Okinawa Rail

Ie Shima VIP Helipad LZ

Final

Environmental Review for Basing MV-22 Aircraft at MCAS Futenma and Operating in Japan

Bambi Bucket

Camp Fuji

MCAS Futenma

MV-22 Osprey

April 2012

How to Use This Document

The Marine Corps' goal is to provide you with a reader-friendly document that presents a thorough, accurate analysis of the current environment and the proposed action and its potential environmental impacts. The organization of this Final Environmental Review, or Final ER, is shown below. Because of their size, the appendices for this document have been included on CD located in the back cover for ease of handling and reference.

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Final

Environmental Review for Basing MV-22 at MCAS Futenma and Operating in Japan

April 2012

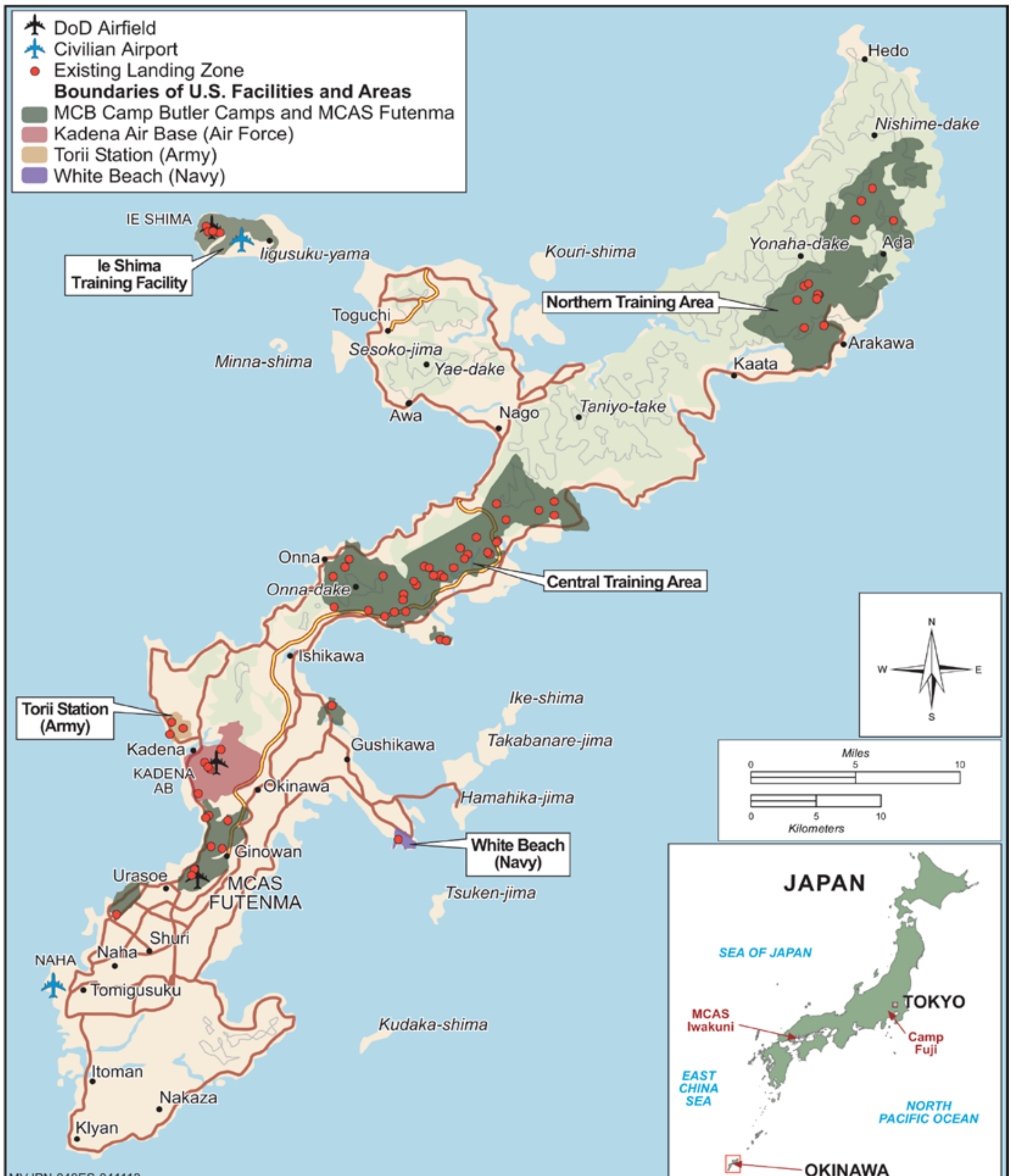
ACRONYMS AND ABBREVIATIONS

˚F	degrees Fahrenheit
1st MAW	First Marine Aircraft Wing
AB	Air Base
AESO	Aircraft Environmental Safety Office
AGL	above ground level
AICUZ	Air Installations Compatible Use Zones
APZ	Accident Potential Zone
BASH	Bird/Wildlife-Aircraft Strike Hazard
BHC	Bird Hazard Condition
CAL	Confined Area Landings
Camp Fuji	Combined Arms Training Center Camp Fuji
CNEL	Community Noise Equivalent Level
$CNEL_{mr}$	Onset-Rate Adjusted Monthly Community Noise Equivalent Level
CO	carbon monoxide
CO_2e	equivalent carbon dioxide
cps	cycles per second
CTA	Central Training Area
CZ	Clear Zone
dB	decibel
dBA	A-weighted decibel
dBG	G-weighted decibel
DNL	Day-Night Average Sound Level
DoD	Department of Defense
DoN	Department of the Navy
EQS	Environmental Quality Standards
E.O.	Executive Order
ER	Environmental Review
FAA	Federal Aviation Administration
FCLP	Field Carrier Landing Practice
FY	Fiscal Year
GHG	greenhouse gas
GoJ	Government of Japan
HC	hydrocarbons
Hz	hertz
IFR	Instrument Flight Rules
ISTF	Ie Shima Training Facility
JEGS	Japan Environmental Governing Standards
JGSDF	Japan Ground Self-Defense Force
JMSDF	Japan Maritime Self-Defense Force
JWTC	Jungle Warfare Training Center
L_{dnmr}	Onset Rate-Adjusted Monthly Day-Night Average Sound Level
LEED	Leadership in Energy and Environmental Design
LFN	low-frequency noise
LHA	Landing Helicopter Assault
LHD	Landing Helicopter Dock
L_{max}	Maximum Sound Level
LZ	Landing Zone
MAG	Marine Aircraft Group
MCAS	Marine Corps Air Station
MCB	Marine Corps Base
MCIPAC	Marine Corps Installations Pacific
MCO	Marine Corps Order
MEF	Marine Expeditionary Force
MOE	Ministry of the Environment
mph	miles per hour
MSL	mean sea level
MWLK	Marine Wing Liaison Kadena
NAV	Navigation
NAWCAD	Naval Air Warfare Center Aircraft Division
NO_x	nitrous oxides
nm	nautical mile
NTA	Northern Training Area
OPG	Okinawan Prefectural Government
OPNAVINST	Office of the Chief of Naval Operations Instruction
PM_{10}	particulate matter less than or equal to 10 microns in diameter
ppm	parts per million
RAICUZ	Range Air Installations Compatible Use Zones
SC LZ	LZs scheduled for construction
SEL	Sound Exposure Level
SEL_r	Onset-Rate Adjusted Sound Exposure Level
SO_2	sulfur dioxide
SUA	Special Use Airspace
TERF	Terrain Flight
UFC	Unified Facilities Criteria
$\mu g/m^3$	micrograms per cubic meter
U.S.	United States
U.S.C.	United States Code
USEPA	United States Environmental Protection Agency
USFJ	United States Forces Japan
USMC	United States Marine Corps
VFR	Visual Flight Rules
VIP	Very Important Person
VOC	volatile organic compound
VTOL	vertical take-off and landing
WECPNL	Weighted Equivalent Continuous Perceived Noise Level

Executive Summary

EXECUTIVE SUMMARY

Marine Corps Installations Pacific (MCIPAC) prepared this Environmental Review (ER) to evaluate the potential environmental impacts of basing two MV-22 squadrons at Marine Corps Air Station (MCAS) Futenma and operating the MV-22 at United States (U.S.) facilities and areas in Japan. The MV-22 aircraft would replace an equal number of aging CH-46E helicopters currently stationed at MCAS Futenma in Okinawa, Japan. The U.S. Marine Corps (USMC) anticipates the initial deployment of the MV-22 to Okinawa by the end of Fiscal Year (FY) 2012. However, a final determination on that date has not been made.



Two MV-22 squadrons would be based at MCAS Futenma, conduct training at LZs on Okinawa, and deploy to bases on mainland Japan.

The MV-22 is a highly-capable aircraft with an excellent operational safety record. The aircraft combines the vertical capability of a helicopter with the speed and range of a fixed-wing aircraft. Its capabilities would significantly strengthen Marine Expeditionary Force's (III MEF's) ability to assist in the defense of Japan, perform humanitarian assistance and disaster response, and fulfill other Alliance roles.

A major component of training for the MV-22 aircrews would consist of Confined Area Landing (CAL) operations at existing tactical Landing Zones (LZs) located within U.S. facilities and training areas on Okinawa[1]. These LZs are already used by the CH-46E squadrons. Although the aircraft would be based at MCAS Futenma, portions of a squadron (two to six MV-22s) would deploy monthly for 2 to 3 days to the Combined Arms Training Center Camp Fuji (Camp Fuji) and MCAS Iwakuni on mainland Japan.[2] During these brief deployments, the MV-22 squadrons would conduct training operations within established training areas and airspace over mainland Japan. On occasion, longer deployments could occur as a result of actions such as assisting in the defense of Japan, training exercises, or humanitarian/disaster relief.

Basing the MV-22 at MCAS Futenma and operating it in Japan would not result in significant harm to the environment especially because the MV-22:

- **Has an excellent safety record with an average of 1.12 mishaps/100,000 flying hours**
- **Generates less noise during almost all modes of flight except arrivals**
- **Would conduct fewer overall airfield and LZ training operations on Okinawa**
- **Flies, on average, at a higher altitude than CH-46Es**

This ER was prepared to comply with Executive Order (E.O.) 12114, *Environmental Effects Abroad of Major Federal Actions*, DoD Directive 6050.7, *Environmental Effects Abroad of Major Department of Defense Actions*, and Marine Corps Order (MCO) P5090.2A, *Environmental Compliance and Protection Manual, Change 2* (May 2009), which establishes procedures and policy on taking environmental considerations into account for federal actions outside of the U.S. and its territories and possessions. The review also integrates applicable conformance requirements from the Japan Environmental Governing Standards (JEGS) (updated 2010). Important areas that were analyzed during the ER process include:

- **Aircraft Safety** • **Aircraft Noise** • **Natural Resources** • **Cultural Resources**

LOCATIONS OF THE PROPOSED ACTION

To accomplish basing of the MV-22 and meet training requirements, the proposed action would involve use of installations, training areas, and established Special Use Airspace (SUA) on Okinawa and mainland Japan. For Okinawa, the focus of activity under the proposed action, the MV-22 squadrons would use the following locations:

- **MCAS Futenma** – Situated on the southern third of the island, this air station supports 57 based aircraft as well as transient (not based) aircraft operations. As the base for the CH-46E

[1] Okinawa includes Okinawa-honto, or the main island, and the other Ryukyu Islands. Okinawa in this document refers to Okinawa-honto where MCAS Futenma, Northern Training Area, Central Training Area, and Kadena Air Base are located. Ie Shima is one of the Ryukyu Islands and contains the Ie Shima Training Facility.

[2] The term "mainland Japan" is used herein not as an official geographic name but rather as a means to distinguish the group of islands mainly Hokkaido, Honshu, Kyushu, and Shikoku from Okinawa.

helicopters, MCAS Futenma would form the site for basing the MV-22 squadrons. It would be home to the MV-22 squadrons' operational, maintenance, and administrative personnel.

- **Training Areas and LZs** – The MV-22 squadrons would conduct training and readiness operations within three existing training areas within Okinawa: Ie Shima Training Facility (ISTF), Northern Training Area (NTA), and Central Training Area (CTA). These training areas support tactical LZs, which the CH-46E squadrons currently use. MV-22 squadrons propose to use a total of 50 tactical LZs for required CAL operations. Field Carrier Landing Practice (FCLP) would continue to occur at the simulated "deck" at ISTF complex. Additionally, the NTA contains a Terrain Flight (TERF) route along which the CH-46Es currently fly at low-altitudes (50 to 200 feet above ground level [AGL]). MV-22 squadrons would rarely use this TERF route and only when other options (i.e., simulators) become unavailable. MV-22 operations in the training areas would require transit flights from and to MCAS Futenma.

MV-22 aircrews would conduct FCLP operations at the "LHD Deck" on Ie Shima. AV-8B Harriers and helicopters would continue to train here also.

- **New LZs Scheduled for Construction (SC)** – The Government of Japan (GoJ) currently is constructing six new tactical SC LZs in the NTA that will become part of U.S. facilities when complete. These SC LZs are being analyzed in this ER to determine potential impacts to the environment should they be used for MV-22 training operations in the future. Although the GoJ prepared an Environmental Assessment Report (former Naha DFAB 2006) addressing the impacts of site clearing, LZ construction, and infrastructure development, it did not evaluate current or proposed operations, such as those by the MV-22.

- **Kadena Air Base (AB)** – Operated by the U.S. Air Force, Kadena AB lies about 5 miles north of MCAS Futenma. Currently, aircraft from the CH-46E squadrons visit Kadena AB about three times per month to load small caliber (e.g., 0.50 caliber) ammunition for training on off-shore targets. The MV-22 squadrons would continue this practice.

Although important, the training activities on mainland Japan would account for a much smaller part of the MV-22 regimen. Currently, the CH-46E squadrons do not use the facilities and airspace described below:

- **Camp Fuji and MCAS Iwakuni** – Under typical training conditions, a squadron detachment (varying from two to six aircraft) would deploy to and conduct training from these installations for 2 to 3 days monthly. Training frequency and number of aircraft could vary depending on mission and other

The MV-22s ability to fly like an airplane allows it to fly to facilities on mainland Japan.

requirements. Longer deployments could occur for training in response to assist in the defense of Japan, or humanitarian and disaster relief. Occasionally, the detachments could deploy to other installations in Japan. The detachments would conduct the full range of training operations available and allowable at these and related locations.

- **Navigation (NAV) Routes** – MV-22 squadrons would conduct training flights (down to 500 feet AGL) along a suite of six NAV routes during the detachment deployments described above. Five of these existing NAV routes overlie mainland Japan and the sixth extends over the ocean north of Okinawa; existing use by FA-18s and AV-8Bs dominate these routes and would continue under the proposed action.

PURPOSE AND NEED FOR THE ACTION

The purpose of the proposed action is to implement the USMC aviation plan by replacing all existing CH-46E aircraft in Japan with two MV-22 squadrons at MCAS Futenma to operate in support of the U.S.-Japan Alliance. The USMC plan defined in Fiscal Year (FY) 2011 envisions that, by 2025, USMC aviation will be a, "fast, lethal expeditionary force that is ready for the uncertainties of future combat operations, yet has the staying power of engagement in the most austere conditions imaginable." To support the aviation plan, the USMC proposes to enhance its aircraft inventory and reorganize its forces in the Pacific. Proposed basing of MV-22 squadrons in Okinawa represents one step towards achieving these overall goals.

The MV-22 introduces a revolutionary change in capabilities absent in helicopters – a leap forward in speed, payload, and range.

The two MV-22 squadrons (each with 12 aircraft) proposed at MCAS Futenma would operate at U.S. facilities and areas in Japan to support the U.S.-Japan Alliance, training of USMC combat forces, and humanitarian missions in the region. The MV-22s would improve and modernize medium-lift capability to support the III MEF, as part of the USMC aviation plan. As a self-sufficient USMC air and ground combat force, the III MEF has the mission to fight as an integrated team and respond on short notice to war contingencies or humanitarian missions. In addition, the USMC seeks to efficiently and effectively maintain combat capability and mission readiness as it faces increased deployments across a spectrum of missions. As such, the proposed action would ensure that the MV-22 squadrons have ready access to existing airfields, training areas, LZs, and airspace to conduct required training and readiness operations. In short, the USMC could continue to train as it fights, using improved, more effective aircraft. Additionally, the proposed basing action would support the III MEF mission, while making use of existing facilities to the greatest extent practicable and preventing impacts to combat capability and mission readiness during the transition.

In terms of need, the proposed basing of MV-22 aircraft in Japan would form part of a USMC-wide process of replacing its aging fleet of medium-lift helicopters with more advanced, operationally-capable aircraft. A large part of the need centers on meeting current and future force structure requirements in the USMC aviation plan. As such, the MV-22 squadrons would replace two squadrons of the existing fleet of less-capable, 1980s-era CH-46E medium-lift helicopters currently based and operating in Japan. Current and future trends in asymmetrical warfare would make the slower and lower flying CH-46Es more vulnerable to attack. The MV-22 introduces a revolutionary change in capabilities absent in helicopters – a leap forward in speed, payload, and range. It utilizes tiltrotor technology that provides the maneuverability and lift of a helicopter and, in fixed-wing mode, provides the ability to fly roughly twice as fast, four times as far, and carry three times the combat or humanitarian mission load of the CH-46E. Replacement of the CH-46E helicopters with the MV-22 would modernize the USMC medium-lift fleet, improve the operational capabilities of the III MEF, limit vulnerabilities in expected combat situations, and maintain combat and mission readiness.

PROPOSED ACTION

The proposed action would consist of the following main components:

- **<u>Basing MV-22 Aircraft at MCAS Futenma</u>**
  - Basing two MV-22 squadrons (24 aircraft) at MCAS Futenma to replace two CH-46E helicopter squadrons (24 aircraft) currently at the installation;
  - Decommissioning, demilitarizing, and dismantling existing CH-46E aircraft and processing them for recycling at Camp Kinser;
  - Conducting MV-22 flight operations at the existing airfield;
  - Emplacing two MV-22 simulators on a new concrete pad at the installation; and
  - Replacing approximately 400 military personnel authorizations at MCAS Futenma (no net change in total personnel) to operate, maintain, and support the MV-22 aircraft.
- **<u>Training and Readiness Operations</u>**
  - Performing training and readiness operations at training areas and 50 tactical LZs on Okinawa;
  - Using, when constructed, six LZs established by the Government of Japan (GoJ) to replace existing LZs in the Northern Training Area;
  - Loading small-arms ordnance at the same location at Kadena Air Base (AB) as currently used by CH-46E aircraft;
  - Conducting short-duration (two to three days) deployments of detachments (two to six aircraft) of MV-22s to Camp Fuji and MCAS Iwakuni on mainland Japan; and
  - Training along existing NAV routes over mainland Japan.

Basing the MV-22 at MCAS Futenma

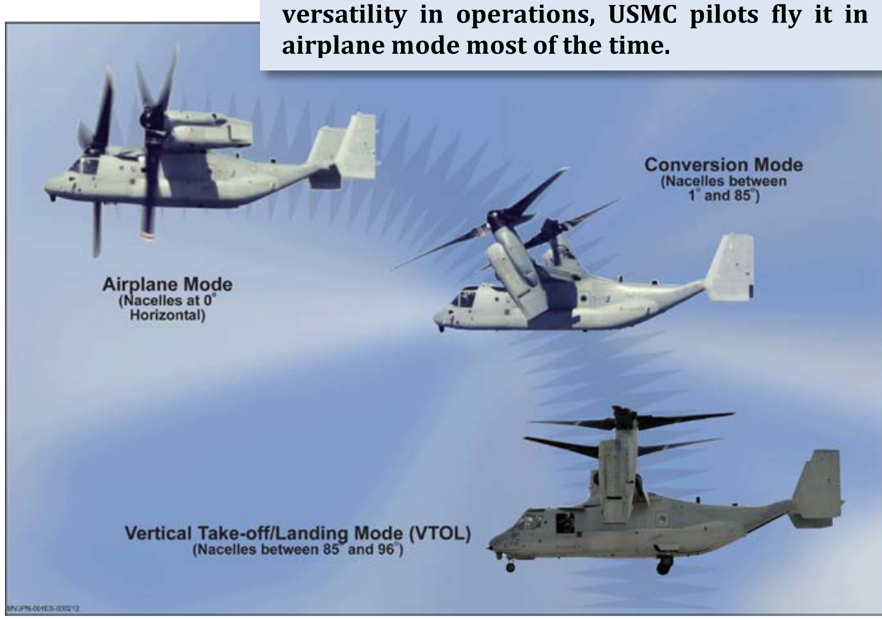
Under the proposed action and defined by the concept of operations for MV-22 basing, MCAS Futenma would comprise the location where most operations would originate, personnel would work, and basic maintenance would occur. MCAS Futenma, constructed in 1945, serves an essential role for USMC deployment of aircraft in the Far East, offering hangars, maintenance facilities, housing, fuel storage, a control tower, and other support services necessary for the USMC mission.

***Aircraft Basing and Removal*.** Under the proposed action, the USMC would replace the 24 based CH-46E helicopters with the MV-22 tiltrotor aircraft on a one-for-one basis. USMC anticipates initial deployment of the MV-22 to Okinawa MCAS Futenma at the end of fiscal year 2012. However, a final determination of that date has not been made. No net change in total based aircraft would result from the proposed action. Other based aircraft at MCAS Futenma would continue to include USMC helicopters (CH 53E, AH-1W, and UH-1N) and transports (UC-12W, UC-35D, and KC-130J).

Trained and qualified USMC personnel would decommission, dismantle, and/or demilitarize the retired CH-46Es in accordance with Department of Defense (DoD) Manual 4160.28-M-V1, June 7, 2011 and other applicable guidance. The process to decommission the helicopters would involve removal of all fuel, oil, lubricants, hazardous materials, and any sensitive components or instrumentation prior to processing them for recycling. The CH-46Es will undergo the demilitarization process at Camp Kinser by Defense Logistics Agency Disposition Services personnel. This common process, guided by existing safety and environmental procedures, poses no environmental threats.

MV-22 Flight Operations at MCAS Futenma. To provide the training necessary for combat readiness, the MV-22 would conduct operations at the MCAS Futenma airfield. During training activities, the MV-22 would be operated in different flight modes to maximize its capabilities as both an "airplane" and a "helicopter." Operational elements of these modes include hovering and landing (vertical take-off and landing [VTOL] mode), vertical flight, horizontal flight (airplane mode), and transition (conversion mode) from one state to another. Typically, USMC pilots fly the MV-22 in airplane mode. Flying in VTOL mode would account for about 5 percent (or less) of total flight time for the MV-22. The MV-22 operates in this mode only for take-offs and landings, transitioning to airplane mode quickly in order to take advantage of the increased speed and range. Hovering would occur during some landings and take-offs, commonly lasting only for a few seconds.

