB/DME RWY 25



B

TNI Terminal Instrument Approach Procedures

Appendix B: TNI Terminal Instrument Approach Procedures

TINIAN ISLAND, CO

AI-6848 (FAA)

RNAV (GPS) RWY 8 TINIAN INTL (TNI)(PGWT)

APP CRS 078°	Rwy Idg 8600
	TDZE 243
	Apt Elev 271

⚠ DME/DME RNP-0.3 NA. Obtain local altimeter setting on CTAF; when not received, use Saipan altimeter setting. VDP NA when using Saipan altimeter setting.

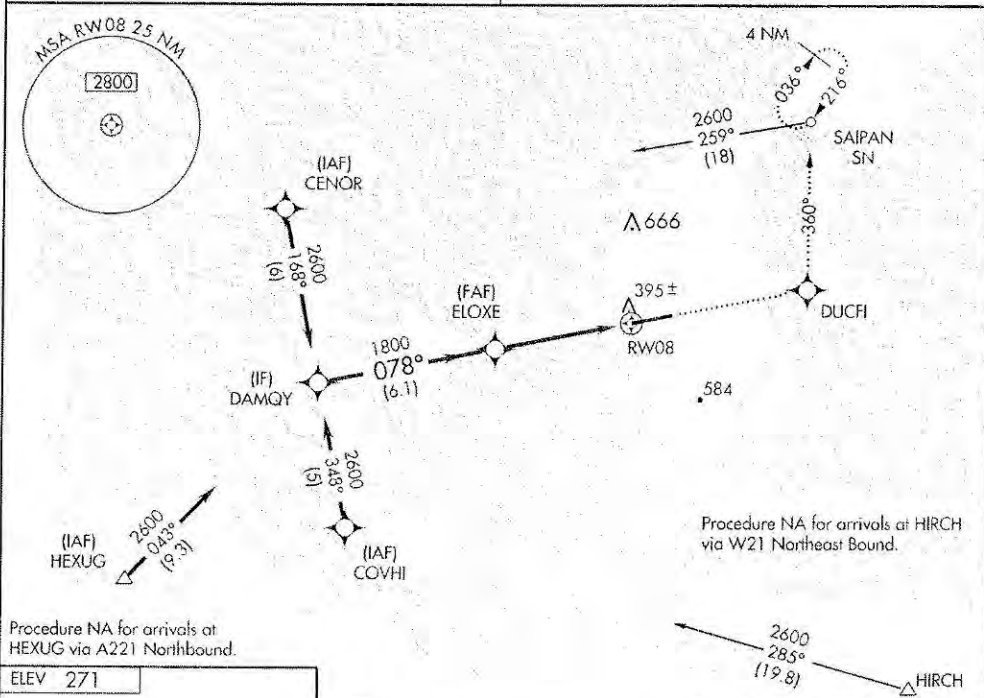
MISSED APPROACH: Climb to 2800 direct DUCFI and via 360° track to SN NDB and hold, continue climb-in-hold to 2800.

GUAM APP CON
118.4 290.5

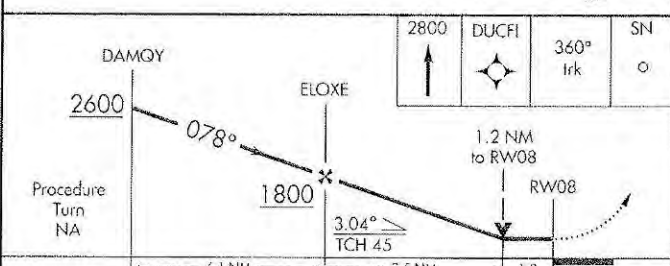
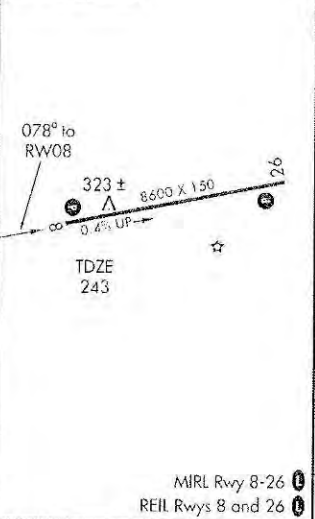
SAIPAN RADIO
123.6 (CTAF) 0