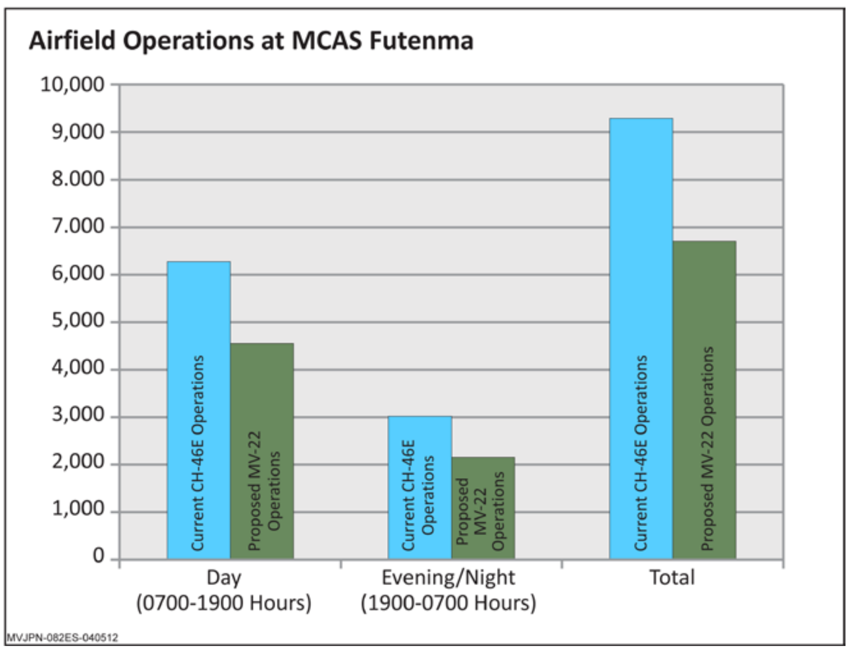
While the tiltrotor design gives the MV-22 versatility in operations, USMC pilots fly it in airplane mode most of the time.



Replacement of the 24 CH-46E helicopters with an equal number of MV-22 aircraft would reduce overall operations at MCAS Futenma by 11 percent (about 2,600 operations annually). A substantial decrease in the need for conducting pattern work and increased use of sophisticated simulators would account for this expected reduction in total airfield operations. Operations by MV-22 squadrons during after dark hours (evening = 1900 to 2200 hours; night = 2200 to 0700 hours) would also decrease by a combined 15 percent. Overall, the MV-22 would fly like an airplane most (95 percent or more) of the time, operating like a helicopter (in VTOL) mode only for take-offs and landings.

Two terms describe different components of aircraft flying activities: *sortie* and *operation*. A *sortie* consists of the flight of a single military aircraft from take-off through landing, and includes a flying mission. An *operation* can apply to an airfield, an LZ, or airspace unit. At an airfield, an *operation* consists of a single aircraft movement such as a landing or take-off, or can include a low approach. For an LZ, each landing and each take-off represents an *operation*. During a single *sortie*, an aircraft may conduct a number of *operations*.

***Emplacing MV-22 Simulators*.** The MV-22 squadrons would use existing facilities and infrastructure at MCAS Futenma with a single facility upgrade planned in association with the proposed action. Two containerized simulator facilities for the MV-22 would be emplaced on an extension of an existing concrete pad, affecting 5,500 square feet and creating 0.13 acres of new impervious surface. These sophisticated simulators would enhance safety by providing aircrews the ability to practice realistic emergency procedures without actual flying. In addition, fewer low-altitude flights would be necessary.



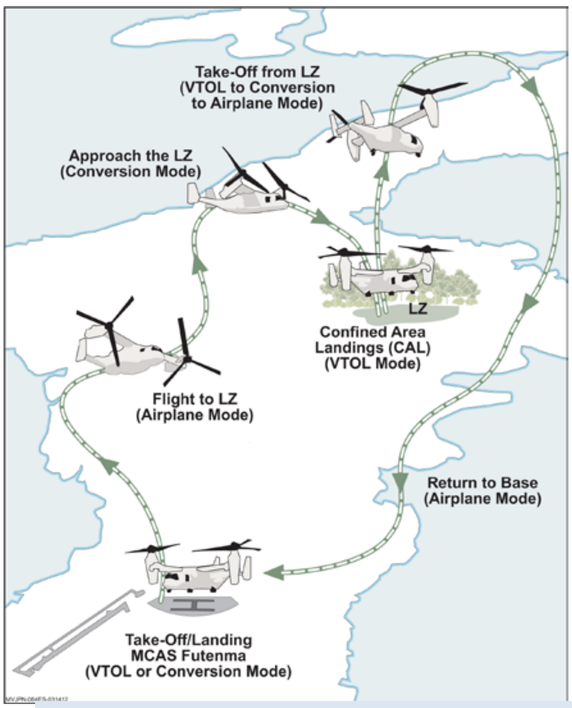
***Replacing Personnel*.** Basing the MV-22 at MCAS Futenma would provide expanded capabilities with no net change in military personnel authorizations. Assigned military personnel associated with the two MV-22 squadrons would total approximately 400, the same as for the CH-46E squadrons being replaced. Personnel would include aircrews for the MV-22s, maintenance and ground operations staff, and administrative and support personnel. Pilots and crew arriving with the MV-22s would be trained and experienced personnel already capable of operating and maintaining the aircraft.

Training and Readiness Operations

MV-22 with Bambi Bucket®

MV-22 offers greater capabilities for firefighting and humanitarian missions.

Training and readiness operations for both MV-22 squadrons would focus on providing USMC commanders with combat-capable and ready squadrons to perform essential missions: operations from expeditionary sea- and land-based sites, assault support, and air evacuation. These training activities are performed in training areas, on LZs, and in overwater special use airspace (SUA) designated as Warning Areas. On Okinawa, the MV-22 squadrons would rarely fly along the TERF route, and only when simulators are unavailable. In addition to training and assisting in the defense of Japan, MV-22 squadrons would provide emergency support to the community and region under mutual emergency operations agreements. Wildland firefighting in the training areas using "Bambi Buckets®" to transport and dump water represents an important function. The Bambi Buckets used by the MV-22s can transport three times the amount of water than the CH-46E buckets can carry. Other roles would include humanitarian assistance and disaster relief.



MV-22 squadrons would conduct CAL operations at existing LZs.

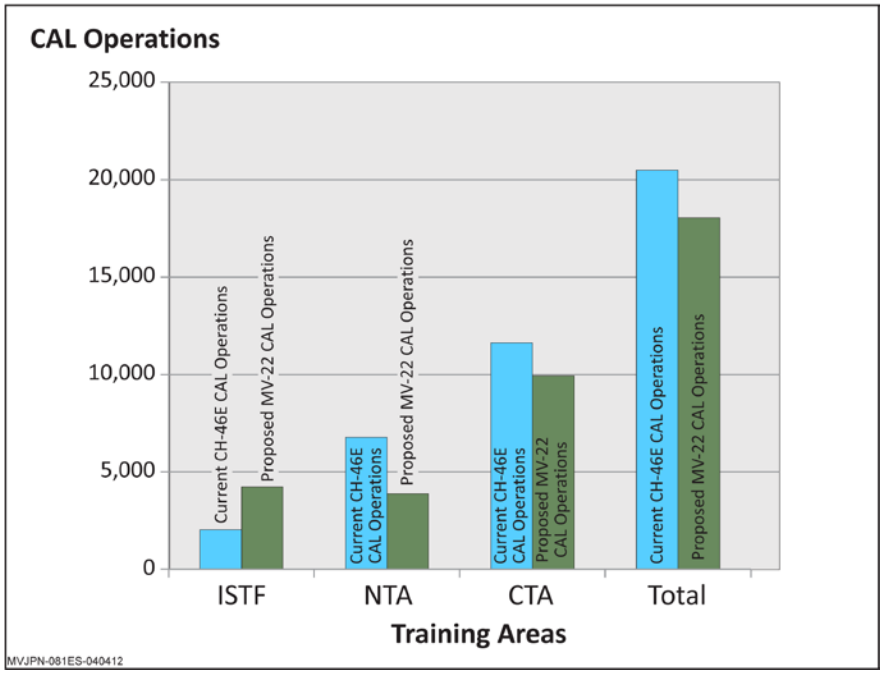
Existing Landing Zones. An essential function of the MV-22 squadrons is to make shipboard departures and quickly transport personnel, equipment, and supplies inland to forward combat areas while avoiding the need for beachhead or interim transfers. To accomplish these missions, MV-22 aircrews must be able to effectively and efficiently locate, approach, land on, and depart from LZs that reflect reality in terms of terrain, accessibility, and vegetation, and offer a variety of circumstances and conditions. This training, known as CALs, would use 50 existing tactical LZs situated within the ISTF, NTA, and CTA.

An ***Administrative LZ*** *is used occasionally for emergency or special purposes, such as VIP transport or medical evacuations.*

A Tactical LZ *is used routinely for training activities, such as CALs.*

CALs include a landing and takeoff at an LZ within the defined landing pad. All of these training locations consist of existing U.S. facilities and areas currently used by the CH-46E helicopters. CAL training at these 50 tactical LZs would decrease overall by about 12 percent from current conditions, with a decrease in the use of LZs in the NTA and CTA and an increase in operations for the ISTF complex. A total of 16 percent of the tactical LZs would receive Frequent use

(1,260 CAL operations per year), 25 percent would receive Average use (420 CAL operations per year), and the remainder (59 percent) would be slated for Rare use (14 CAL operations per year). In addition, the MV-22 squadrons would perform FCLP on the existing simulated "deck" at the ISTF, accounting for approximately 2,500 operations annually.



A total of 19 Administrative LZs are located within the developed portions of installations on Okinawa, including Camp Butler and MCAS Futenma. Situated on sites with developed landing pads, parking areas, or parts of runways/taxiways, all Administrative LZs would be used minimally (≤4 operations per year) by the MV-22 squadrons for transport rather than training. Kadena AB, located just north of MCAS Futenma, would be used only for ordnance loading as is currently done by the CH-46E aircrews (approximately three times per month per aircraft).

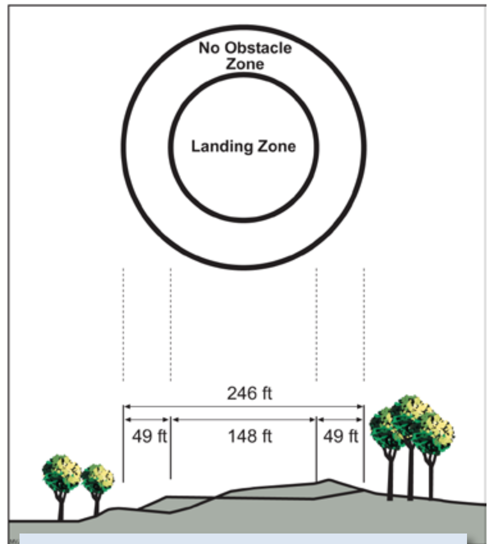
LZ 17 in the NTA

LZ Flamingo in the CTA

Administrative LZ at MCAS Futenma

Although the MV-22 squadrons need low-altitude training, the aircrews would rarely fly along the TERF route in the NTA. Most of this type of training would be achieved through the use of simulators. However, circumstances may arise when an MV-22 aircrew needs to use the TERF route. An estimated 25 MV-22 operations annually would involve flying this TERF route. MV-22 pilots would tend to fly, on average, higher than the CH-46Es. Actual low-altitude training for the MV-22 aircrews would predominantly be achieved by transiting between LZs and during deployments. Under the proposed action, the remainder of the existing based helicopter crews would continue to fly the TERF route at the same frequency (about 1,200 operations per year).

LZs Scheduled for Construction. The GoJ currently is constructing six new tactical LZs in the NTA that will become part of U.S. facilities and areas when complete. Designated LZs scheduled for construction (SC LZs) for this ER, these sites would replace existing LZs within lands being returned to the GoJ from U.S. areas and facilities. Including a developed landing pad, each SC LZ would measure approximately 250 feet in diameter, covering about 1.1 acres of cleared land. Although the GoJ prepared an Environmental Assessment Report addressing the impacts of site clearing, LZ construction, and infrastructure development, it did not evaluate current or proposed operations in general or for the MV-22 specifically. Therefore, these six SC LZs are being analyzed in this ER to determine potential impacts to the environment should they be used for MV-22 training operations in the future. At this time, the USMC estimates each new LZ would receive Average use (420 operations per year).



The new SC LZs would be cleared and include a landing pad.

Ordnance Loading at Kadena AB. The MV-22 squadrons propose to fly the short distance (about 4.5 nautical miles) from MCAS Futenma to Kadena AB in order to load live ammunition primarily for use by the aircrew for training with the on-board weapons which include a GAU-17 7.62 millimeter mini-gun, a 7.62 millimeter M240D machine gun, and two .50 caliber machine guns. Currently, the CH-46E squadrons also perform ordnance loading for a 7.62 millimeter gun and a .50 caliber machine gun. All loading would occur in existing authorized areas off the flightline and would adhere to all safety procedures. Based on training requirements, the MV-22 aircrews would need to practice firing guns three times per month, on average, so the squadrons would conduct a total of approximately 1,200 operations (landings and take-offs) at Kadena AB each year for ordnance loading, similar to that performed by the CH-46E squadrons. Training to fire the guns would continue to use authorized targets at overwater ranges.

Detachment Deployments. Additional training would involve deploying detachments of MV-22s (two to six aircraft) to MCAS Iwakuni and Camp Fuji on mainland Japan for an average of two to three days per month. On occasion, longer deployments could occur and more aircraft could participate. Other bases in Japan may also be used for deployments from time to time. At Camp Fuji, the deployed MV-22 detachments are anticipated to fly approximately 500 annual operations for a 10 percent increase in overall activity at that location. For MCAS Iwakuni, a similar number of annual MV-22 operations would be expected, on average, and account for a 0.8 percent increase in total airfield operations. Such small increases commonly fall within the normal year-to-year variation in operations at these airfields.

As part of these deployments, the MV-22 squadrons may, at times, fly along predetermined and defined routes for NAV training. Flight proficiency requires consistent, realistic training, including navigation and tactics. The MV-22 squadrons would conduct a portion of their required navigation training along a suite of six existing NAV routes with five of these routes extending as corridors over portions of mainland Japan, and one extending north of Okinawa over small islands and the East China Sea. The USMC expects that the MV-22 squadrons would likely fly on one or more of these NAV routes during each day of deployment, conducting a total of 330 operations annually on each route. These added operations would result in increases in use averaging 21 percent for all routes, with the other primary users consisting of AV-8B Harriers and FA-18 Hornets. MV-22 operations would use altitudes of 500 feet AGL or greater, and fly at airspeeds of 120 to 250 knots, depending upon the flight mode.

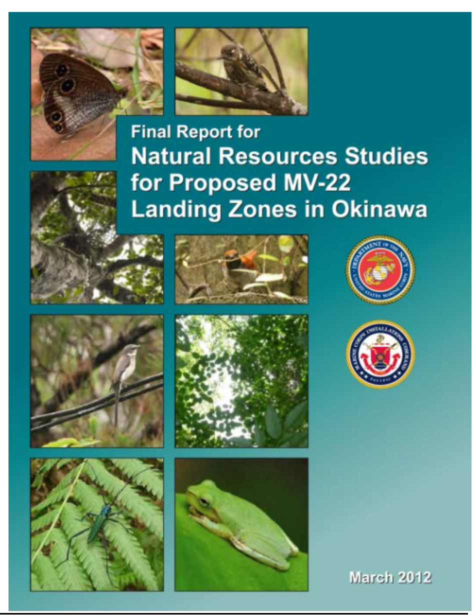
ORGANIZATION OF DOCUMENT

This ER is organized to assist the reader in understanding the proposed action and its impacts at the various locations involved. Chapter 1 presents the background, purpose, and need for basing and operating the MV-22s. Chapter 2 provides a detailed description of all the components of the proposed action divided according to basing at MCAS Futenma and operating the MV-22 squadrons at U.S. facilities and areas in Okinawa and mainland Japan. Chapter 3 focuses solely on describing existing conditions for MCAS Futenma and assessing the environmental impacts of basing the MV-22 at that installation. Chapter 4 addresses operating the MV-22, examining both current conditions and potential impacts, at LZs, training areas, airspace, and other facilities. Chapters 5 through 7 provide administrative data on preparers, references, and distribution of the ER. A total of four technical appendices offer substantial detail on operations, safety (fire, rotorwash), noise, and natural resources.

SUPPORTING STUDIES

This ER utilizes the results of three independent studies conducted in relation to the basing of the MV-22 at MCAS Futenma and its operations in Japan. These studies, discussed below, offer objective information on components of the proposed action and certain potential impacts separate from the ER. Each study is included as an appendix to the ER.

- *Aircraft Noise Study for the Basing of the MV-22 at MCAS Futenma and Operating in Japan* (Wyle 2012). This detailed noise study examined the current and proposed noise levels for MCAS Futenma, the ISTF, and a representative sample of LZs in the NTA and CTA. Based on the best available data for operations, flight tracks, and profiles for all aircraft, this study employed approved DoD noise modeling software and metrics to identify changes in noise conditions and potential impacts to specific points of interest (Appendix C).



- *Natural Resources Studies for Proposed MV-22 Landing Zones in Okinawa* (EAC 2012). Performed by an experienced and local Okinawa team of biologists, flora and fauna surveys were conducted during the summer of 2011 at 35 LZs in order to identify any Protected Species found on and around the LZs and to update vegetation mapping of the areas. Methods used in these surveys adhered to standards consistently employed on Okinawa (Appendix D).

- *MV-22 Site Evaluation Report for Marine Corps Bases Japan (*The Boeing Company 2010). This detailed two-volume study examined all potential LZs at the ISTF, NTA, CTA, and Administrative areas for their suitability to support MV-22 operations. The survey documented the size, configuration, development, and access for 89 existing LZs, providing detailed descriptions, maps, and photographs (The Boeing Company 2010).

SUMMARY OF ENVIRONMENTAL IMPACTS

In accordance with DoD Directive 6050.7 (E2.5.3), an ER must "enable DoD officials to be informed and take account of environmental considerations when authorizing or approving certain major federal actions that may do significant harm to the environment of places outside the U.S." The ER analyzes the potential environmental impacts resulting from implementation of the proposed action according to component, geographic location, and resource. As detailed below, the proposed action overall would result in minimal impacts and would not change current conditions for most resources. The most notable potential impacts would be confined to limited portions of four LZs in the NTA where two protected bird species (Okinawa rail and Japanese wood pigeon) have been found in the past. To ensure that no significant harm occurs to these species, the USMC would conduct annual surveys and would, if appropriate, institute mitigation measures to reduce potential impacts to less than significant levels. For all other resources, the analysis established no potential for significant harm to the environment from the proposed action.

Overall, implementing the proposed action would not change the natural or human environment relative to current conditions for several reasons:

- **The number of aircraft would not change.**
- **Operations by all aircraft, based or operating, at MCAS Futenma would decrease by 11 percent.**
- **No net change to personnel would occur.**
- **Expansion of a concrete pad on which to emplace MV-22 simulators would affect 0.13 acre.**
- **Overall CAL operations would decrease by 12 percent.**

Addition of MV-22 operations at Camp Fuji, MCAS Iwakuni, and on the NAV routes on mainland Japan would represent a negligible (<1 percent) to minimal (10 percent) change in activity. To characterize the impacts of the proposed action and associated circumstances, Table ES-1 summarizes the magnitude of those impacts for all the affected locations and resources. Analysis demonstrated that three levels of impacts applied:

- **None** – No change to the overall conditions or nature of the resource would result from implementing the proposed action.
- **Minimal** – Changes or impacts to some aspect of the overall conditions or nature of a resource would result from implementing the proposed action, but such changes or impacts would not be readily perceptible, would be limited in geographic scope and/or duration, and would not require any modifications to the proposed action or reduction/avoidance measures.
- **Moderate/Significant** – Moderate changes or impacts to some aspect of the overall conditions or nature of a resource would not reach the level of "significant harm," but would be readily perceptible and could have an expanded geographic scope or duration. Significant impacts

would require implementing measures for reduction or avoidance of impacts to avoid a result of "significant harm." All such impacts would be mitigated to less than significant levels.

Table ES-1. Summary of Environmental Impacts

Resources	Impacts According to Affected Area					
	MCAS Futenma	*Landing Zones*	*Camp Fuji*	*MCAS Iwakuni*	*NAV Routes*	*Kadena Air Base*
Airfield/Airspace Management	None	None	None	None	None	None
Noise	Minimal	Minimal	None	None	None	None
Land Use	None	None	None	None	None	None
Air Quality	Minimal	None	None	None	None	None
Safety	None	None	None	None	None	None
Biological Resources	None	Moderate/ Significant	None	None	None	None
Cultural Resources	None	None	None	None	None	None
Geology and Soils		Minimal				
Water Resources		None				

= No analysis required

Of the six locations, analysis in this ER established that a classification of **None** applies to all resource categories for ***Camp Fuji, MCAS Iwakuni, the NAV Routes, and Kadena AB***. Addition of MV-22 operations at these locations would be minimal and within normal ongoing annual variation for activities. Under these circumstances, no change to overall noise, air quality, or other conditions would result. Moreover, the noise contribution of the MV-22s would be minimal compared to the contributions of aircraft currently operating at these locations (i.e., FA-18, AV-8B, F-15), and would not perceptibly alter noise conditions. Similarly, the low number of annual operations by the MV-22 squadrons at these locations and their brief durations would not generate emissions sufficient to alter air quality conditions. Aircraft safety would not degrade with introduction of the MV-22 with its excellent safety record. With no impacts to these resources, and no construction, ground disturbance, or changes to personnel, the proposed action at these locations would not measurably affect other environmental resources. For the other two locations, MCAS Futenma and the LZs, impacts to certain resources would potentially occur, as detailed below.

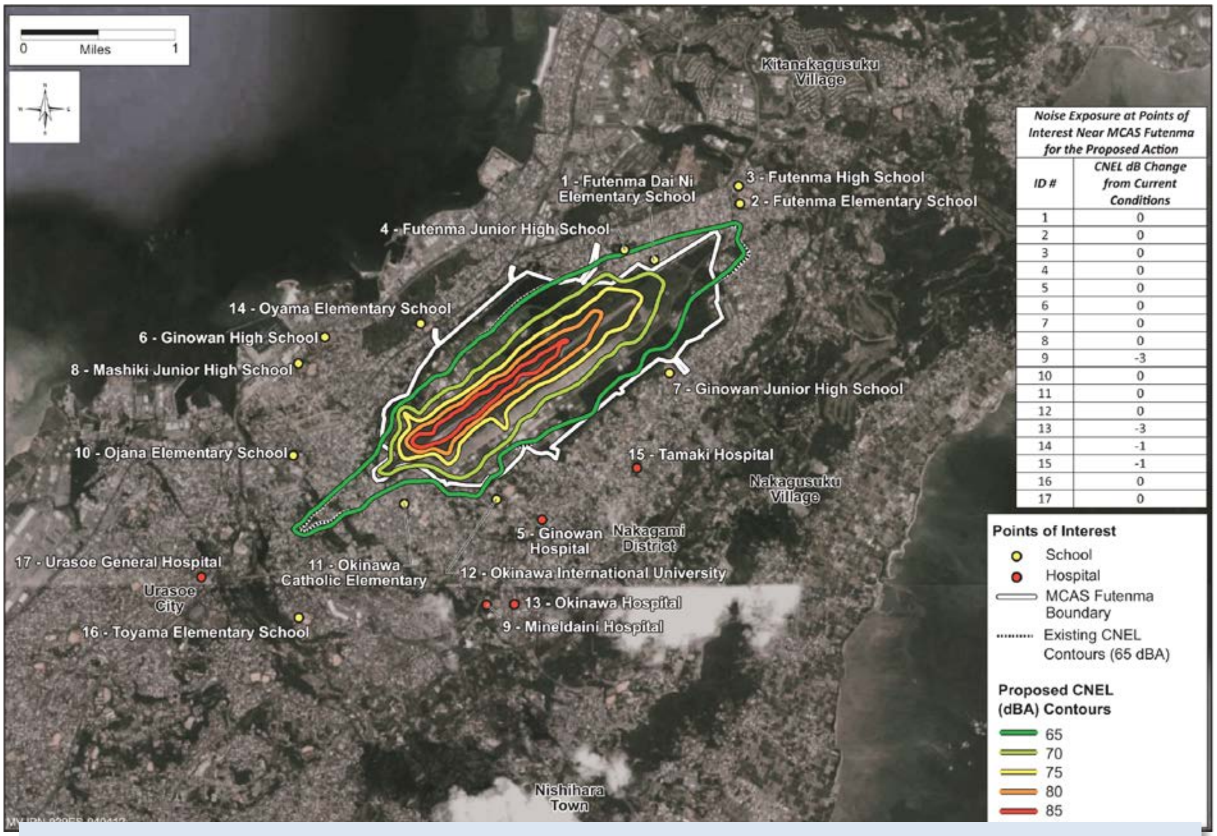
IMPACTS OF BASING THE MV-22 AT MCAS FUTENMA

Airfields and Airspace

Under the proposed action, no change would occur to the structure or management of MCAS Futenma airspace management around the airfield or within the airspace. The total number of aircraft based at MCAS Futenma would remain the same, but airfield operations would decrease by approximately 2,600 per year (11 percent) relative to current conditions. No change to the basic type of activities would result from the proposed action.

Noise

The MV-22 would generate lower noise levels than the CH-46E in all phases of flight except arrivals. For this reason, and because of the reduction in annual operations, noise levels produced by the proposed action would vary minimally from the existing conditions, with a total of 4 fewer acres affected by 65 decibels (dB) Community Noise Equivalent Level (CNEL) or greater. Of 17 points of interest (schools and hospitals) outside MCAS Futenma, noise levels would decrease by 3 dB at 2 locations and 1 dB at another 2 locations; no change in noise would occur at the remaining 13 locations.



Noise Exposure at Points of Interest Near MCAS Futenma for the Proposed Action

ID #	CNEL dB Change from Current Conditions
1	0
2	0
3	0
4	0
5	0
6	0
7	0
8	0
9	-3
10	0
11	0
12	0
13	-3
14	-1
15	-1
16	0
17	0

Noise conditions at MCAS Futenma would not change perceptibility with basing the MV-22s.

In 2011, the Okinawa Defense Bureau (ODB) released an Environmental Impact Assessment (EIA) that considered potential effects of low-frequency noise (LFN) from the MV-22 as well as AH-1 and CH-53 helicopters. This ODB analysis is the only known study of LFN for the MV-22, and it was reported in the ER for informational purposes. LFN generally correlates to the components of noise with frequencies of 200 Hz or less, although variations in the upper LFN threshold differ among researchers (e.g., 100 Hz, 80 Hz). The nature and effects of LFN remain incompletely understood, and in some cases, inconsistently defined. Effects that individuals allege experiencing include annoyance, stress, headaches, or frustration, and some individuals allege more severe physical effects. The ODB's EIA concluded that the impacts due to LFN generated by the MV-22 would be minimal and environmental conservation measures would still be met because the actions performed by the MV-22s are brief and transitory.

Land Use

Noise from aircraft operations represents the only aspect of the proposed action that required consideration in terms of land use. However, noise from MV-22 operations would not alter land use either on MCAS Futenma or outside it. The area within MCAS Futenma affected by aircraft noise would remain essentially identical to current conditions and the structure or size of the clear zones would not change. Lands outside MCAS Futenma affected by noise levels of 65 dB CNEL would increase slightly, but under standard DoD metrics and guidelines, the proposed action would not result in impacts to land use beyond those already affecting off-station areas.

Air Quality

Comparison of the MV-22 to the CH-46E reveals that the MV-22 would generate substantially less carbon monoxide and hydrocarbons, but nitrous oxides and particulate matter would increase. None of these changes would produce noticeable effects on the air quality of MCAS Futenma and its vicinity. The industrial, commercial, and vehicle sources in the densely populated area around the installation would continue to comprise the major contributors of emissions.

Safety

Redesigns and software revisions performed on the MV-22 in 2002 have proven to be successful. Since that time, the MV-22 has an excellent safety record.

The MV-22 is a highly capable aircraft with an excellent safety record that is consistently better than USMC averages. From 2003 through 2011, the MV-22 achieved a mishap rate of 1.12 per 100,000 flying hours. In comparison, the CH-46 achieved a rate of 1.14, and the USMC average for all aircraft was 2.47. With fewer overall operations and greater use of sophisticated flight simulators, the MV-22 would enhance safe aircraft operations at MCAS Futenma and its vicinity. Bird-aircraft strikes would not be expected to increase since the MV-22 squadrons would perform fewer operations.

Biological Resources

There would be no direct loss of vegetation or wildlife, or wildlife habitat, or any expected increase in bird or wildlife airstrike hazards as a result of the proposed action at the airfield. The lack of change in noise levels would not have any effect on wildlife or Protected Species that are already habituated to similar or louder aircraft operations. Operations would occur at and over already developed areas.

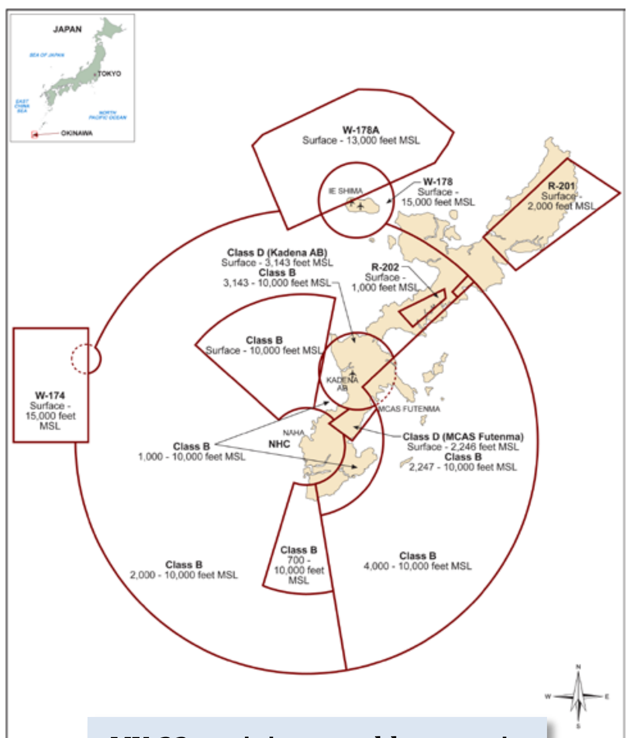
Cultural Resources

The proposed action at MCAS Futenma would not result in effects to cultural resources eligible for or listed as a World Heritage Site, GoJ equivalent National Register property, or to sites possessing a high historical or scholarly value.

TRAINING AND READINESS OPERATIONS

Landing Zones

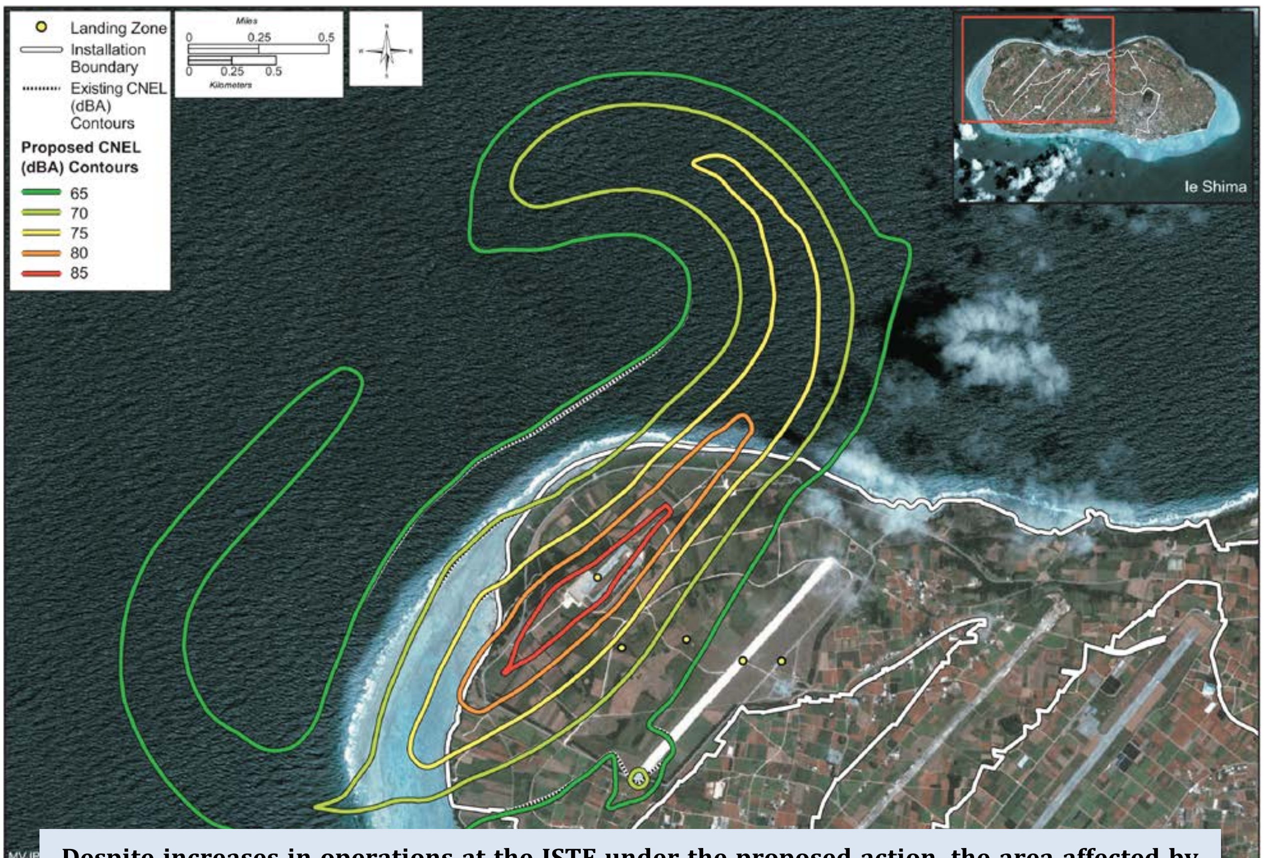
Airspace Management and Use. No aspect of operating the MV-22 in the training areas and at the LZs would affect the airspace structure, management, or use. The nature and profiles of MV-22 CAL operations at the LZs would not differ



MV-22 training would occur in Special Use Airspace.

appreciably from those used by the CH-46Es. Annual operations would decrease in the NTA and CTA; the increase in use of the ISTF would not exceed the capacity of the airspace or the ability of range control to manage it.

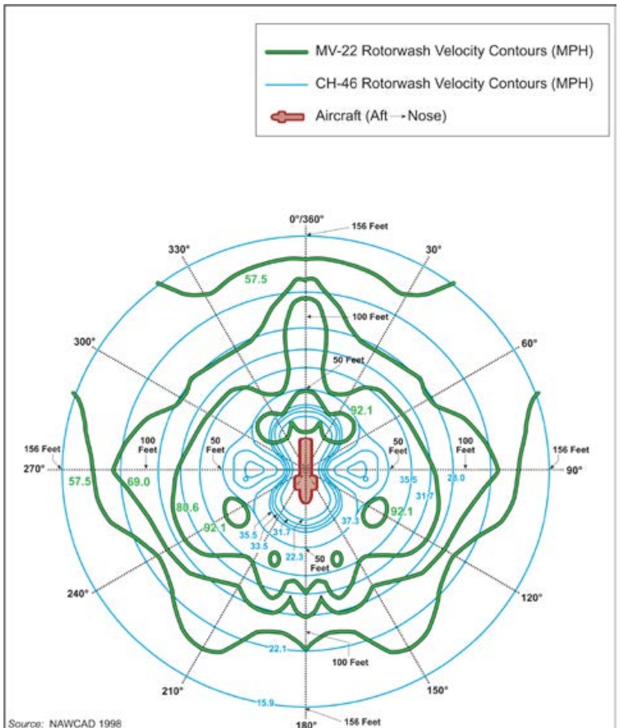
***Noise*.** Overall, the shift from CH-46E operations to MV-22 operations would not perceptibly change noise (i.e., 3 dB or greater) at any of the LZs in the training areas. At the ISTF, the increase in operations resulting from the proposed action would expand the area affected by 65 dB CNEL or greater by 27 acres, all of which lie within the boundaries of the complex. The noise contours would continue to predominantly overlie the water and no additional land areas off the ISTF would be affected. Cumulatively, operations by the AV-8B Harriers would continue to affect the noise contours to the greatest extent. No perceptible changes to noise levels would occur at the NTA or CTA LZs. The MV-22s would generate slightly lower single event noise levels than the CH-46Es during all phases of flight except during brief periods of hovering on arrivals at the LZs. Should they be used by the MV-22s, the SC LZs in the NTA would not be expected to experience noise levels different from other Average use LZs.



Despite increases in operations at the ISTF under the proposed action, the area affected by noise would only expand by 27 acres, all of which lie within the boundaries of the facility.

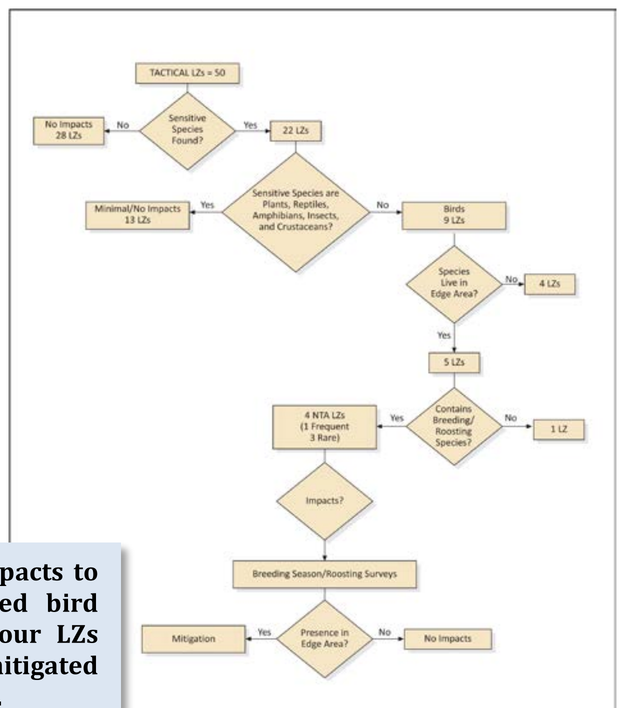
***Land Use*.** The proposed action would not alter the management or function of the lands at the LZs or within other portions of the training areas. Return of lands to the GoJ and replacement of LZs in the NTA are not part of this action and have already been assessed by the GoJ. The negligible expansion of noise contours at the ISTF would not affect lands outside the complex, so no impacts to land use would be expected. Similarly, the lack of perceptible change in noise at the LZs in the NTA and CTA would not affect land uses in the vicinity. Most of the affected areas consist of U.S. areas and facilities used for training. Noise levels would affect only small (less than 15 acres) areas in one NTA LZ and lesser areas for two CTA LZs that extend beyond the limits of the U.S. areas and facilities. These lands consist of uninhabited, densely vegetated forest.

Air Quality. No noticeable effects on the air quality of the training areas would result from use of the LZs and associated operations. Decreases in carbon monoxide and hydrocarbons would occur, whereas nitrous oxides emissions and particulate matter would increase. None of these changes would degrade air quality in the large regions encompassed by the training areas.



Rotorwash from the MV-22 would exceed that of the CH-46E, but would not pose an issue for public safety due to the locations of the LZs within training areas.

Safety. For the same reasons discussed above, the proposed action would not measurably affect aircraft safety at the LZs. The MV-22 squadrons would adhere to all operational and safety procedures applicable for the airspace and training areas. Risks of fires would not increase given the use of engine deflectors and other procedures during landings and take-offs at the LZs. Although rotorwash would increase substantially with the MV-22, the analysis demonstrated that no issues with public safety would occur. Only 2 of the 50 tactical LZs would expose a public road to rotorwash. In both instances, the potential for the interaction of a person or vehicle with MV-22 rotorwash would be negligible and would not pose a hazard.



Biological Resources. Based on a thorough investigation, including natural resource surveys of 35 LZs, the analysis determined that vegetation, wildlife, and most Protected Species would either not be affected or affected minimally. No vegetation removal would be required at the LZs and use of the deflectors would prevent fires. Current habitat for wildlife would not change in terms of content or structure, and noise levels would not differ perceptibly

Potential impacts to two protected bird species at four LZs would be mitigated by the USMC.

from those to which wildlife has become habituated. If, however, nesting or roosting (sleeping at night in trees) protected bird species occur in forest edge areas near a landing point, significant impacts could occur due to an increase in rotorwash from the MV-22 aircraft. These potential impacts would be confined to a limited area at four LZs in the NTA where two protected bird species (Okinawa rail and Japanese wood pigeon) have been found in the past. In order to ensure that no significant harm occurs to these species, the USMC would conduct additional surveys and institute mitigation measures, if appropriate, to reduce potential impacts to less than significant levels, and therefore, meet the U.S. requirements under Japan Environmental Governing Standards of 2010-- "to protect and enhance known endangered or threatened species and GoJ Protected Species and their habitat."

***Cultural Resources*.** Given the lack of ground disturbance, the proposed action would not likely affect cultural resources eligible for or listed as a World Heritage Site, GoJ equivalent National Register property, or sites possessing a high historical or scholarly value. Potential effects on Natural Monument species protected as cultural resources would be mitigated as discussed under Biological Resources.

***Geology and Soils*.** Without ground disturbance, the potential for effects on geology and soils would be minimal. Consideration of erosion from MV-22 rotorwash revealed that the soils at the LZs tend to not be susceptible to wind erosion and impacts due to rotorwash are unlikely because of prepared surfaces and vegetation at the LZs. There is a potential for soil erosion at five LZs with unprepared surfaces; however, implementation of standard operating procedures at the LZs would reduce impacts to minor levels.

***Water Resources*.** No aspect of the LZ operations or use would change drainage or erosion affecting water quality or runoff. Existing vegetation and soils at the LZs would persist, and no increased use of water would occur.

Mainland Japan and Other Locations

Proposed operations by the MV-22 on mainland Japan and at Kadena AB (Okinawa) represent another component of the proposed action. Analysis of the potential effects of these components of proposed MV-22 basing and operations revealed:

- MV-22 operations at these locations – Camp Fuji, MCAS Iwakuni, NAV Routes, and Kadena AB – would represent negligible to minimal additions to overall activities currently occurring there. In all cases, other aircraft operations, including those by Japan Self-Defense Forces (i.e., Camp Fuji), would continue to be dominant.
- The sporadic and short-duration use of these other locations by the MV-22s would minimize their contribution to noise conditions and air emissions, especially compared to the contributions by aircraft currently operating at these locations.
- No construction or other ground disturbance would result at any of these locations as a result of the MV-22 training and readiness operations, thereby minimizing or precluding such impacts to biological resources, cultural resources, soils, and water.
- In combination, the results of the review established that no important environmental issues would arise from implementing the proposed MV-22 basing and operations.

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Purpose and Need

Chapter 1

1.0 PURPOSE AND NEED

1.1 INTRODUCTION

Marine Corps Installations Pacific (MCIPAC) prepared this Environmental Review (ER) to evaluate the potential environmental impacts of basing two MV-22 squadrons at Marine Corps Air Station (MCAS) Futenma on Okinawa, Japan (Figure 1-1) and operating the MV-22 at United States (U.S.) facilities and areas in Japan. The MV-22 aircraft would replace an equal number of aging CH-46E helicopters currently stationed at MCAS Futenma. The U.S. Marine Corps (USMC) anticipates the initial deployment of the MV-22 to Okinawa by the end of Fiscal Year (FY) 2012. However, a final determination on that date has not been made.

A major component of training for the MV-22 aircrews would consist of Confined Area Landing (CAL) operations (landings and take-offs) at existing tactical Landing Zones (LZs) located within U.S. facilities and areas on Okinawa[1] and already used by the CH-46E squadrons (refer to Figure 1-1). Although the aircraft would be based at MCAS Futenma, portions of a squadron (2 to 6 MV-22s) would deploy monthly for 2 to 3 days to Combined Arms Training Center Camp Fuji (Camp Fuji) and MCAS Iwakuni on mainland Japan.[2] During these brief deployments, the MV-22 crews would conduct training operations within established training areas and in airspace over mainland Japan, including Navigation (NAV) routes. On occasion, longer deployments could occur as a result of actions such as to assist in the defense of Japan, training exercises, or humanitarian and disaster relief. This ER identifies the important environmental issues arising from basing and operating the MV-22s at MCAS Futenma, Camp Fuji, MCAS Iwakuni, portions of Kadena Air Base (AB), and at LZs within training areas on Okinawa.