PAC, 09 FEB 2012 to 05 APR 2012

PAC, 09 FEB 2012 to 05 APR 2012



ELEV 271



CATEGORY	A	B	C	D
LNNAV MDA	660-1	417 (400-1)	660-1½	417 (400-1½)
CIRCLING	760-1	489 (500-1)	800-1½ 529 (600-1½)	960-2½ 689 (700-2½)
SAIPAN ALTIMETER SETTING MINIMUMS				
LNNAV MDA	680-1	437 (500-1)	680-1½ 437 (500-1½)	680-1½ 437 (500-1½)
CIRCLING	800-1	529 (600-1)	840-1½ 569 (600-1½)	1000-2½ 729 (800-2½)

TINIAN ISLAND, CO
Amdt 1 09239

15° 00'N-145° 37'E

TINIAN INTL (TNI)(PGWT) RNAV (GPS) RWY 8

TINIAN ISLAND, CG

AL-6848 (FAA)

RNAV (GPS) RWY 26

TINIAN INTL (TNI)(PGWT)

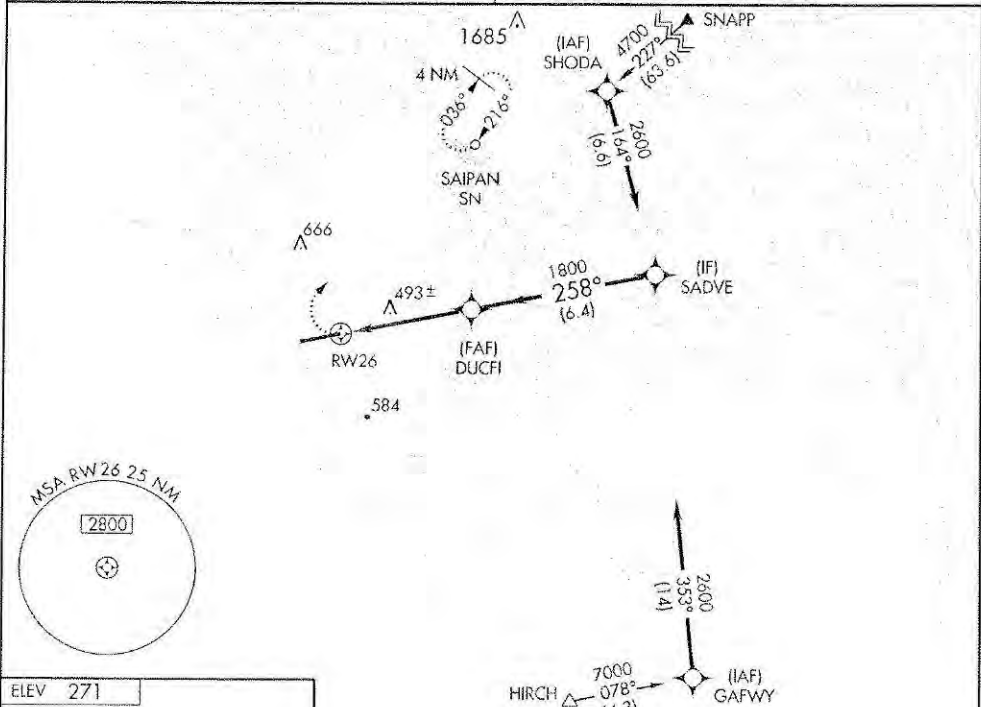
APP CRS	Rwy Idg	8600
258°	TDZE	271
	Apt Elev	271

⚠ DME/DME RNP-0.3 NA. Obtain local altimeter setting on CTAF; when not received, use Saipan altimeter setting.
⚠ VDP NA when using Saipan altimeter setting

MISSED APPROACH. Climbing right turn to 2800 direct SN NDB and hold, continue climb-in-hold to 2800.