The MV-22 provides a medium-lift capability, employs an innovative tiltrotor design with the unique capability to take-off and land vertically like a helicopter, and also flies horizontally like a fixed-wing aircraft. In vertical flight (i.e., Vertical Take-off/Landing [VTOL] Mode), the MV-22 provides the lift and maneuverability of a helicopter. When in fixed-wing configuration (i.e., Airplane Mode), the MV-22 flies faster, farther, and more efficiently than medium-lift helicopters. The aircraft's primary role is to transport Marines into battle, with a secondary role of transporting supplies. Replacement of the CH-46Es with the MV-22s will modernize the USMC fleet and improve operational capabilities for all aspects of training and combat. Its capabilities would significantly strengthen III Marine Expeditionary Force (III MEF)'s ability to assist in the defense of Japan, perform humanitarian assistance and disaster response, and fulfill other alliance roles.

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[1] Okinawa includes Okinawa-honto, or the main island, and the other Ryukyu Islands. Okinawa in this document refers to Okinawa-honto where MCAS Futenma, Northern Training Area, Central Training Area, and Kadena Air Base are located. Ie Shima is one of the Ryukyu Islands and contains the Ie Shima Training Facility.

[2] The term "mainland Japan" is used herein not as an official geographic name but rather as a means to distinguish the group of islands, mainly Hokkaido, Honshu, Kyushu, and Shikoku, from Okinawa.

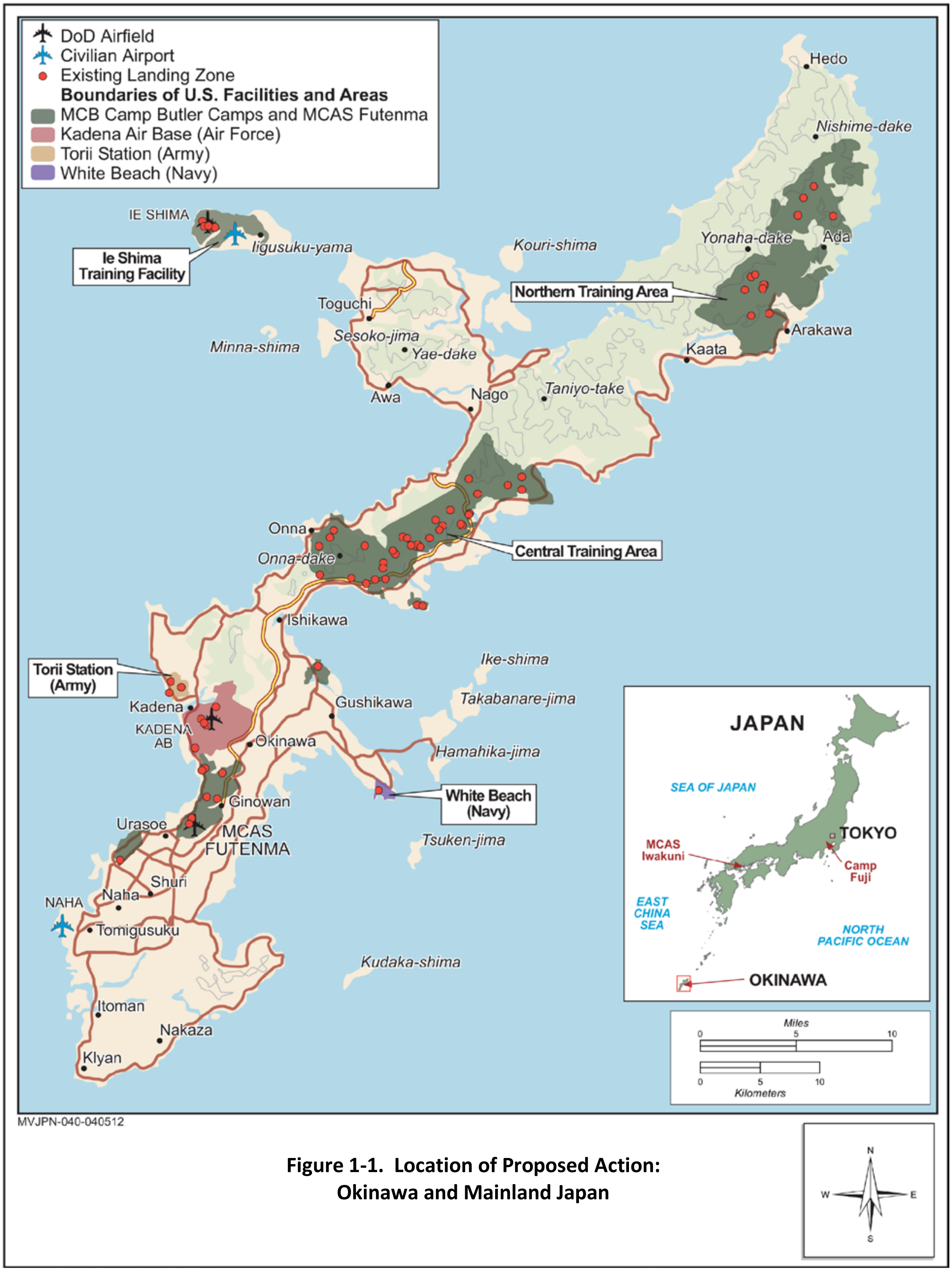


Figure 1-1. Location of Proposed Action: Okinawa and Mainland Japan

The MV-22 is a highly capable aircraft with an excellent operational safety record. This ER incorporates the best available current information on training operations and flight activities. However, with the maturity of the MV-22 program and operational deployments in harsh conditions, a greater understanding of the aircraft's capabilities may lead to developmental changes in operations and training. As the MV-22 program evolves, the Department of the Navy (DoN) will monitor its implementation, identify (if any) and reduce potential environmental consequences, evaluate results relative to new information, and prepare, as appropriate, further environmental documentation.

This ER was prepared to comply with Executive Order (E.O.) 12114, *Environmental Effects Abroad of Major Federal Actions*, Department of Defense (DoD) Directive 6050.7, *Environmental Effects Abroad of Major Department of Defense Actions*, and Marine Corps Order P5090.2A, Change 2, *Environmental Compliance and Protection Manual* (May 2009) which establishes procedures regarding environmental considerations of projects outside the U.S., its territories and possessions. The review also integrates applicable conformance requirements from the Japan Environmental Governing Standards (updated 2010).

1.2 DESCRIPTION OF AIRCRAFT

1.2.1 CH-46E Sea Knight

First fielded in 1980, the Boeing CH-46E Sea Knight is a medium-lift tandem rotor transport helicopter, used by the USMC to provide all-weather, day-or-night assault transport of combat troops, supplies, and equipment. Assault support is its primary function, and the movement of supplies and equipment is secondary. Additional tasks include combat support, search and rescue, support for forward refueling and re-arming points, casualty evacuation, and tactical recovery of aircraft and personnel. It also provides humanitarian mission and disaster relief support. The CH-46E has tandem counter-rotating rotors powered by two upgraded T58-GE-16 turboshaft engines producing 1,870 horsepower each. The engines are coupled so either could power both rotors in an emergency. The rotors each feature three fiberglass blades and can be folded for shipboard operations. Starting in the mid-1990s, component upgrades were implemented to provide for safety, engineering and electronic improvements. The CH-46E has a cargo bay with a rear loading ramp that could be removed or left open in flight for extended cargo or for parachute drops. An internal winch is mounted in the forward cabin and can be used to pull external cargo on pallets into the aircraft via the ramp and rollers. A belly cargo hook can be attached for carrying external cargo. The Sea Knight can accommodate a crew of five and a troop capacity of 24 combat-loaded Marines; or it can be outfitted to carry medical evacuation litters when responding to disasters. Aircraft specifications include a fuselage length of 45 feet, 8 inches; width of 7 feet, 3 inches;

height of 16 feet, 8.5 inches; and rotor diameter of 51 feet. Empty aircraft weight is 15,537 pounds; loaded with armor, guns, and ammunition, it weighs in at 17,396 pounds. Armament includes two .50 caliber machine guns and a M240D 7.62 millimeter machine gun. The aircraft's maximum take-off weight is 24,300 pounds. The Sea Knight has the fuel endurance to stay airborne for approximately 2 hours, or up to 3 hours with an extra internal tank. The CH-46E has a combat range of 75 nautical miles (nm) for an assault mission with 12 passengers, at a cruise speed of 120 knots.

1.2.2 MV-22 Osprey

The MV-22 Osprey is a twin-engine, dual-piloted, tiltrotor vertical/short take-off and landing aircraft designed for combat, combat support, combat service support, special operations, and humanitarian/disaster relief missions worldwide. The MV-22 has been designed to the most stringent safety, reliability, readiness, and performance requirements of any rotary-wing aircraft ever built. MCAS New River, North Carolina was home to the USMC's first combat-ready MV-22 squadron when the USMC reached Initial Operational Capability in 2007. The MV-22, with tiltrotor technology that provides the maneuverability and lift of a helicopter, also operates like a turboprop airplane which gives it the ability to fly roughly twice as fast, carry nearly three times the payload, and has approximately four times the combat radius of the CH-46E. The MV-22 is shipboard compatible (able to land and take-off from ships) with the world's first complete blade fold and storage system that allows aircraft to be easily accommodated aboard ship. It can also operate from austere expeditionary sites, providing virtually unlimited basing options. The MV-22's speed and range advantages offer a response to potential contingency operations by rapidly moving credible fighting forces from ships directly into operational objectives. The MV-22 can carry up to 24 combat-loaded Marines, or 20,000 pounds of cargo, at a maximum cruising speed in excess of 260 knots. It has a combat range of 325 nm with a maximum take-off weight of 52,600 pounds in vertical take-off and landing mode and 57,500 pounds in short take-off and landing mode. Other aircraft specifications include a length of 57 feet, 4 inches; wingspan of 45 feet, 10 inches; width with rotors of 84 feet, 7 inches; and a height of 22 feet, 1 inch. Two Rolls Royce Allison T406/AE 1107 C Liberty turboshaft engines provide 6,150 horsepower each. The MV-22 includes a GAU-17 7.62 millimeter mini-gun, a 7.62 millimeter M240D machine gun, and a ramp-mounted .50 caliber machine gun.

1.3 PURPOSE AND NEED FOR PROPOSED ACTION

The purpose of the proposed action is to implement the USMC aviation plan by replacing all existing CH-46E aircraft in Japan with two MV-22 squadrons at MCAS Futenma to operate in support of the U.S.-Japan Alliance. The USMC plan defined in Fiscal Year (FY) 2011 envisions that, by 2025, USMC aviation will be a, "fast, lethal expeditionary force that is ready for the uncertainties of future combat operations, yet has the staying power of engagement in the most austere conditions imaginable." To support the aviation plan, the USMC proposes to enhance its aircraft inventory and reorganize its forces in the Pacific. Proposed basing of MV-22 squadrons in Okinawa represents one step towards achieving these overall goals.

The two MV-22 squadrons (each with 12 aircraft) proposed at MCAS Futenma would operate at U.S. facilities and areas in Japan to support the U.S.-Japan Alliance, training of USMC combat forces, and humanitarian missions in the region. The MV-22s would improve and modernize medium-lift capability to support the III MEF, as part of the USMC aviation plan. As a self-sufficient USMC air and ground combat force, the III MEF has the mission to fight as an integrated team and respond on short notice to war contingencies or humanitarian missions. In addition, the USMC seeks to efficiently and effectively maintain combat capability and readiness as it faces increased deployments across a spectrum of missions. As such, the proposed action would ensure that the MV-22 squadrons have ready access to existing airfields, training areas, LZs, and airspace to conduct required training and readiness operations. In short, the USMC could continue to train as it fights, using improved, more effective aircraft. Additionally, the proposed basing action would support the III MEF mission while making use of existing facilities to the greatest extent practicable and preventing impacts to combat capability and mission readiness during the transition.

In terms of need, the proposed basing of MV-22 aircraft in Japan would form part of a USMC-wide process of replacing its aging fleet of medium-lift helicopters with more advanced, operationally-capable aircraft. A large part of the need centers on meeting current and future force structure requirements in the USMC aviation plan. As such, the MV-22 squadrons would replace two squadrons of the existing fleet of less capable, 1980s-era CH-46E medium-lift helicopters currently based and operating in Japan. Current and future trends in asymmetrical warfare would make the slower and lower flying CH-46Es more vulnerable to attack. The MV-22 introduces a revolutionary change in capabilities absent in helicopters – a leap forward in speed, payload, and range. It utilizes tiltrotor technology that provides the maneuverability and lift of a helicopter and, in fixed-wing mode, provides the ability to fly roughly twice as fast, four times as far, and carry three times the combat or humanitarian mission load of the CH-46E. Replacement of the CH-46E helicopters with the MV-22 would modernize the USMC medium-lift fleet, improve the operational capabilities of the III MEF, limit vulnerabilities in expected combat situations, and maintain combat and mission readiness.

Description of Proposed Action and Current Conditions

Chapter 2

2.0 DESCRIPTION OF PROPOSED ACTION AND CURRENT CONDITIONS

2.1 INTRODUCTION

The United States (U.S.) Marine Corps (USMC) proposes to base and operate MV-22 aircraft in Japan to provide medium-lift capability to the III Marine Expeditionary Force (III MEF) as the replacement for outdated CH-46E helicopters quickly approaching the end of their service life. The proposed action, slated to start in 2012, consists of the following main components:

- **<u>Basing MV-22 Aircraft at MCAS Futenma</u>**
  - Basing two MV-22 squadrons (24 aircraft) at MCAS Futenma to replace two CH-46E helicopter squadrons (24 aircraft) currently at the installation;
  - Decommissioning, demilitarizing and dismantling existing CH-46E aircraft and processing them for recycling at Camp Kinser;
  - Conducting MV-22 flight operations at the existing airfield;
  - Emplacing two MV-22 simulators on a new concrete pad at the installation; and
  - Replacing approximately 400 military personnel authorizations at MCAS Futenma (no net change in total personnel) to operate, maintain, and support the MV-22 aircraft.
- **<u>Training and Readiness Operations</u>**
  - Performing training and readiness operations at training areas and 50 tactical Landing Zones (LZs) on Okinawa;
  - Using, when constructed, six LZs established by the Government of Japan (GoJ) to replace existing LZs in the Northern Training Area;
  - Loading small-arms ordnance at the same location at Kadena Air Base (AB) as currently used by CH-46E aircraft;
  - Conducting short-duration (two to three days) deployments of detachments (two to six aircraft) of MV-22s to Combined Arms Training Facility Camp Fuji and MCAS Iwakuni on mainland Japan; and
  - Training along existing navigation (NAV) routes over mainland Japan.

The following sections detail these components of the proposed action and describe the current conditions for comparison. The current conditions reflect circumstances with the CH-46Es based at MCAS Futenma and conducting operations in existing training areas and airspace proposed for use by the MV-22s.

2.2 PROPOSED ACTION

Under the proposed action, several installations and training facilities would be used for different purposes and functions to support basing and training for the MV-22 squadrons (refer to Figure 1-1). As defined by the concept of operations for the MV-22 basing, MCAS Futenma would comprise the location where most operations would originate, personnel would live, and basic maintenance would occur. MV-22 aircraft flying out of MCAS Futenma would consistently conduct training operations at existing facilities on and in airspace over Okinawa including defined training areas, LZs, and Kadena Air Base

(AB). The training areas, all part of Marine Corps Base (MCB) Camp Butler, consist of the Northern Training Area (NTA), Central Training Area (CTA), and the Ie Shima Training Facility (ISTF). Within these training areas, the USMC proposes to use 50 existing tactical LZs for landings and take-offs known as Confined Area Landings (CALs). Training at these LZs would vary with 20 percent receiving Frequent use, 24 percent receiving Average use, and the remainder (56 percent) receiving Rare use. At the ISTF, the MV-22 squadron would also perform Field Carrier Landing Practice (FCLP). A total of 19 Administrative LZs occur within the developed portions of U.S. installations on Okinawa; all of these LZs would be used minimally for transport rather than for tactical training. Kadena AB, located just north of MCAS Futenma, would be used only for ordnance loading as is currently done by the CH-46Es.

As part of an on-going process to return lands to the Government of Japan (GoJ), the GoJ has scheduled construction of six new LZs in the NTA. Three existing LZs within the returned lands would be replaced by the newly-constructed sites. Although construction of these LZs is not part of the proposed action, they may be used by MV-22s once completed.

Additional training under normal conditions would involve deploying detachments of MV-22s (2 to 6 aircraft) to MCAS Iwakuni and Combined Arms Training Center Camp Fuji (Camp Fuji) on mainland Japan for an average of 2 to 3 days per month, although occasional 2-week detachment deployments could occur. Other U.S. bases in Japan may, on occasion, also receive use by MV-22 aircrews. As part of these deployments, the MV-22 aircrews would also perform flight training using six existing NAV routes primarily over mainland Japan. In combination, all of these training activities would ensure combat readiness for the USMC MV-22 squadrons based in Japan.

The CH-46E helicopters to be replaced by the MV-22s already operate out of MCAS Futenma and use the installations, training areas, and LZs on Okinawa. Due to the distance, the CH-46E aircrews do not regularly conduct operations on mainland Japan. However, given the MV-22s ability to fly in airplane mode, these aircraft would be able to cover greater distances in less time than the CH-46s. When compared to the CH-46s, patterns of use and emphasis on different training activities would shift with the basing of MV-22 aircraft.

2.2.1 Basing at MCAS Futenma

The USMC proposes to base the MV-22s at MCAS Futenma and remove the CH-46Es currently stationed at that location. MCAS Futenma, constructed in 1945, occupies 1,188 acres in the center of Ginowan City located about 6 miles northeast of the city of Naha in the southern portion of Okinawa (Figure 2-1). MCAS Futenma has a 9,002 foot-long northeast-southwest runway and parallel taxiway that can accommodate most fixed-wing and rotary-wing aircraft. As the home base of the Marine Aircraft Group (MAG) 36, the installation serves an essential role for USMC deployment of aircraft in the Far East. MCAS Futenma offers hangars, maintenance facilities, housing, fuel storage, a control tower, and other support services necessary for its mission. If in the future these aircraft need to be stationed at another facility, appropriate environmental analysis would be conducted prior to that action.

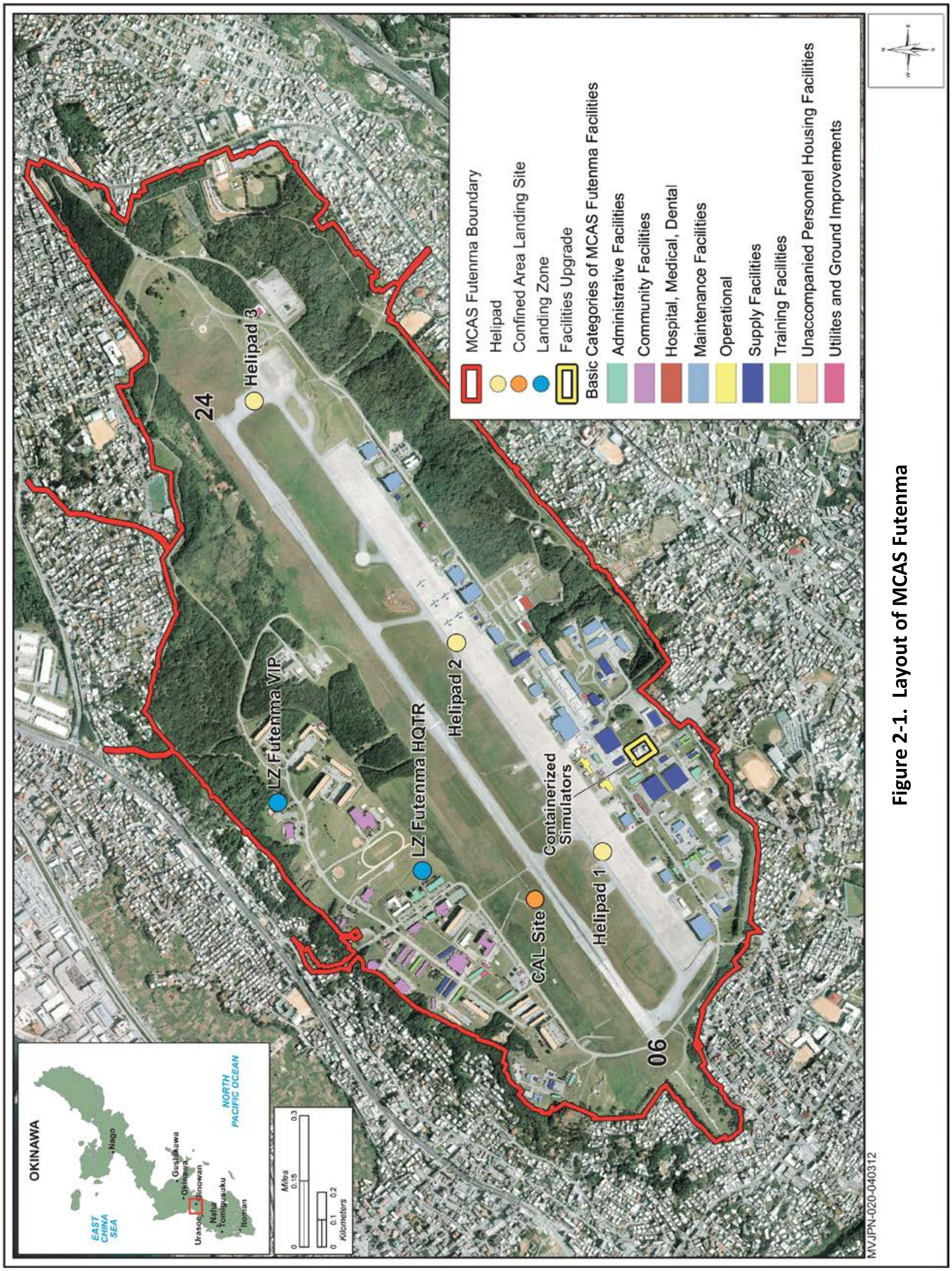


Figure 2-1. Layout of MCAS Futenma

2.2.1.1 Aircraft Basing and Removal

Basing MV-22 Squadrons

Under the proposed action, the USMC would replace the 24 based CH-46E helicopters with the MV-22 tiltrotor aircraft on a one-for-one basis (Table 2-1). USMC anticipates initial deployment of the MV-22 to MCAS Futenma at the end of fiscal year 2012. However, a final determination of that date has not been made. Minor and short-term overlaps of incoming MV-22 and outgoing CH-46E aircraft inventory may occur during the replacement process, although at completion, no net change in total based aircraft would result from the proposed action. Other based aircraft at MCAS Futenma include USMC helicopters (CH-53E, AH-1W, and UH-1N) and transports (UC-12W, UC-35D, and KC-130J).

Table 2-1. Proposed Changes to Aircraft Inventory[1]

Current Inventory			Proposed Action Inventory		
Based Aircraft	*Quantity*	*Description*	*Based Aircraft*	*Quantity*	*Description*
CH-46E	24	Sea Knight Medium-Lift Helicopter	MV-22	24	Osprey Medium-Lift Multi-mission Tiltrotor Aircraft
CH-53E	5	Super Stallion Heavy-Lift Helicopters	CH-53E	5	Super Stallion Heavy-Lift Helicopters
AH-1W[3]	5	Super Cobra Light-Attack Helicopters	AH-1W	5	Super Cobra Light-Attack Helicopters
UH-1N[3]	4	Iroquois (Huey) Utility Helicopters	UH-1N	4	Iroquois (Huey) Utility Helicopters
UC-12W	1	King Air 350 Cargo/VIP Transport (small twin turboprop)	UC-12W	1	King Air 350 Cargo/VIP Transport (small twin turboprop)
UC-35D	3	Encore VIP Transports (small twin jet)	UC-35D	3	Encore VIP Transports (small twin jet)
KC-130J	15	Hercules Cargo Transport	KC-130J	15	Hercules Cargo Transport[2]
Total	**57**		**Total**	**57**	

Note:
[1] In a previous study (Wyle 2012), the number of based CH-53, AH-1, and UH-1 helicopters was greater. This table reflects current conditions.
[2] Under current plans, KC-130J Transports currently at MCAS Futenma would move to MCAS Iwakuni in 2014. This would reduce total based aircraft inventory, personnel, and operations at MCAS Futenma. Any appropriate environmental analysis related to KC-130J operations would be conducted before the action occurs.
[3] The AH-1W and the UH-1N will be upgraded to AH-1Z and the UH-1Y no earlier than May 2012, and there is no foreseeable significant harm to any environmental resources.

Removal of CH-46E Helicopters

Trained and qualified USMC personnel would demilitarize decommission, dismantle, and/or demilitarize the retired CH-46Es in accordance with Department of Defense (DoD) Manual 4160.28-M-V1, June 7, 2011 and other applicable guidance. The process to decommission the helicopters would involve removal of all fuel, oil, lubricants, hazardous materials, and any sensitive components or instrumentation prior to processing them for recycling. The CH-46Es will undergo the demilitarization process at Camp Kinser by Defense Logistics Agency Disposition Services personnel.

Several of the CH-46E provided support to Operation Tomodachi after the 2011 Great East Japan Earthquake, tsunami, and nuclear crisis. All aircraft, personnel, and equipment were checked for radiation and decontaminated upon completion of Operation Tomodachi to meet the levels required under all USMC and DoD Standards (McConnell 2011). Before the CH-46Es are transported from MCAS Futenma to Camp Kinser for the demilitarization process, the aircraft will be dismantled, inspected and scanned in accordance with Technical Directive, *Proposed H-46 Airframe Bulletin No. 415, TD Code 74, One Time Inspection of H-46 Aircraft for Radiological Contamination*, and released from radiological control by U.S. Naval Sea Systems Command and U.S. Naval Air Systems Command only when verified as safe for demilitarization, dismantlement, and scrapping for recycling.

After the aircraft are released from radiological control at MCAS Futenma, they will be transported to Camp Kinser for the demilitarization process. Once decommissioned, dismantled, and/or demilitarized, the USMC will provide the materials to the Defense Logistics Agency at Camp Kinser on Okinawa for recycling and sale. This common process, guided by existing safety and environmental procedures, poses no environmental threats and requires no further evaluation in this Environmental Review (ER).

Transient Aircraft

Transient (not based) aircraft also use MCAS Futenma for landings and take-offs. These include FA-18C/D multirole fighters, P-3 Orion reconnaissance aircraft, a variety of transport and refueling aircraft (e.g., KC-135, C-5), and military helicopters. General aviation helicopters and rare commercial transports also comprise transient users. None of these transient aircraft place a measurable demand on parking, ramp space, or facilities due to their short-duration visits.

2.2.1.2 Personnel

The MV-22 would provide expanded capabilities with no net change in military personnel numbers. With completion of the transition from the CH-46Es to MV-22s, assigned military personnel associated with the two MV-22 squadrons would total approximately 400 (same as the current CH-46E squadrons). These personnel would include aircrews for the MV-22s, maintenance and ground operations staff, and administrative and support functions. Pilots and crew arriving with the MV-22 would be trained and experienced personnel already capable of operating and maintaining the aircraft.

2.2.1.3 Facilities

The MV-22 squadrons would use existing facilities and infrastructure at MCAS Futenma. Currently, there are aircraft hangar improvements and other projects scheduled to address existing requirements that are not required to operate MV-22s. Some of these projects would benefit the MV-22 and, as appropriate, environmental analysis would be prepared when these projects are approved.

The proposed action would include emplacement of two containerized simulator facilities on an extension of an existing concrete pad (Figure 2-2). Although a grassy area would be covered with concrete and utilities linked to the pads, the location represents a small amount (5,500 square feet) of new ground disturbance. The amount of impervious surface would increase by 0.13 acre. As part of this project, the facility would include typhoon tie rods and electrical power for the simulators. The simulators, consisting of self-contained units, would support vital training and help to reduce the amount of actual flying.

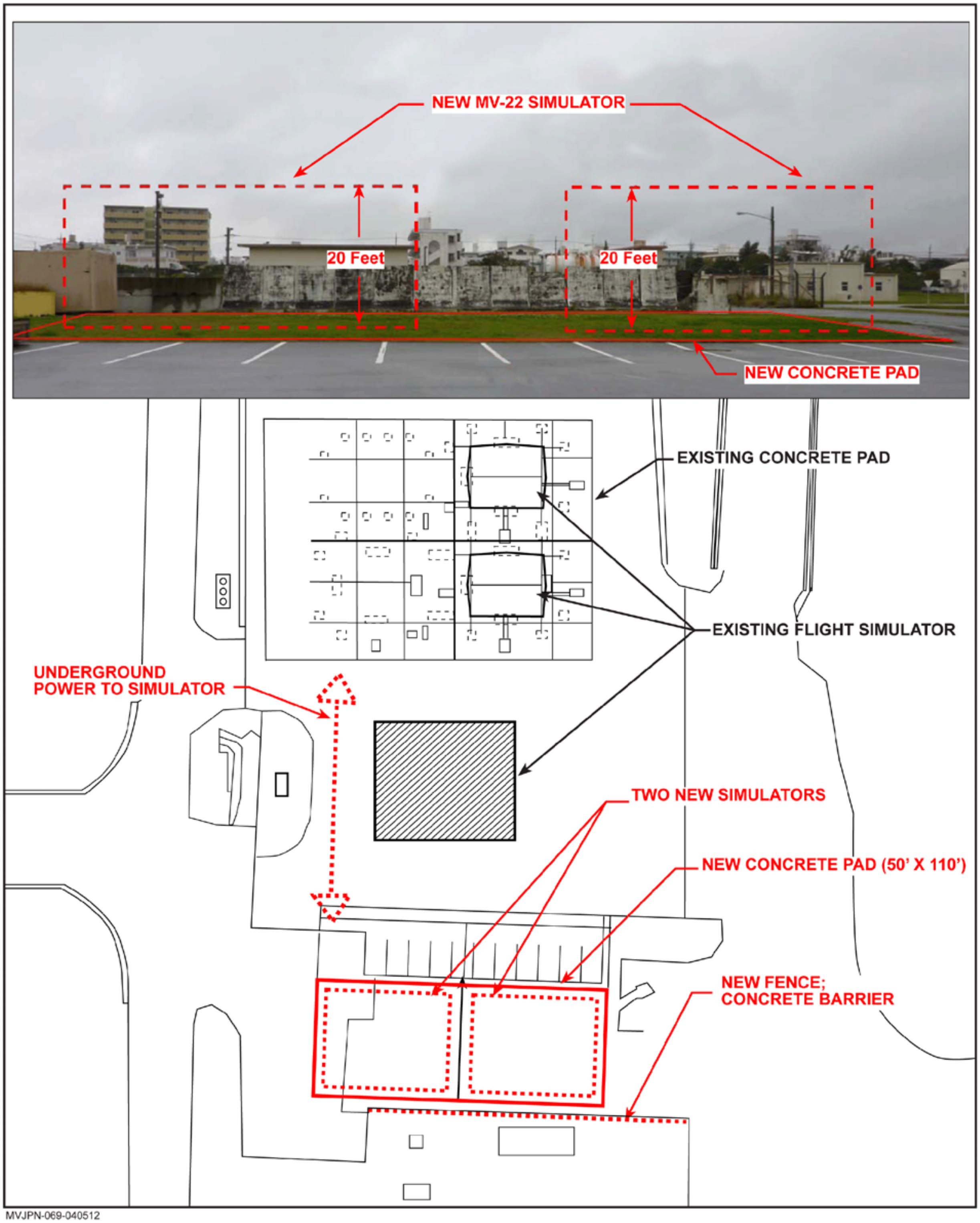


Figure 2-2. Emplacement of MV-22 Containerized Simulators

As noted previously, MCAS Futenma is a dynamic installation constantly in need of infrastructure and facility additions, improvements, and maintenance. Numerous other construction, renovation, and repair projects, both ongoing and planned, would receive use from and accrue benefit to the MV-22 squadrons. However, none of these projects stem directly from basing the MV-22; rather, they are associated with existing aircraft, operations, and functions on the installation. For these reasons, these ancillary facilities and infrastructure projects receive no further evaluation in this ER.

2.2.1.4 Airfield Operations

To provide the training necessary for combat readiness, the MV-22 would conduct operations at the MCAS Futenma airfield. Based on currently available information including training and readiness plans, the USMC developed data on the nature, frequency, and location of proposed operations. These data account for the MV-22's capabilities, its designated missions, and operations currently performed by MV-22s elsewhere.

During training activities, the MV-22 would be operated in different flight modes to maximize its capabilities as both an "airplane" and a "helicopter" (Figure 2-3). Operational elements of these modes include hovering and landing (vertical take-off and landing [VTOL] mode), vertical flight, horizontal flight (airplane mode), and transition (conversion mode) from one state to another. All of these flight activities are defined in the *Naval Aviation Training and Operating Procedure Standards for the MV-22* (Department of the Navy [DoN] 2009). While operating like a helicopter (i.e., conversion or VTOL mode), its speeds, patterns, and activities would be similar to the CH-46E that it is replacing. While operating like a fixed-wing aircraft (i.e., airplane mode), the MV-22 aircrews would use speeds and patterns more closely resembling medium-sized turboprop aircraft. When performed near an airfield, such operations would blend in well with those performed by the fixed-wing aircraft there.

Typically, USMC pilots fly the MV-22 in airplane mode. Flying in VTOL mode would account for about 5 percent (or less) of total flight time for the MV-22. The MV-22 operates in this mode only for take-off and landing, transitioning to airplane mode quickly in order to take advantage of the increased speed and range. Hovering would occur during some landings and take-offs, commonly lasting only for a few seconds.

This ER uses two terms to describe different components of aircraft flying activities: *sortie* and *operation*. Each has a distinct meaning and commonly applies to a specific set of training activities. These terms also provide a means to quantify activities for the purposes of analysis. A *sortie* consists of the flight of a single military aircraft from take-off through landing, and includes a flying mission. For this ER, the term *sortie* is commonly used when summarizing an amount of flight activity from a base. A sortie can include more than one operation. The term *operation* can apply to airfield, LZ, or airspace activities. At an airfield, an operation consists of a single aircraft movement such as a landing or take-off, or can include a low approach and other operations. For an LZ, each landing and each take-off represents an operation. For the Terrain Flight (TERF) and NAV routes, each flight by an aircraft comprises an operation. During a single sortie, an aircraft may conduct a number of operations such as a take-off from a base, use of a TERF route to an LZ, several landings and take-offs at LZs, and a return landing at the base. Figure 2-4 presents a stylized depiction of a sortie with the individual operations it involves.

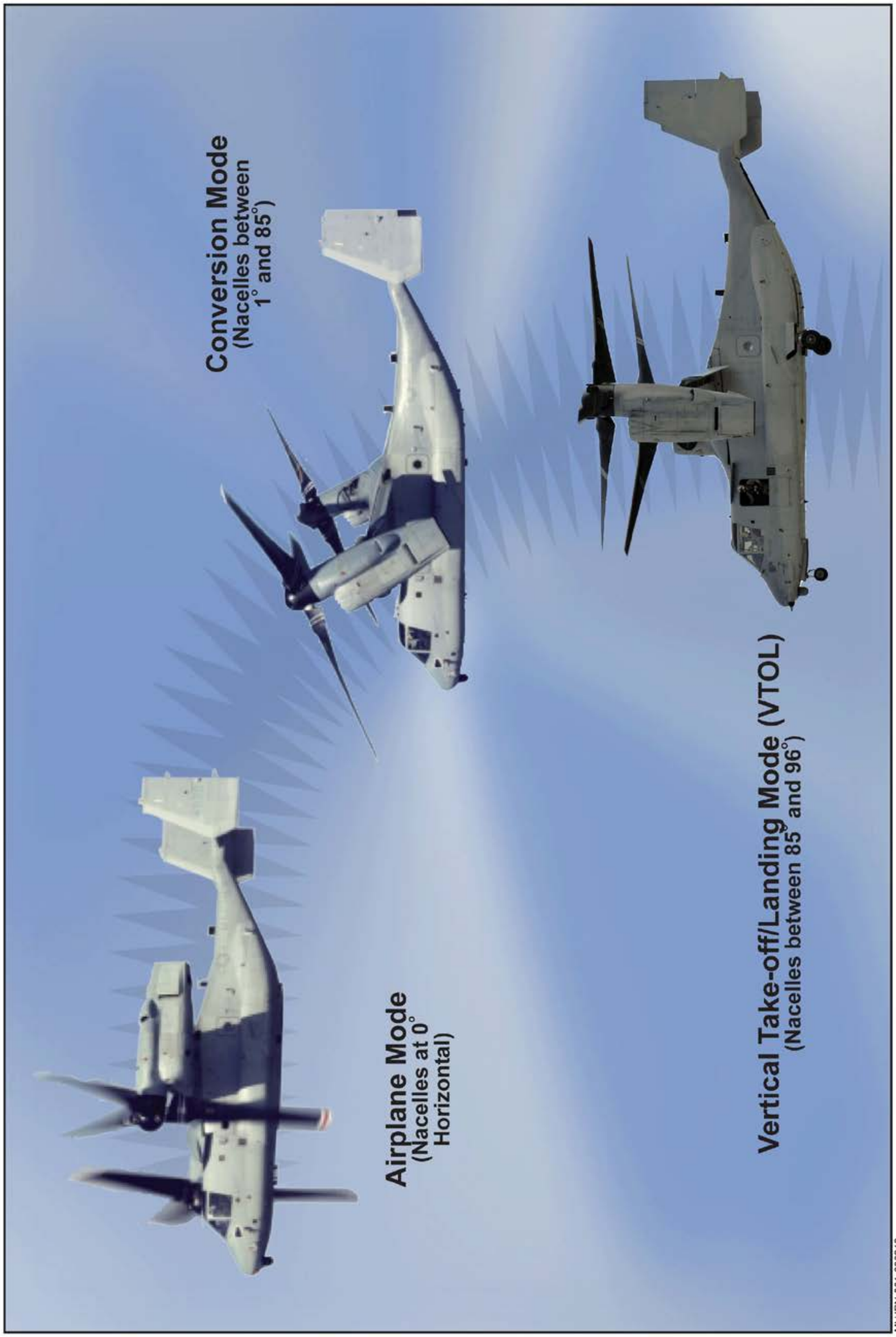


Figure 2-3. Stages of Flight for MV-22s

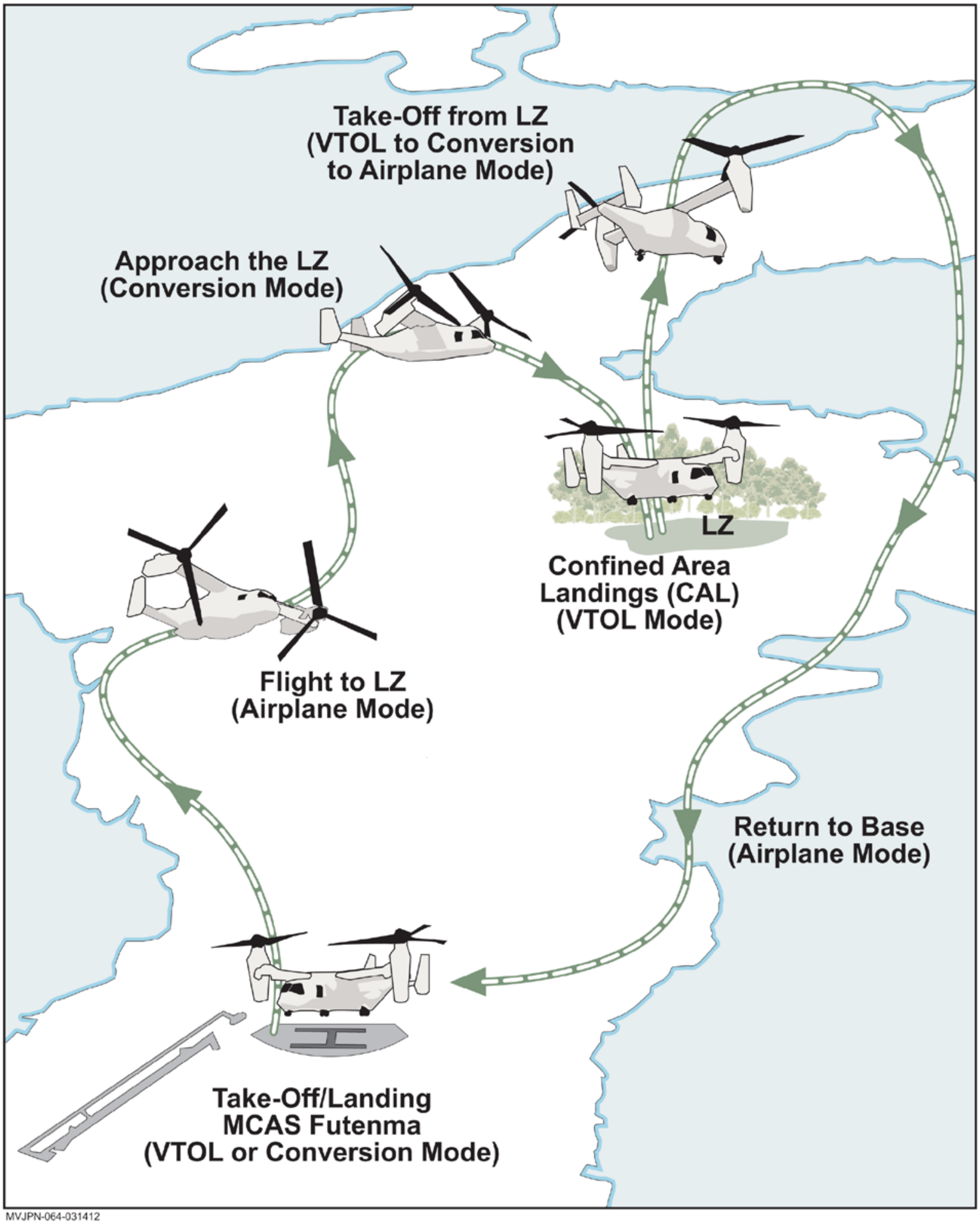


Figure 2-4. Stylized Depiction of Sortie with Component Operations

Types of Airfield Operations

At an airfield (or aboard a Landing Helicopter Assault [LHA] ship), the MV-22 aircraft may depart (take-off) either vertically or using a short-roll take-off that requires less than 200 feet depending upon wind speed/direction, aircraft weight, ground elevation, and other factors. On departure, the aircraft quickly rises and transitions through the conversion mode with the propellers tilting to horizontal. Once in this position, the aircraft operates in airplane mode to fly like a conventional turboprop aircraft (refer to Figure 2-3) for approximately 95 percent or more of an average sortie. For arrivals, this process is reversed, with a transition from horizontal to vertical flight for landing. Unlike the CH-46Es, the MV-22s would operate along both helicopter and fixed-wing flight tracks. At MCAS Futenma, the USMC expects the MV-22s to land and take-off to the northeast (Runway 06) 80 percent of the time (refer to Figure 2-1), with overall runway utilization patterns remaining the same as under current conditions (Wyle 2012). Take-offs and landings would utilize the existing helipads (1 through 3) at MCAS Futenma (refer to Figure 2-1), as well as the runway. Hovering, if necessary, would be brief for both take-off and landing, and would occur within the confines of the airfield. The MV-22s would also perform touch-and-goes and ground-controlled approaches in and around the airfield, as well as use LZs on the airfield and nearby on the installation. With the exception of the airplane flight mode, the existing CH-46Es also operate in a similar manner. Types of airfield operations conducted by the MV-22s would fall into three major categories: departures, arrivals, and closed patterns. Further explanation of these operations is presented in Appendix A.

Numbers of Airfield Operations

Current Operations

Table 2-2 summarizes the annual operations of all aircraft at MCAS Futenma under current conditions. As these data show, the CH-46Es dominate, accounting for 50 percent of based annual aircraft operations (9,292 of 18,555) and 40 percent of total annual operations (23,366). The based KC-130J aircraft account for 11 percent of total operations. Operations by the UC-35 transport jets and AH-1W helicopters, the next two most numerous aircraft, each contribute about 7 percent to total operations. Among fixed-wing aircraft, the transient FA-18C/Ds conduct about 4 percent of all airfield operations. Transient users perform about 21 percent of the total annual operations under current conditions.