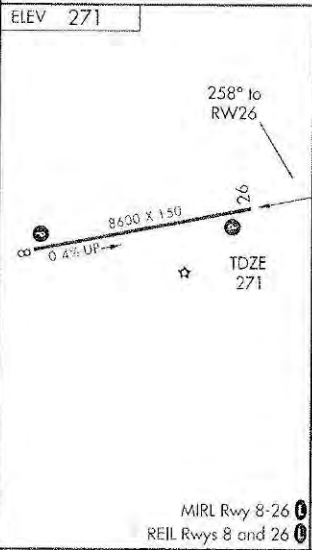
GUAM APP CON
118.4 290.5

SAIPAN RADIO
123.6 (CTAF) **0**



PAC, 09 FEB 2012 to 05 APR 2012

PAC, 09 FEB 2012 to 05 APR 2012



	2800	SN		
		o		
	1.4	1.4 NM to RWY26	3.2 NM	6.4 NM
		DUCHI	1800	SADVE
			258°	2600
			≤ 3.04°	Procedure Turn NA
			TCH 45	
CATEGORY	A	B	C	D
LNAV MDA	760-1	489 (500-1)	760-1¼ 489 (500-1¼)	760-1½ 489 (500-1½)
CIRCLING	760-1	489 (500-1)	800-1½ 529 (600-1½)	960-2¼ 689 (700-2¼)
SAIPAN ALTIMETER SETTING MINIMUMS				
LNAV MDA	780-1	509 (600-1)	780-1½	509 (600-1½)
CIRCLING	800-1	529 (600-1)	840-1½ 569 (600-1½)	1000-2¼ 729 (800-2¼)