Realistic training requires pilots to fly after dark some of the time and meet the special challenges posed by nighttime conditions. “After dark” flying can occur during environmental evening or night; for Okinawa, environmental day is 0700 to 1900, evening is defined as 1900 to 2200, and night is defined as 2200 to 0700. Evening and night are environmental standards used in noise assessment; noise generated during these times receives penalties in the noise modeling process. Noise levels of operations occurring in the evening are increased by 5 decibels (dB), while those from night operations are increased by 10 dB. These penalties account for increased community annoyance and sensitivity to noise during these periods. The CH-46E helicopters conduct the greatest number of evening and night flights. Under current conditions, evening flights by the based CH-46E helicopters account for 13 percent of all operations; night operations by the CH-46E aircraft also account for 0.3 percent of all operations. Overall, evening and night operations by all aircraft amount to 24 percent of total annual operations.

Proposed Operations

Under the proposed action (Table 2-3), basing MV-22s and replacing CH-46Es would result in an 11 percent reduction in total annual airfield operations (i.e., a decrease of 2,586). With the CH-46Es eliminated, the MV-22 operations would account for 32 percent of total activity. The MV-22s would fly almost 2,600 fewer operations than the CH-46Es, due to differences in training and readiness requirements, a reduced need to fly closed patterns, and the use of simulators. The sophistication and fidelity of the MV-22 simulators allows for their extensive use in training, thereby reducing the amount of flight time while also enhancing safety.

Replacement of the CH-46Es with MV-22s would reduce “low work” or patterns at the base and its environs from about 5,100 to 1,600 operations annually. When necessary during touch-and-goes within the airfield, very brief intervals of hovering may occur; hovering at the airfield would account for less than 1 percent of the activity. Annual operations by other based and transient aircraft would remain unchanged relative to the current conditions. MV-22 squadrons would fly 1,067 fewer operations in the evening hours, but would conduct 204 more operations at night. However, overall evening and night operations with their associated noise penalties would decrease by 15 percent.

2.2.2 Training and Readiness Operations

Training and readiness operations for both CH-46Es and MV-22s focus on providing USMC commanders with combat-capable and ready squadrons to perform essential missions: operations from expeditionary sea- and land-based sites, assault support, and air evacuation.

Table 2-2. Current Conditions Annual Flight Operations for MCAS Futenma

Based or Transient	Aircraft Category	Aircraft Type	Departure				Arrival[1]				Patterns[2]				Total			
			Day (0700-1900)	Eve (1900-2200)	Night (2200-0700)	Total	Day (0700-1900)	Eve (1900-2200)	Night (2200-0700)	Total	Day (0700-1900)	Eve (1900-2200)	Night (2200-0700)	Total	Day (0700-1900)	Eve (1900-2200)	Night (2200-0700)	Total
Based	Navy/ Marine	UC-35	510	23	-	**533**	280	238	15	**533**	567	65	-	**632**	1,357	326	15	**1,698**
		UC-12W	273	14	-	**287**	177	105	6	**288**	393	27	-	**420**	843	146	6	**995**
		KC-130J	608	102	-	**710**	532	162	18	**712**	1,109	102	-	**1,211**	2,249	366	18	**2,633**
		CH-53E	152	111	-	**263**	151	102	9	**262**	478	153	-	**631**	781	366	9	**1,156**
		AH-1W	211	154	-	**365**	210	142	13	**365**	665	213	-	**878**	1,086	509	13	**1,608**
		UH-1N	154	112	-	**266**	153	104	10	**267**	484	156	-	**640**	791	372	10	**1,173**
		CH-46E	1,217	890	-	**2,107[6]**	1,216	817	76	**2,109**	3,840	1,236	-	**5,076**	6,273	2,943	76	**9,292**
Transient		FA-18C/D[3]	341	69	-	**410**	391	19	-	**410**	80	15	-	**95**	812	103	-	**915**
		P-3	36	-	-	**36**	35	-	-	**35**	1,093	-	-	**1,093**	1,164	-	-	**1,164**
	Other Military[4]		252	83	2	**337**	274	57	6	**337**	120	11	-	**131**	646	151	8	**805**
	General Aviation[5]		511	57	-	**568**	526	61	-	**587**	694	78	-	**772**	1,731	196	-	**1,927**
Totals	Based		3,125	1,406	-	**4,531**	2,719	1,670	147	**4,536**	7,536	1,952	-	**9,488**	13,380	5,028	147	**18,555**
	Transient		1,140	209	2	**1,351**	1,226	137	6	**1,369**	1,987	104	-	**2,091**	4,353	450	8	**4,811**
Grand Total			**4,265**	**1,615**	**2**	**5,882**	**3,945**	**1,807**	**153**	**5,905**	**9,523**	**2,056**	**-**	**11,579**	**17,733**	**5,478**	**155**	**23,366**

Table 2-3. Proposed Annual Flight Operations for MCAS Futenma

Based or Transient	Aircraft Category	Aircraft Type	Departure				Arrival[1]				Patterns[2]				Total			
			Day (0700-1900)	Eve (1900-2200)	Night (2200-0700)	Total	Day (0700-1900)	Eve (1900-2200)	Night (2200-0700)	Total	Day (0700-1900)	Eve (1900-2200)	Night (2200-0700)	Total	Day (0700-1900)	Eve (1900-2200)	Night (2200-0700)	Total
Based	Navy/ Marine	UC-35	510	23	-	**533**	280	238	15	**533**	567	65	-	**632**	1,357	326	15	**1,698**
		UC-12W	273	14	-	**287**	177	105	6	**288**	393	27	-	**420**	843	146	6	**995**
		KC-130J	608	102	-	**710**	532	162	18	**712**	1,109	102	-	**1,211**	2,249	366	18	**2,633**
		CH-53E	152	111	-	**263**	151	102	9	**262**	478	153	-	**631**	781	366	9	**1,156**
		AH-1W	211	154	-	**365**	210	142	13	**365**	665	213	-	**878**	1,086	509	13	**1,608**
		UH-1N	154	112	-	**266**	153	104	10	**267**	484	156	-	**640**	791	372	10	**1,173**
		MV-22	1,741	745	86	**2,572[6]**	1,748	701	123	**2,572**	1,061	430	71	**1,562**	4,550	1,876	280	**6,706**
Transient		FA-18C/D[3]	341	69	-	**410**	391	19	-	**410**	80	15	-	**95**	812	103	-	**915**
		P-3	36	-	-	**36**	35	-	-	**35**	1,093	-	-	**1,093**	1,164	-	-	**1,164**
	Other Military[4]		252	83	2	**337**	274	57	6	**337**	120	11	-	**131**	646	151	8	**805**
	General Aviation[5]		511	57	-	**568**	526	61	-	**587**	694	78	-	**772**	1,731	196	-	**1,927**
Totals	Based		3,649	1,261	86	**4,996**	3,251	1,554	194	**4,999**	4,757	1,146	71	**5,974**	11,657	3,961	351	**15,969**
	Transient		1,140	209	2	**1,351**	1,226	137	6	**1,369**	1,987	104	-	**2,091**	4,353	450	8	**4,811**
Grand Total			**4,789**	**1,470**	**88**	**6,347**	**4,477**	**1,691**	**200**	**6,368**	**6,744**	**1,250**	**71**	**8,065**	**16,010**	**4,411**	**359**	**20,780**
Difference from Current Conditions			**524**	**-145**	**86**	**465**	**532**	**-116**	**47**	**463**	**-2,779**	**-806**	**71**	**-3,514**	**-1,723**	**-1,067**	**204**	**-2,586**

Source: Personnel Communication, Lee 2011 *Notes:* [1] Includes Non-Break Visual Arrivals, Break Arrivals, and Instrument Arrivals; [2] Includes Touch-and-Goes and ground-controlled approach box; each circuit = 1 departure + 1 arrival; [3] FA-18C/D operations data provided by MCAS Futenma (13 October 2011); [4] Includes C-12, KC-135, C-5, H-60, F-15, C-20, C-40, KC-10, and C-17; [5] Includes Dauphin, Eurocopter, Jet Range, Bell 500, Islander, and C-172 and XL-2; MCAS Futenma operations represent a three-year average for 2008 to 2010; [6]Departures equate to sorties.

Table 2-4 summarizes the training activities required for the CH-46E and MV-22 aircrews in order to ensure combat-capable status. For the CH-46Es, these activities are performed in training areas, on LZs, along the TERF route, and in overwater special use airspace (SUA) designated as Warning Areas. MV-22s would conduct most of the same activities – some in the same locations (training areas, LZs, TERF route, Warning Areas) – and some in other existing locations (NAV routes and installations on mainland Japan). With the exception of low-altitude tactics and air-to-air refueling, MV-22 training matches CH-46E activities. The following describes these training locations, detailing the nature and frequency of operations at each.

Table 2-4. Summary of Training Activities

	CH-46E	MV-22
Familiarization/Instrument/Navigation (night and day flights) – develop intermediate and advanced proficiency in operating the aircraft, both day and night.	X	X
Formation – training for flying, take-off, and landing with other aircraft, usually in a two-ship or four-ship group.	X	X
Field Carrier Landing Practice (FCLP) – training to land on amphibious ships (LHA, LHD) and carrier decks.	X	X
Defensive Combat Maneuvers – conduct defensive air maneuvers, countermeasures, and tactics against air-to-air and surface-to-air-threats.	X	X
Weapons/Gunnery – air-to-surface live fire practice.	X	X
Terrain Flight – Flying and navigating at low altitudes. Typical activities include low level and contour flight where aircraft fly at varying altitudes from 50 to 200 feet AGL.	X	X[1]
Low-Altitude Tactics – training for flying at low altitudes and tactics from 50 feet up to 500 feet above ground.	-	X
Assault Support Operations/Special Mission – training in techniques for inserting/extracting troops. Insertion activities could include fastrope, parachute operations, and water insertion. Extraction activities could include casualty/medical evacuations, tactical recovery of aircraft and personnel, non-combatant evacuations, as well as search and rescue.	X	X
Confined Area Landing (CAL) – landings conducted in areas with obstacles, such as high trees, or between buildings.	X	X
Cargo/Lift Operations – internal and external transport of cargo and equipment.	X	X
Air-to-Air Refueling – refueling aircraft while in the air.	-	X
Rapid Ground Refueling – training includes rapid refueling and forward arming and refueling point procedures.	X	X

Sources: DoN 2006, DoN 2009, and DoN 2010

Note: [1]Use of a TERF route by the MV-22s is not required in the training syllabus, but such routes could be flown on rare occasions.

Figure 2-5 provides an overview of the proposed distribution of training and readiness activities for the MV-22 squadrons. It shows the emphasis on different activities and locations in comparison to those performed by the CH-46E squadrons. The following sections detail each set of activities.

MV-22 with Bambi Bucket®

In addition to training and to assist in the defense of Japan, CH-46E squadrons provide emergency support to the community and region under mutual emergency operations agreements. Wildland firefighting in the training areas using Bambi Buckets® to transport and dump water represents an important function. Other roles include humanitarian assistance and disaster relief. The MV-22 squadrons would continue this broad spectrum of support. These Bambi Buckets used by the MV-22s can transport three times the amount of water than the CH-46E buckets can carry.

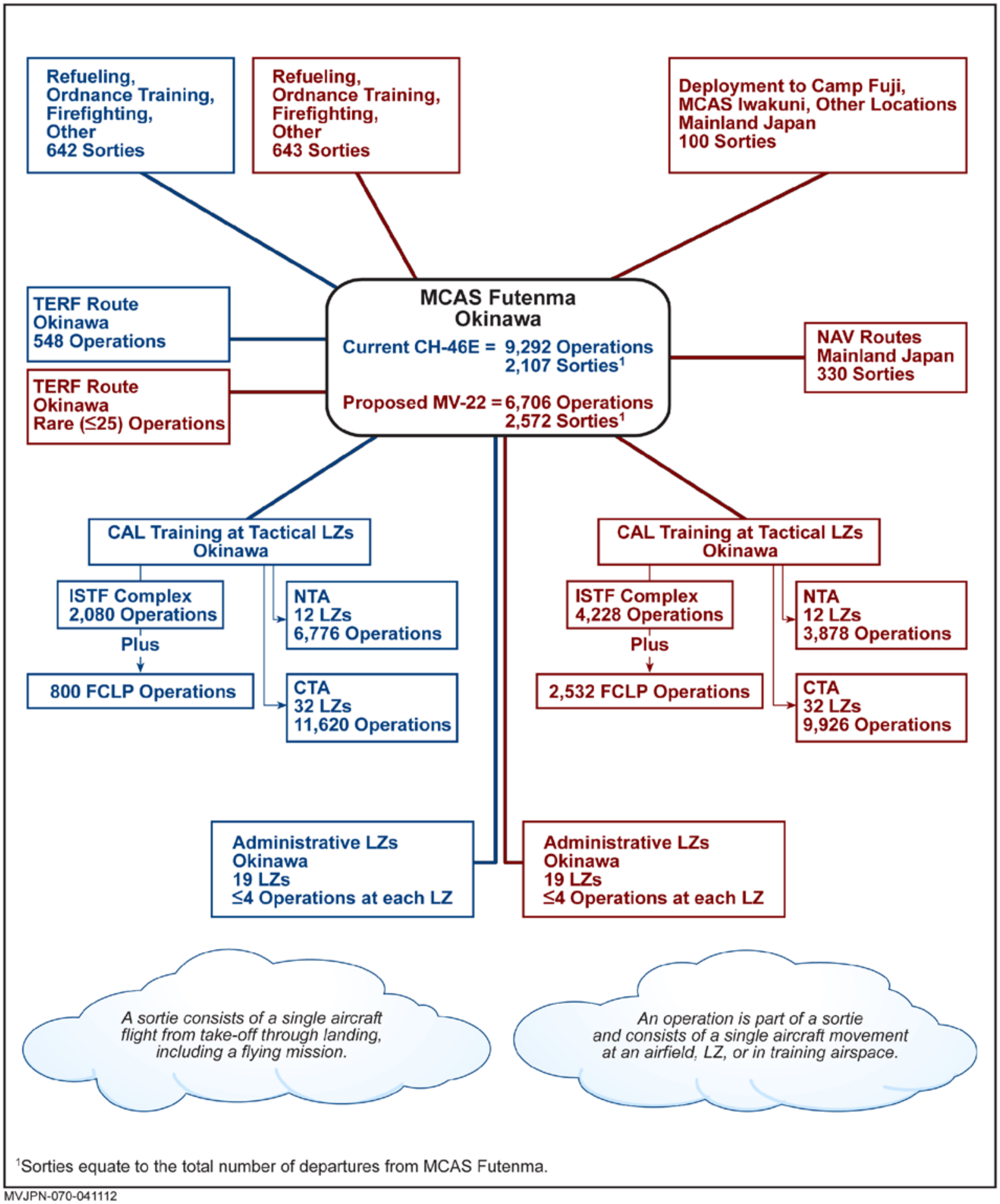


Figure 2-5. Overall Distribution of Training and Readiness Activities: CH-46E vs. MV-22

2.2.2.1 Training Areas

For both existing and proposed aircraft operations, the NTA, CTA, and ISTF represent the primary locations in Okinawa used for medium-lift helicopter training (refer to Figure 1-1). These U.S. facilities and areas in Japan contain LZs and other training assets. The NTA, situated at the northern end of Okinawa, encompasses about 19,300 acres. Mountainous terrain with jungle characterizes this area, which supports the Jungle Warfare Training Center. Airspace restricted to DoD users covers the NTA; range control manages all activities using this airspace. The CTA, which includes varied terrain and environments in its 17,000 acres, stretches across the narrow mid-section of Okinawa. Use of the airspace above the CTA is restricted and permitted only through range control. Situated on a small island (Ie Shima) about 5 miles off the northwest coast of Okinawa, the complete ISTF occupies a 1,981-acre area atop the western half of the island. The ISTF differs substantially from the other training areas in terms of its assets and the range of operations it supports. At the ISTF, a coral runway in the west provides training opportunities primarily for KC-130J transport aircraft. A nearby Landing Helicopter Dock (LHD), known as LHD Deck, supports FCLP training by AV-8B Harriers and helicopters. The farthest east runway (center of island) forms part of a municipal airport. A third runway between these two remains inactive and is used as a thoroughfare by the public. Within the ISTF, a 125-acre complex encompasses all of the LZs and other assets used by the CH-46Es and slated for use by the MV-22s. Located in the western third of the island, this unique complex includes four LZs, the Coral Runway, and the LHD Deck. Due to its proximity, this complex receives use as a single asset rather than a number of individual LZs as in the CTA or NTA. Airspace associated with the ISTF consists of a Warning Area (W-178), which alerts all non-participating aircraft that hazardous activities may be occurring.

2.2.2.2 Landing Zones

Existing Landing Zones

One function of the MV-22 squadrons is to make shipboard departures and quickly transport troops, equipment, and supplies inland to forward combat areas while avoiding the need for beachhead or interim transfers. To accomplish these missions, MV-22 aircrews must be able to effectively and efficiently locate, approach, land on, and depart from LZs that reflect reality in terms of terrain, accessibility, and vegetation, and offer a variety of circumstances and conditions. This training, known as CALs, would use existing LZs situated within the training areas described above.

MV-22 Operations at Landing Zones

Conducting CALs at the LZs involves a basic sequence of events subsumed into a sortie (refer to Figure 2-4). While both CH-46E and MV-22 squadrons need to perform CALs, differences exist between the way in which each conducts the training. For the MV-22, most (80 to 90 percent) flight would involve airplane mode with only a small proportion (≤5 percent) in VTOL mode. The following lists the sequence of a typical sortie to perform CALs at the LZs. Appendix A provides more details on these events and provides, where appropriate, distinctions between CH-46E and MV-22 squadron operations.

- ***Departure from MCAS Futenma***: During a typical training day, MV-22 aircrews would depart MCAS Futenma via vertical or short-roll take-off, quickly converting to the airplane mode.
- ***Flight to LZ***: In airplane mode, the MV-22s are capable of flying at altitudes of about 300 to 10,000 feet above ground level (AGL) and at a speed of 230 nautical miles (nm) per hour (knots) to the training area containing the LZs. Depending on weather and operational considerations, the average altitude in transiting to the LZs in airplane mode would be above 1,000 feet AGL.
- ***Approaching the LZ***: At a point about 3 miles away from the LZ, the pilot would begin to decelerate and convert the MV-22 from airplane mode to conversion mode, arriving at a point approximately 1.2 miles from the LZ at 300 feet AGL and 120 knots.
- ***Hovering/Landing***: Following the conversion, the pilot would continue to decelerate the MV-22 into VTOL mode while beginning to descend from 300 feet to arrive at a point 0.2 miles from the LZ at 150 feet AGL and 50 knots, and then perform a brief stationary hover at 20 feet over the LZ. A vertical landing is then accomplished. Hovering would last a few seconds during the landing.
- ***Take-off***: An MV-22 take-off from an LZ would be in the VTOL mode, usually into the wind and rising straight up through the first 20 feet, then transitioning to forward flight and climbing to eventually reach 200 to 220 knots and a cruising altitude that can vary from 300 to 1,000 feet AGL.
- ***Patterns and Repeated Landings at LZ***: For training, the USMC estimates that every sortie would involve about seven CALs (14 operations) at one or more LZs with patterns that can be conducted either in airplane or VTOL configurations, and repeating the approach, hovering, and landing sequence.
- ***Exiting the LZ***: Using the take-off and transition procedures described above, the MV-22 would exit the LZ.

Types and Locations of LZs

Under direction from the USMC, The Boeing Company (manufacturers of the MV-22) conducted an evaluation of 89 existing LZs on Okinawa (The Boeing Company 2010) to identify those suitable for MV-22 operations. This evaluation focused on size, condition (including development), topography, obstacles, vegetation, soils, and functionality relative to the number of landing points they contain. The size requirement for an LZ depends on the type, size, and number of aircraft required to land at any given time ensuring appropriate separation between multiple landing points for a single aircraft. An MV-22 needs a minimum area of 100 by 100 feet to operate safely, with a recommended planning distance of 250 feet between aircraft (The Boeing Company 2010). Other factors affecting the size of an LZ include spacing to minimize rotorwash effects among aircraft and to provide sufficient clearance for any ground personnel. Weather conditions that could cause poor visibility, such as fog and rain, would also determine spatial separation. Night operations affect the size of the LZ, as well. For the purposes of this proposed action, and based on previous MV-22 LZ assessments (USMC 2010), a single LZ for the MV-22 consists of a 100-foot by 100-foot central square landing area or point surrounded by a "buffer zone" radius of 350 feet extending from the edge of the square (Figure 2-6). Pilots may land MV-22s anywhere in the 100-foot by 100-foot area, depending upon terrain and obstacles. The additional buffer zone stems from consideration of the potential for effects from rotorwash in all types of environments as explained in Appendix B (V-22 Exhaust and Downwash Memoranda).

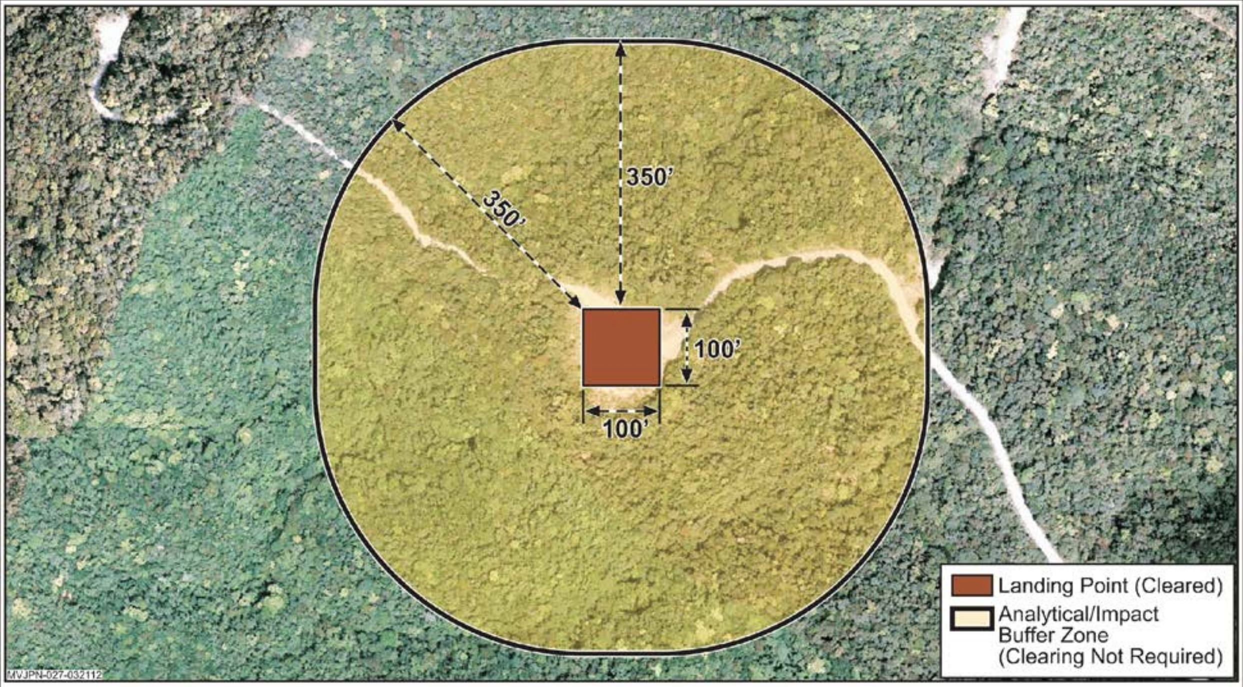


Figure 2-6. Representative Example of a Single Landing Point within an LZ

The total analyzed area for each landing point encompasses 12.3 acres for an LZ, although they differ in the specific size of clearing, pads, and other components. For the 13 tactical LZs that contain multiple landing points and could support multi-ship landings, this analysis considered the 100-foot by 100-foot landing point and 350-foot buffer zone as the affected area for each landing point.