TINIAN ISLAND, CG
Amdt 1 09239

15° 00'N-145° 37'E

TINIAN INTL (TNI)(PGWT) RNAV (GPS) RWY 26

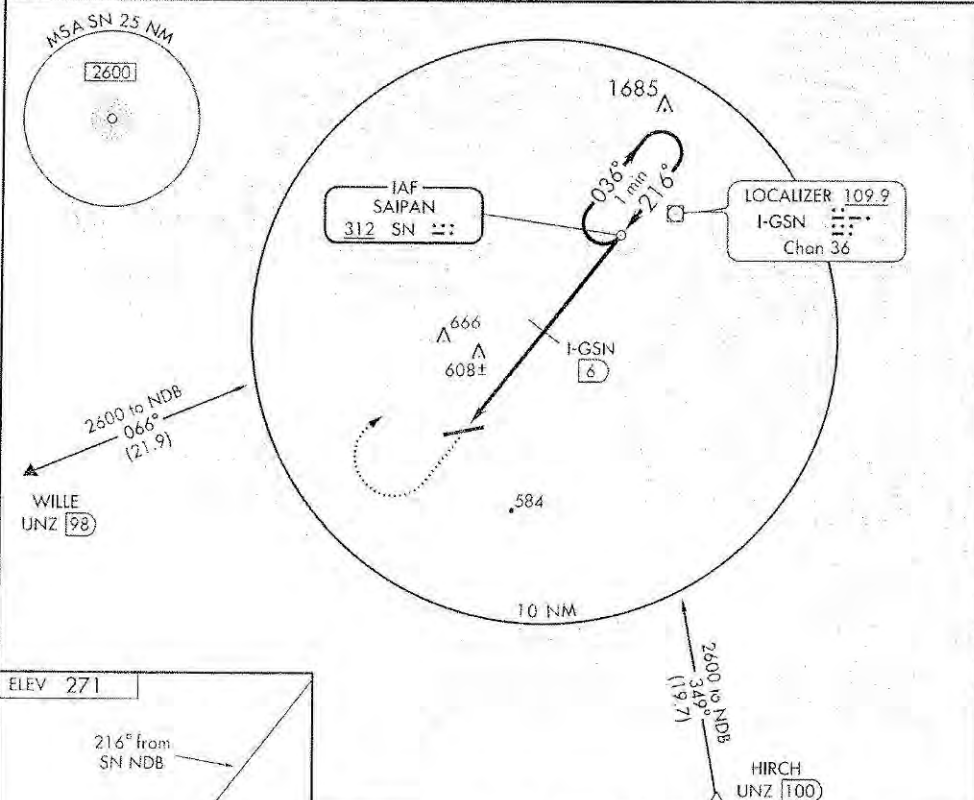
TINIAN ISLAND, CO

AL-6848 (FAA)

SN NDB 312	APP CRS 216°	Rwy Idg TDZE Apt Elev	N/A N/A 271
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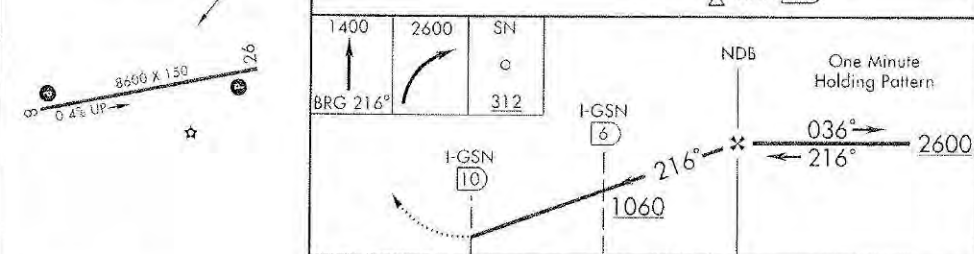
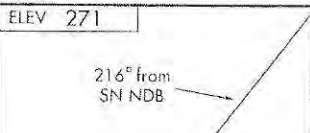
NDB-A
TINIAN INTL (TNI)(PGWT)

<p>▼ ▲</p>	<p>MISSED APPROACH. Climb to 1400 via 216° bearing from SN NDB then climbing right turn to 2600 direct SN NDB and hold.</p>
<p>GUAM APP CON 118.4 290.5</p>	<p>SAIPAN RADIO 123.6 (CTAF) 0</p>



PAC, 09 FEB 2012 to 05 APR 2012

PAC, 09 FEB 2012 to 05 APR 2012



<p>MIRL Rwy 8-26 REIL Rwys 8 and 26</p> <p>FAF to MAP 8.3 NM</p> <table border="1"> <tr> <td>Knots</td> <td>60</td> <td>90</td> <td>120</td> <td>150</td> <td>180</td> </tr> <tr> <td>Min:Sec</td> <td>8:18</td> <td>5:32</td> <td>4:09</td> <td>3:19</td> <td>2:46</td> </tr> </table>	Knots	60	90	120	150	180	Min:Sec	8:18	5:32	4:09	3:19	2:46	<table border="1"> <tr> <td>1400</td> <td>2600</td> <td>SN</td> </tr> <tr> <td>BRG 216°</td> <td></td> <td>312</td> </tr> </table> <table border="1"> <tr> <td>1060-1</td> <td>1060-1¼</td> <td>1060-2¼</td> <td>1060-2½</td> </tr> <tr> <td>789 (800-1)</td> <td>789 (800-1¼)</td> <td>789 (800-2¼)</td> <td>789 (800-2½)</td> </tr> </table> <table border="1"> <tr> <td colspan="4">DME MINIMUMS</td> </tr> <tr> <td>CIRCLING</td> <td>940-1</td> <td>669 (700-1)</td> <td>940-2</td> </tr> <tr> <td></td> <td></td> <td></td> <td>669 (700-2)</td> </tr> <tr> <td></td> <td></td> <td></td> <td>940-2¼</td> </tr> <tr> <td></td> <td></td> <td></td> <td>669 (700-2¼)</td> </tr> </table>	1400	2600	SN	BRG 216°		312	1060-1	1060-1¼	1060-2¼	1060-2½	789 (800-1)	789 (800-1¼)	789 (800-2¼)	789 (800-2½)	DME MINIMUMS				CIRCLING	940-1	669 (700-1)	940-2				669 (700-2)				940-2¼				669 (700-2¼)
Knots	60	90	120	150	180																																										
Min:Sec	8:18	5:32	4:09	3:19	2:46																																										
1400	2600	SN																																													
BRG 216°		312																																													
1060-1	1060-1¼	1060-2¼	1060-2½																																												
789 (800-1)	789 (800-1¼)	789 (800-2¼)	789 (800-2½)																																												
DME MINIMUMS																																															
CIRCLING	940-1	669 (700-1)	940-2																																												
			669 (700-2)																																												
			940-2¼																																												
			669 (700-2¼)																																												

TINIAN ISLAND, CO
Amdt 1C 09015

15°00'N-145°37'E

TINIAN INTL (TNI)(PGWT)
NDB-A

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C

Personnel Contacted



Appendix C: Personnel Contacted

Name	Organization	Title
Renaldo Advinula	Star Marianas Airline	Station Manager
John Baraina	TNI (CPA)	Fire/Rescue and Police
Anthony Calvo	FAA ARTCC Guam	Enroute Supervisor
Raymond Carbella	Saipan ATC Tower	Air Traffic Controller
MSgt Wendell Carver	36 th OSS/OSA	Deputy Chief Controller
Eric Cleveland	HDR	Airspace/Airfield Analyst
James Colson	36 th WG/OSS	Airspace Manager
Tim Cornelison	FAA Guam ARTCC	Air Route Center Manager
Gerald Crisostomo	TNI (CPA)	Asst Port Manager
Michelle Cruz	FAA WSA	Via telecom
James Diaz	CPA	Fire Chief (Saipan & Tinian)
James Duke	PACAF/A3O	Airspace Manager
Amjad Farhoud	Freedom Air	Pilot
Carol Gaudette	PACAF/A7P	Requirements Branch Chief
Tim Glickman	PACAF/A3O	Airspace Manager
MSgt Michael Hammond	PACAF/PAX	Plans Division Manager
Rob Henry	FAA WSA	Via telecom
Julie Hong	PACAF/A7P	Booz, Allen, Hamilton
Joaquin Kileleman	GSN (CPA)	Airport Operations Supervisor
Greg Lee	PACAF/A7P	Community Planner
Jeff LeVault	PACAF/A5U	Booz, Allen, Hamilton
Maryann Lizama	CPA	Acting Director/Port Manager
Ed Lynch	HDR	Key Pursuits Leader
Bernard Marcos	PACAF/A7P	Civil Engineer
MSgt Anthony Matthews	36 th OSS/OSA	Deputy Airfield Manager
Ed Mendiola	GSN (CPA)	Airport Manager
Joseph Mendiola	TNI (CPA)	Port Manager
Lt Col William Percival	36 th MRS/DO	Ops Officer Combat Readiness
Steve Pyle	HDR	Project Manager
Terry Pyle	FAA ARTCC Guam	Operations Manager
Nick Sablan	GSN (CPA)	Captain, Fire Department
Jush Sanchez	TNI (CPA)	Fire/Rescue and Police
Ron Simpson	FAA Airport Division	Airport Division Manager
Greg Spencer	PACAF/A7P	Community Planner
TSgt Chad Thompson	36 th OSS/OSA	Air Traffic Controller
John Thompson	36 th CES/CEF	Chief, Fire and Rescue
Stanley Torres	36 th CES/CEF	Deputy Chief, Fire and Rescue

Name	Organization	Title
Maj Peter Toves	PACAF/A5U	Requirements Branch Chief
Cardiff Walker	Freedom Air	Pilot
Lt Col Adrienne Williams	36 th WG/SE	Chief of Safety
Gordon Wong	FAA Airport Division	Airport Specialist
Steve Wong	FAA Airport Division	Airport Specialist
Brian Yamada	FAA Honolulu ARTCC	Via telecom

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