Out of the total of 89 LZs examined, The Boeing Company study defined 77 as suitable for use by the MV-22s (The Boeing Company 2010). Subsequently, further evaluation of these sites by the USMC resulted in elimination of nine other LZs due to operational, logistic, and obstruction issues (Table 2-5). One new LZ, under construction at Camp Foster, was added to the suite of LZs for a total of 69.

Table 2-5. Suitable Landing Zones Eliminated from Further Consideration for MV-22 Operations

LZ Designation	Geographic Area	Rationale for Elimination
LZ Kin Red	Central Training Area	Not considered a recognized LZ by range control
LZ Kin Red (Alternate)	Central Training Area	Not considered a recognized LZ by range control
LZ Meadowlark	Central Training Area	Returned to Government of Japan in September 2011
LZ Petral	Central Training Area	Per information provided by MAG-36 Operations Officer, placed on no fly list, May 25, 2011
LZ Tern	Central Training Area	
LZ Turkey	Central Training Area	
LZ Camp Shield	Administrative Area	Navy eliminated for MV-22 proposed use July 20, 2011
LZ Schwab 3	Administrative Area	Camp Schwab eliminated based on safety and clearance requirements July 20, 2011
LZ Schwab Fuel	Administrative Area	

In the study, the LZs were assessed for their utility for MV-22 operations and classified into one of three categories:

1. ***Adequate***: The LZ satisfies MV-22 support requirements as derived from the applicable UFCs, Operation, and Training Requirements. A total of 36 LZs met these standards.
2. ***Substandard***: Although unable to fully satisfy MV-22 support requirements as derived from the applicable UFCs, these LZs could support MV-22 operations with upgrades available through Minor Repair Operating and Sustainment or Military Construction programs. These upgrades would not require construction, but would address issues that could arise during long-term, extensive use such as regrowth of vegetation in cleared areas. A total of 32 of the 68 evaluated LZs fell into this category.
3. ***Inadequate***: The LZs in this category can neither fully satisfy MV-22 support requirements nor support MV-22 operations with mitigations available through Minor Repair Operating and Sustainment or Military Construction programs. Twelve of the LZs were considered inadequate and were eliminated from further consideration for use by the MV-22s. These include the following: LZ 2, 11, and 16 in the NTA; LZ Osprey, Puffin, Rhea, Robin, and Teal in the CTA; and LZ Butler, Hansen VIP, Schwab, and Schwab 1 in the Administrative Area. If any of these LZs undergo modification or updating in the future, they will be analyzed under an appropriate environmental review process at that time.

Table 2-6 lists the 69 LZs proposed for use by the MV-22. The eliminated 21 LZs may continue to receive use from other helicopters in accordance with current operations. Table 2-6 also presents additional data regarding these LZs including information on their geographic area, operational characteristics, development and disturbance, and other conditions pertinent to understanding use and potential impacts.

Functional Types of LZs: The 69 LZs consist of two major functional types: tactical and administrative. *Tactical* LZs represent those used solely for training purposes consisting of landings, take-offs, and approaches that would reflect combat situations. A total of 50 of the 69 LZs comprise tactical LZs (numbers 1 through 50). *Administrative* LZs consist of sites, commonly in or near developed portions of installations, where refueling, troop transport, VIP transport, and emergency medical operations occur today and would continue to occur with basing of the MV-22 (numbers 51 to 69).

An Administrative LZ *is used occasionally for emergency or special purposes, such as VIP transport or medical evacuations.*

A Tactical LZ *is used routinely for training activities, such as CALs.*

Table 2-6. Existing Landing Zone Summary Data

#	LZ Designation	MV-22 Operational Characteristics		Development and Disturbance		Other Conditions	
		The Boeing Company Evaluation[1]	*Can Support Multi-Aircraft Landings*[2]	*Landing Point Area Characteristics*[3]	*% of LZ Developed*[4]	*Level Of Maintenance*[5]	*Proximity to Public Road*[6]
Ie Shima Training Facility (Tactical)							
1	Coral Runway	Adequate		Coral Runway	100	Substantial	Gated
2	Sling Load	Substandard		Pad/Maintained Grass	70-100	Substantial	Gated
3	Sling Load Alternative	Adequate		Maintained Grass	10-40	Moderate	Gated
4	VIP Helipad	Substandard		Pad/Maintained Grass	70-100	Substantial	Gated
5	LHD Deck	Adequate	Yes	AM-2 Matting	100	Substantial	Gated
6	Drop Zone	Adequate	Yes	Grass	<10	Limited	Gated
Northern Training Area (Tactical)							
7	LZ 1	Substandard		Cleared/Soil/Vegetation	10-40	Limited	213 feet
8	LZ 3	Substandard		Cleared/Soil/Vegetation	10-40	Limited	113 feet
9	LZ 4	Substandard		Cleared/Soil/Vegetation	10-40	Moderate	201 feet
10	LZ 12	Substandard		Pad/Vegetation	10-40	Moderate	4,600 feet
11	LZ 12A	Substandard		Cleared/Soil/Vegetation	10-40	Limited	5,600 feet
12	LZ 13	Substandard		Pad/Maintained Grass	70-100	Moderate	3,700 feet
13	LZ 14	Substandard		Maintained Grass	70-100	Moderate	3,975 feet
14	LZ 15	Substandard		Pad/Gravel/Vegetation	10-40	Moderate	4,500 feet
15	LZ 17	Adequate	Yes	Cleared/Soil/Vegetation	10-40	Moderate	400 feet
16	LZ 18	Substandard		Cleared/Soil/Vegetation	10-40	Moderate	6,900 feet
17	LZ Baseball	Adequate		Maintained Grass	100	Substantial	3,400 feet
18	LZ Firebase Jones	Substandard	Yes	Cleared/Soil/Vegetation	10-40	Limited	3,625 feet
Central Training Area (Tactical)							
19	LZ Buzzard	Adequate		Maintained Grass/Vegetation	40-70	Substantial	185 feet
20	LZ Cardinal	Adequate	Yes	Cleared/Soil/Vegetation	40-70	Moderate	2,800 feet
21	LZ Condor	Substandard		Maintained Grass/Road Surface/Vegetation	10-40	Moderate	4,400 feet
22	LZ Coot	Adequate		Cleared/Soil/Vegetation	10-40	Moderate	430 feet
23	LZ Crane	Substandard		Pad/Maintained Grass	10-40	Moderate	1,700 feet
24	LZ Crow	Adequate		Pad/Gravel	40-70	Substantial	246 feet
25	LZ Curlew	Adequate		Maintained Grass/Road Surface	40-70	Moderate	530 feet
26	LZ Dodo	Adequate	Yes	Maintained Grass/Road Surface	40-70	Moderate	2,200 feet
27	LZ Duck	Substandard		Cleared/Soil/Vegetation	10-40	Limited	1,150 feet
28	LZ Falcon	Adequate	Yes	Maintained Grass/Road Surface/Vegetation	40-70	Moderate	747 feet
29	LZ Flamingo	Adequate		Pad/Vegetation	10-40	Moderate	199 feet
30	LZ Gander	Adequate	Yes	Cleared/Soil/Vegetation	70-100	Moderate	1,660 feet
31	LZ Goose	Adequate		Maintained Grass/Road Surface/Vegetation	10-40	Moderate	2,950 feet
32	LZ Hawk	Adequate		Maintained Grass/Soil/Vegetation	40-70	Moderate	940 feet
33	LZ Heron	Substandard		Pad/Vegetation	10-40	Moderate	1,525 feet
34	LZ Kin Blue	Adequate	Yes	Cleared/Gravel/Soil	40-70	Moderate	1,700 feet
35	LZ Kiwi	Adequate		Maintained Grass/Vegetation	10-40	Moderate	2,960 feet
36	LZ Macaw	Substandard		Pad/Maintained Grass	70-100	Substantial	875 feet
37	LZ Magpie	Substandard		Pad/Maintained Grass	10-40	Moderate	1,095 feet
38	LZ Mallard	Adequate		Maintained Grass/Vegetation	10-40	Moderate	190 feet
39	LZ Owl	Adequate		Cleared/Vegetation	10-40	Moderate	420 feet
40	LZ Peacock	Adequate		Cleared/Vegetation	10-40	Moderate	3,300 feet
41	LZ Phoenix	Adequate	Yes	Cleared/Vegetation	40-70	Moderate	520 feet
42	LZ Pigeon	Adequate		Cleared/Soil/Vegetation	10-40	Moderate	2,280 feet
43	LZ Rail	Adequate		Cleared/Vegetation	10-40	Limited	565 feet

Table 2-6. Existing Landing Zone Summary Data

#	LZ Designation	MV-22 Operational Characteristics		Development and Disturbance		Other Conditions	
		The Boeing Company Evaluation[1]	*Can Support Multi-Aircraft Landings*[2]	*Landing Point Area Characteristics*[3]	*% of LZ Developed*[4]	*Level Of Maintenance*[5]	*Proximity to Public Road*[6]
Central Training Area (Tactical) (con't)							
44	LZ Raven	Substandard		Pad/Gravel/Vegetation	10-40	Moderate	200 feet
45	LZ Rook	Substandard		Pad/Gravel/Vegetation	10-40	Moderate	2,500 feet
46	LZ Starling	Adequate	Yes	Cleared/Vegetation	10-40	Moderate	515 feet
47	LZ Swallow	Substandard		Pad/Maintained Grass/Vegetation	40-70	Substantial	390 feet
48	LZ Swan	Substandard		Pad/Maintained Grass/Vegetation	40-70	Substantial	1,725 feet
49	LZ Whippoorwill	Adequate	Yes	Cleared/Vegetation	10-40	Moderate	900 feet
50	LZ Wren	Adequate		Pad/Gravel/Vegetation	10-40	Moderate	Gated
Administrative (Non-Tactical)							
51	LZ Courtney	Substandard		Pad/Maintained Grass	100	Substantial	Gated
52	LZ Foster	Adequate	Yes	Maintained Grass	100	Substantial	Gated
53	LZ Futenma HQTR	Substandard		Pad/Maintained Grass	100	Substantial	Gated
54	LZ Futenma VIP	Substandard		Pad/Maintained Grass	100	Substantial	Gated
55	LZ Hansen 2	Adequate	Yes	Maintained Grass	100	Substantial	Gated
56	LZ Kadena Charlie Pad	Substandard		Runway/Taxiway	100	Substantial	Gated
57	LZ Kadena Echo Pad	Substandard		Runway/Taxiway	100	Substantial	Gated
58	LZ Kadena Rescue Pad	Substandard		Runway/Taxiway	100	Substantial	Gated
59	LZ Kadena VIP	Adequate	Yes	Maintained Grass	100	Substantial	Gated
60	LZ Kadena VTOL Pad	Adequate		Runway/Taxiway	100	Substantial	Gated
61	LZ Kinser 1	Substandard		Pad/Maintained Grass	100	Substantial	Gated
62	LZ Lester Hospital	Substandard		Pad/Maintained Grass	100	Substantial	Gated
63	LZ Lester School	Adequate	Yes	Maintained Grass	100	Substantial	300 feet
64	LZ Plaza	Substandard		Pad/Maintained Grass	100	Substantial	Gated
65	LZ Torii 1	Substandard		Pad/Road	100	Substantial	Gated
66	LZ Torii 2	Adequate	Yes	Maintained Grass	100	Substantial	Gated
67	LZ Torii Beach	Adequate	Yes	Maintained Grass/Road	100	Substantial	Gated
68	LZ White Beach	Adequate		Pad/Maintained Grass	100	Substantial	Gated
69	New Hospital LZ	Not in original study[7]		Pad/Maintained Grass	100	Substantial	Gated

Notes:

[1] The Boeing Company LZ Site Survey (2010) was conducted to identify current landing areas where the MV-22 can safely land; it did not provide specific recommendations on how those landing areas should be modified. It categorized LZs as Adequate, Substandard, or Inadequate. Substandard LZs were included since MV-22s could use them and they do not necessarily require construction. Rather, these LZs exhibit issues warranting concern if the LZ receives extensive use over a period of time (e.g., surface conditions consist of asphalt; potential heating issues due to exhaust; facility planners should coordinate with local command to determine use of the LZ, etc.).

[2] "Multi-aircraft" indicates that more than one MV-22 could safely land at an LZ simultaneously. Maximum number of aircraft considered was 4. Separation of 250 feet between MV-22s required.

[3] Applies to the central 100-foot x 100-foot area and immediate surroundings for each LZ.

[4] Derived from inspection of aerial photography and applies to the entire 12.3-acre area analyzed for each LZ.

[5] Based on nature of development and site photographs and visits.

[6] Provided by MCB Camp Butler Facilities Systems Maintenance Branch.

[7] Analyzed after The Boeing Company study; construction to be completed in 2012.

Geographic Distribution of LZs: The 69 LZs are situated in four geographic areas (ISTF, NTA, CTA, and Administrative Area) (refer to Figure 1-1). The CTA contains the most with 32 LZs, while the NTA and ISTF include 12 and 6 LZs, respectively. The 19 Administrative LZs lie within installations in the southern part of Okinawa. Despite their broad distribution, all of the LZs proposed for use lie within U.S. facilities and areas.

Development, Disturbance, and Other Conditions at the LZs: Details are given for the nature and extent of development and disturbance of the 69 LZs by the MV-22 squadrons. The information presented below summarizes these conditions for the ISTF, NTA, CTA, and Administrative Area.

ISTF (6 LZs). As noted above, the ISTF offers a unique training asset with multiple assets in a small complex. The LZs on Ie Shima (Figure 2-7) are situated relatively near one another within a 125-acre complex in an exclusive use area for USMC training. This developed complex clusters around an LHD Deck which also can be used as an LZ. The LHD Deck recently underwent refurbishment with placement of new matting so that it now supports landing lights, a tower, and other features for supporting FCLPs. AV-8B Harriers and CH-46Es dominate use of this deck for FCLP training. The Coral Runway receives use primarily by KC-130J aircraft performing touch-and-goes. While this runway can support LZs, the MV-22 squadrons would not employ it in that manner. Two of the other LZs within the complex include developed pads and two others consist of grasses (refer to Table 2-6). With the exception of the large Drop Zone, the LZs lie on flat terrain and receive regular maintenance including mowing of the grass. The Drop Zone LZ includes small hummocks and swales, and retains a somewhat natural appearance despite limited maintenance and mowing of vegetation. Four of the six LZs within the ISTF reflect extensive development and/or disturbance; lesser levels of disturbance and development apply to the Sling Load Alternative and Drop Zone. The USMC controls access to this gated area, restricting public use of the roads.

NTA (12 LZs). The NTA, also known as the Jungle Warfare Training Center, offers the most remote and rugged training opportunities on Okinawa. The 12 LZs proposed for use within the NTA (Figure 2-8) lie within hilly terrain, although the central portions of the LZs (i.e., Landing Points) consist of flat, cleared and graded topography. Four LZs (1, 3, 4, and 12A) contain small, cleared, open areas surrounded by trees and thick vegetation. LZs 15, 17, and 18 each lie within an irregularly-shaped cleared area with trees and vegetation on the perimeter. Complete or partial central pads bordered by maintained grass or gravel occur within three LZs (12, 13, and 15). One site (LZ Baseball) consists of a developed baseball field, whereas LZ Firebase Jones comprises a large area of exposed soil bounded by trees. Roads extend to many of the LZs in the NTA. The degree of development and disturbance characteristic of these LZs is relatively low, with nine sites consisting of cleared areas bounded by thick vegetation and trees. Regular maintenance to reduce the height of grasses and remove shrubs from the landing point area and vicinity is conducted at five LZs (4, 12, 15, 17, and 18). Only one LZ (Baseball) exhibits 100 percent development and disturbance. A total of three LZs (1, 3, and 4) lie within 300 feet of roads offering public access.

CTA (32 LZs). With 32 LZs distributed over an extensive portion of central Okinawa (Figure 2-9), the CTA represents a primary training location for the MV-22s. Of the total LZs in the CTA, 11 include developed pads. Cleared areas with maintained grass characterize a total of nine CTA LZs, some bordered by trees and others manifesting more open conditions. All these LZs have been wholly or partially cleared and are generally flat. The area affected by development and disturbance ranges from 10 to 40 percent for 19 of these LZs and 40 to 70 percent for 10 of them. Only two LZs show 70 to 100 percent development and disturbance. Regular maintenance of areas from 0.1 to 6.6 acres occurs at 23 of the LZs in the CTA. Roads connect to all these LZs, although only five LZs (Buzzard, Crow, Flamingo, Mallard, and Raven) lie within 300 feet of a road permitting public access.

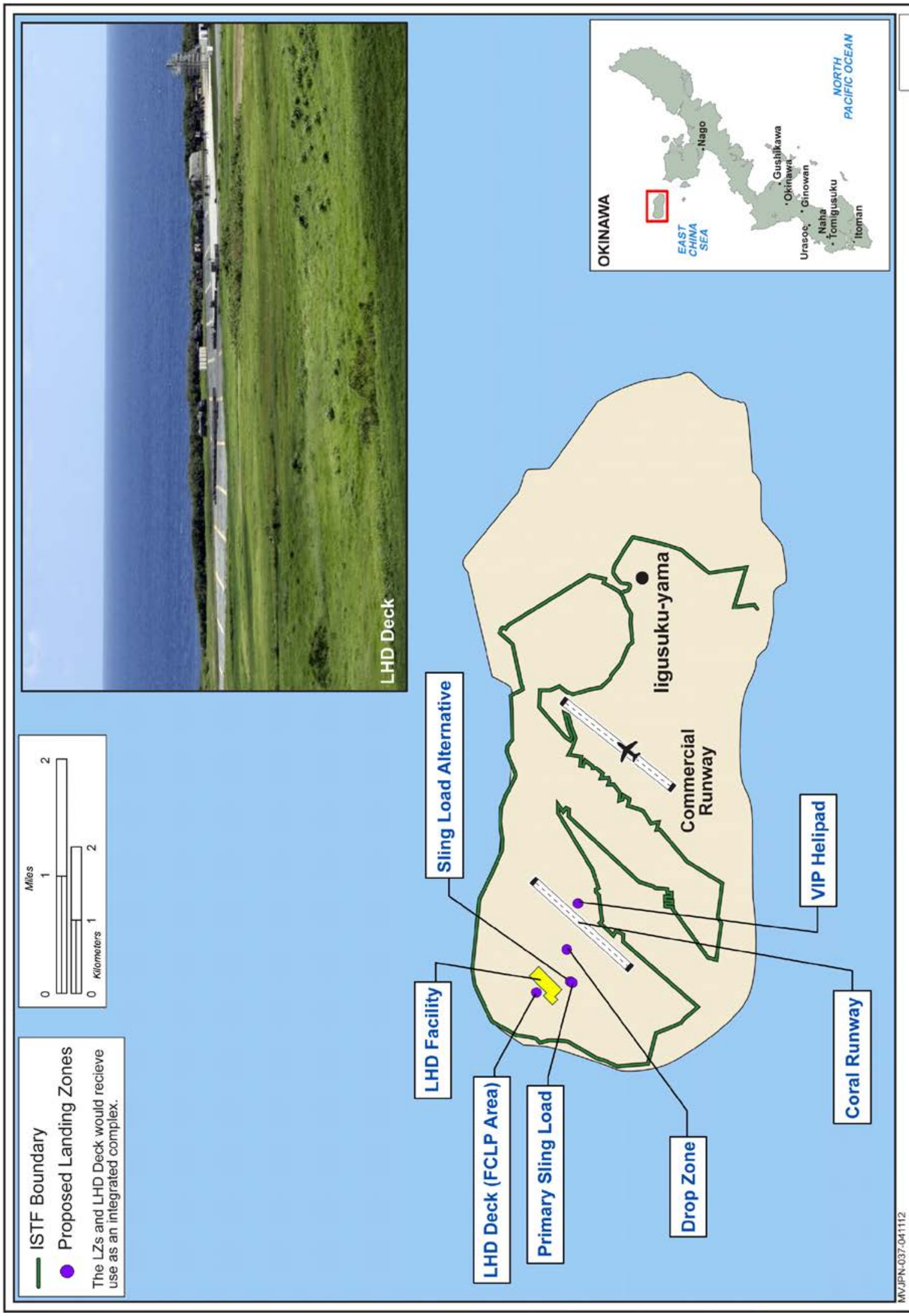


Figure 2-7. Landing Zones on Ie Shima Training Facility

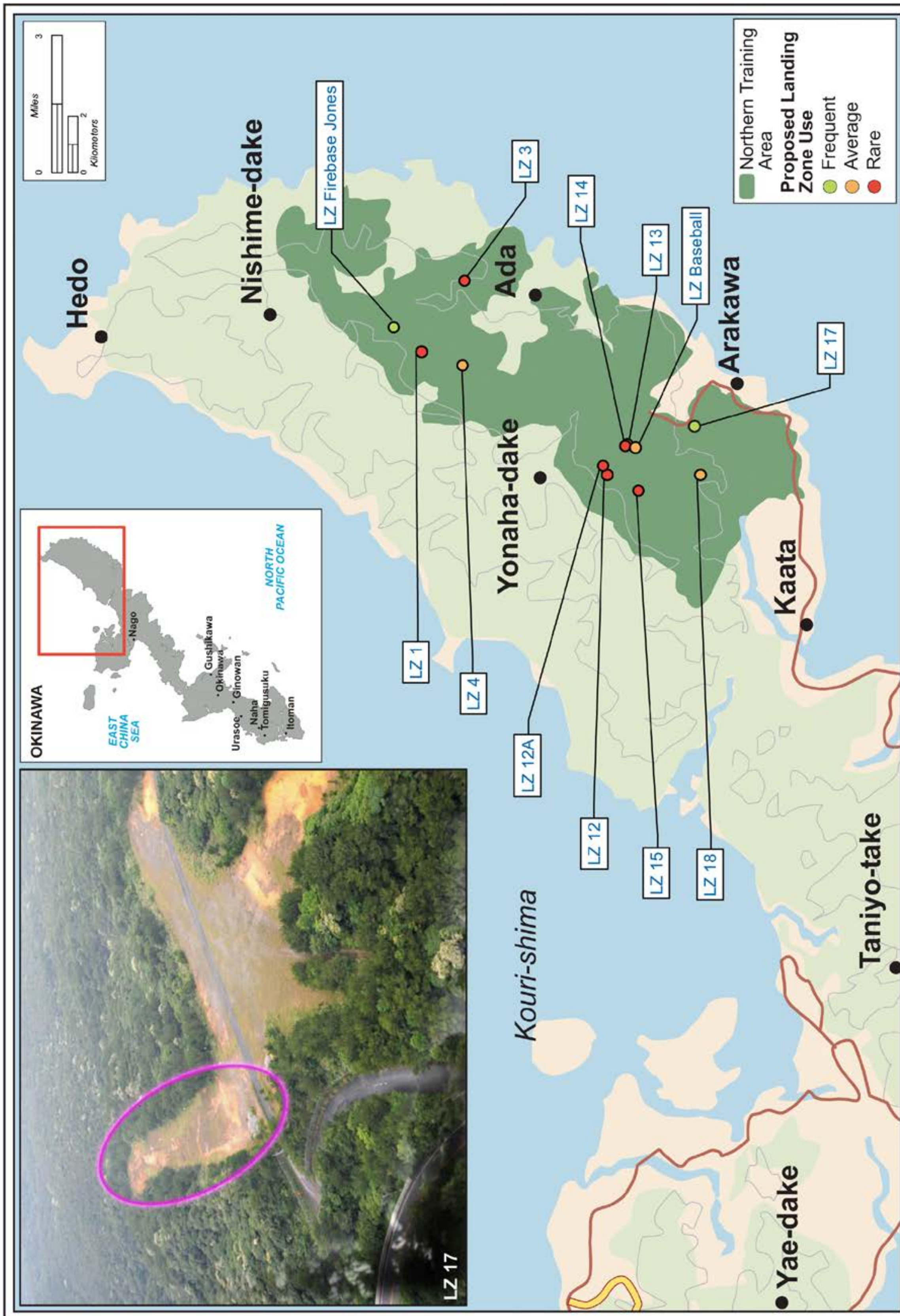


Figure 2-8. Existing Landing Zones in the Northern Training Area

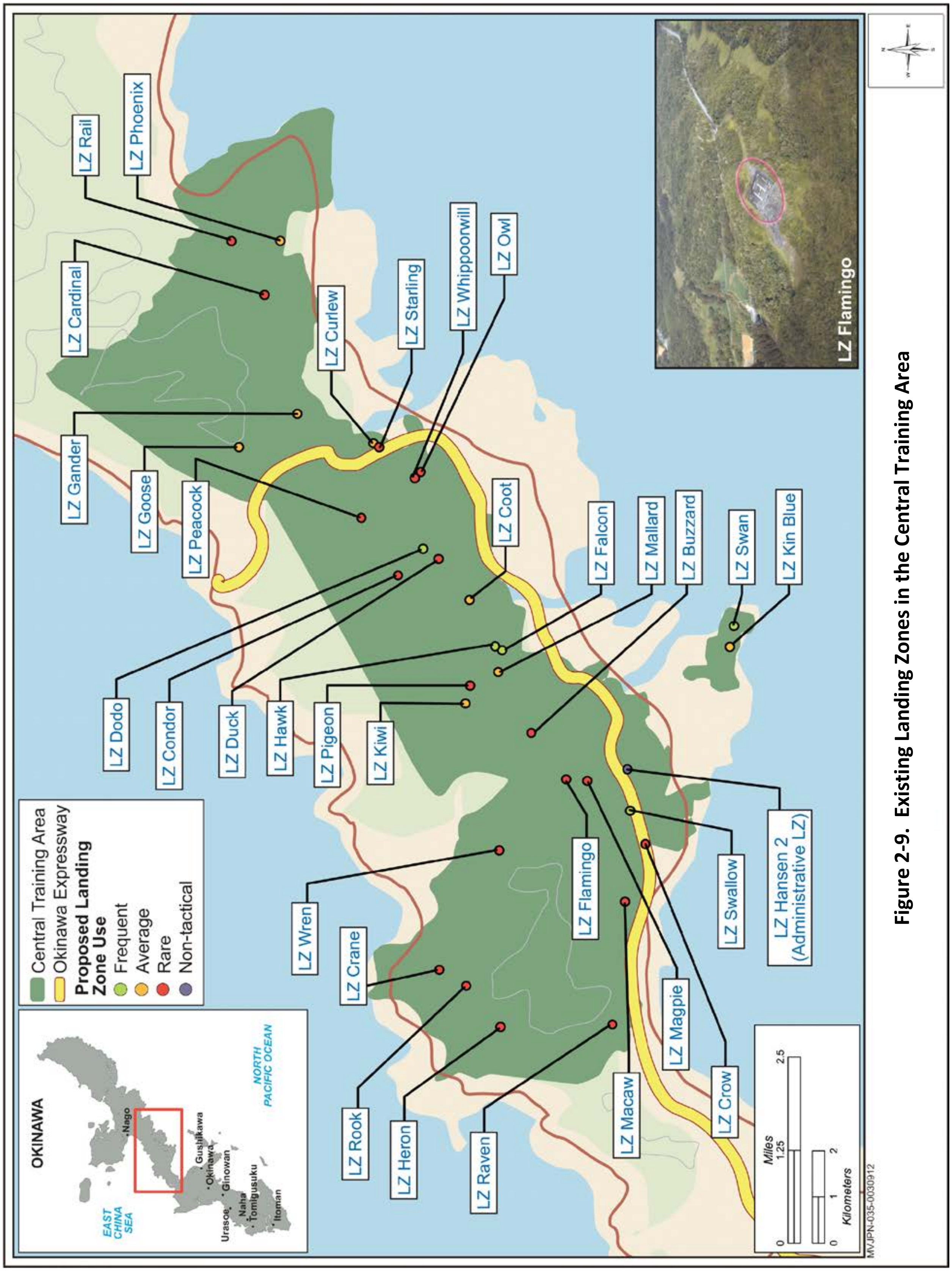


Figure 2-9. Existing Landing Zones in the Central Training Area

Administrative Area. As noted previously, 19 Administrative LZs occur within the developed sections of MCAS Futenma, Kadena AB, Camp Foster, Camp Kinser, Camp Courtney, White Beach, and Torii Station, situated in the southern half of Okinawa (Figure 2-10). All of the existing 18 (numbers 51 to 68) Administrative LZs are substantially developed, and 13 contain landing pads or form part of existing runway/taxiway areas. These pads are surrounded by grass and landscaping. The remaining 5 LZs consist of maintained grass fields used for various other purposes. Structures occur on 11 of these Administrative LZs, although none pose an obstruction hazard. Seventeen LZs lie within controlled-access installations without public roads; LZ Lester School lies within 300 feet of a public access road. The New Hospital LZ (number 69) will not be completed until 2012, but will include a landing pad. Impacts of construction have been assessed by the GoJ in a separate analysis.

LZs Scheduled for Construction

The GoJ is constructing six LZs to replace existing LZs on portions of U.S. facilities and areas on Okinawa slated for return to the GoJ. Construction of the new LZs would include support infrastructure such as roads, fences, and gates. Originally conceived to support CH-53 helicopter operations, the U.S. and GoJ recognized that slight modifications to plans may be necessary to accommodate MV-22 CAL operations. Although the GoJ prepared an Environmental Assessment (former Naha Defense Facilities Administration Bureau [DFAB] 2011) addressing the impacts of site clearing, LZ construction, and infrastructure development, it did not evaluate current or proposed operations in general or MV-22 operations specifically.

The six LZs scheduled for construction (SC) will replace six existing LZs, all of which lie within the NTA and include LZs 1, 1A, 2, 2A, 3, Firebase Jones, and 21. Three of these LZs, 1, 3, and Firebase Jones, represent sites proposed for use by the MV-22. At this time, however, the timing of construction and operational availability remains unconfirmed. Similarly, the correlation of existing LZs and SC LZs is undefined. Therefore, this ER will assess operations at the existing LZs, while also using best available information to analyze operations at the SC LZs.

Situated within the eastern portion of the NTA (Figure 2-11), these SC LZs would consist of a circular landing point about 150 feet in diameter surrounded by a cleared no-obstacle zone extending another 50 feet beyond the inner circle. In total, each SC LZ would measure approximately 250 feet in diameter, covering about 1.1 acres of cleared land. These SC LZs would not be expected to support multi-ship landings given their size.

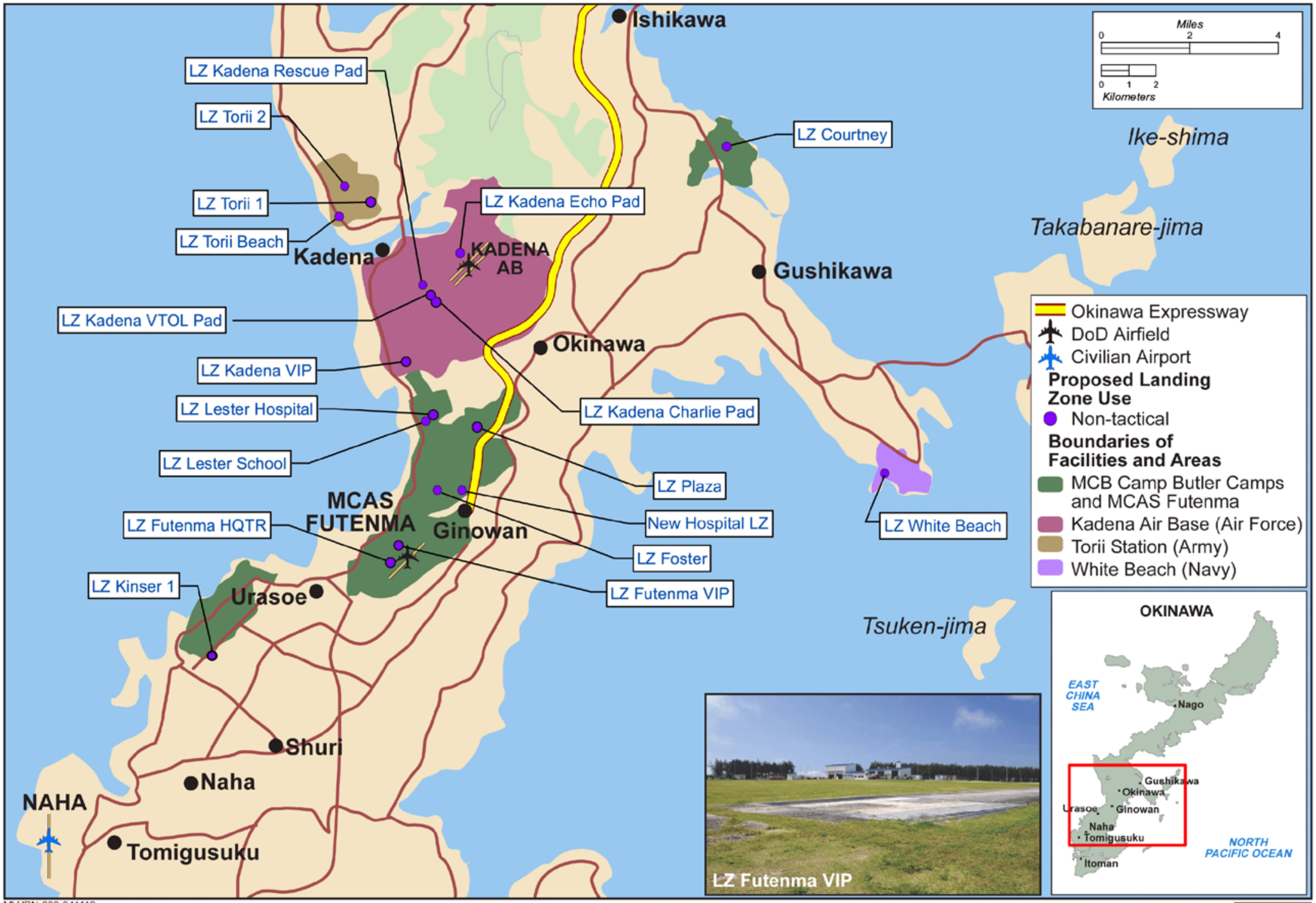


Figure 2-10. Existing Landing Zones in the Administrative Area

Note: LZ Hansen 2 can be found on Figure 2-9

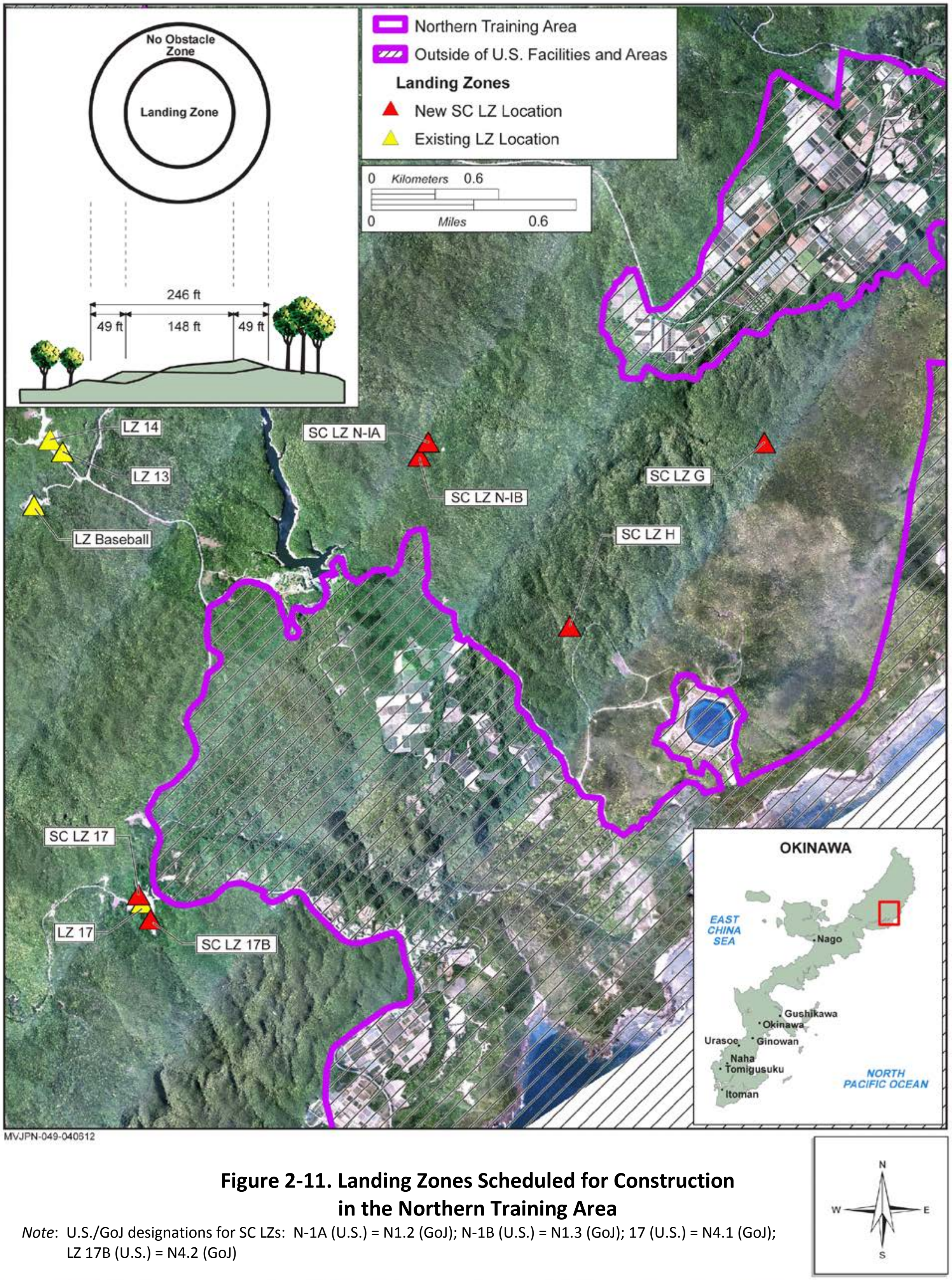


Figure 2-11. Landing Zones Scheduled for Construction in the Northern Training Area

Note: U.S./GoJ designations for SC LZs: N-1A (U.S.) = N1.2 (GoJ); N-1B (U.S.) = N1.3 (GoJ); 17 (U.S.) = N4.1 (GoJ); LZ 17B (U.S.) = N4.2 (GoJ)

Operations at Landing Zones

Current Conditions

For many years, the 50 existing tactical LZs have supported CAL operations by CH-46E and other helicopters including CH-53Es, AH-1Ws, and UH-1Ns. Based on data derived from USMC aviators, approximately 50 percent of the CH-46E helicopter sorties from MCAS Futenma involve CAL operations. Most of these CAL operations are performed in the CTA and NTA, with about 57 percent conducted in the CTA LZs and 33 percent flown in the NTA LZs. At ISTF, the LZs within the complex support roughly 10 percent of the CH-46 CAL operations annually. However, as described later, the ISTF is used heavily for FCLPs. All other helicopters perform less than half of the total operations.

Based on inputs from CH-46E aircrews (Wyle 2012; personal communication, Holden 2011), three levels of use characterize the frequency of CH-46E operations at the tactical LZs: Frequent, Average, and Rare (Table 2-7). USMC aviators currently flying the CH-46Es conduct an estimated 7 CALs per sortie at an LZ. Consisting of a landing and take-off each, these CALs account for 14 operations. For a Frequent LZ, CH-46E operations would total 1,260 per year; at an Average LZ, CH-46E operations would total about 420 per year. Tactical LZs classified as Rare use would support an estimated 14 operations per year. While equivalent to the average number of CAL operations during a single sortie, it is expected that these LZs would be used sporadically. Under current conditions, 27 percent of the 50 tactical LZs receive Frequent use, 16 percent receive Average use, and 57 percent receive Rare use.

Table 2-7. Use Level Categories for Tactical Landing Zones

Use Level	Estimate Percent of LZs by Use Level	
	CH-46E	***MV-22***
Frequent (1,260 operations/year)	27%	16%
Average (420 operations/year)	16%	25%
Rare (14 operations/year)	57%	59%

The CTA contains eight Frequent use LZs for CH-46Es, and the NTA includes four Frequent use LZs for these current aircraft (Table 2-8). At the ISTF, the LHD Deck and LZs are used to varying degrees in concert and combination for CAL operations. While none of the LZs at the ISTF currently experience Frequent use, CH-46E CAL operations total 2,080 per year there. In addition, the CH-46E squadrons perform 800 annual FCLP and touch-and-go operations at the ISTF LHD Deck and runway. AV-8B Harriers conduct 37 percent of all FCLP operations on the deck and over Ie Shima.

Table 2-8. Comparison of CH-46E and MV-22 Operations at Existing Landing Zones

#	LZ Designation	CH-46 Current Use[1]	CH-46 Current Operations[1]	MV-22 Proposed Use[3]	MV-22 Operations[3]	Net Increase or Decrease in Use
Ie Shima Training Facility[2]						
1	Coral Runway		2,080[4]		4,228[5]	Increase
2	Sling Load					
3	Sling Load Alternative					
4	VIP Helipad					
5	LHD Deck					
6	Drop Zone					
Northern Training Area						
7	LZ 1	Average	420	Rare	14	Decrease
8	LZ 3	Rare	14	Rare	14	No Change
9	LZ 4	Average	420	Average	420	No Change
10	LZ 12	Rare	14	Rare	14	No Change
11	LZ 12A	Rare	14	Rare	14	No Change
12	LZ 13	Average	420	Rare	14	Decrease
13	LZ 14	Average	420	Rare	14	Decrease
14	LZ 15	Rare	14	Rare	14	No Change
15	LZ 17	Frequent	1,260	Frequent	1,260	No Change
16	LZ 18	Frequent	1,260	Average	420	Decrease
17	LZ Baseball	Frequent	1,260	Average	420	Decrease
18	LZ Firebase Jones	Frequent	1,260	Frequent	1,260	No Change
Central Training Area						
19	LZ Buzzard	Rare	14	Rare	14	No Change
20	LZ Cardinal	Rare	14	Rare	14	No Change
21	LZ Condor	Rare	14	Rare	14	No Change
22	LZ Coot	Rare	14	Average	420	Increase
23	LZ Crane	Rare	14	Rare	14	No Change
24	LZ Crow	Rare	14	Rare	14	No Change
25	LZ Curlew	Frequent	1,260	Average	420	Decrease
26	LZ Dodo	Frequent	1,260	Frequent	1,260	No Change
27	LZ Duck	Frequent	1,260	Rare	14	Decrease
28	LZ Falcon	Rare	14	Frequent	1,260	Increase
29	LZ Flamingo	Rare	14	Rare	14	No Change
30	LZ Gander	Frequent	1,260	Average	420	Decrease
31	LZ Goose	Frequent	1,260	Average	420	Decrease
32	LZ Hawk	Frequent	1,260	Frequent	1,260	No Change
33	LZ Heron	Rare	14	Rare	14	No Change
34	LZ Kin Blue	Rare	14	Average	420	Increase
35	LZ Kiwi	Frequent	1,260	Average	420	Decrease
36	LZ Macaw	Rare	14	Rare	14	No Change
37	LZ Magpie	Rare	14	Rare	14	No Change
38	LZ Mallard	Rare	14	Average	420	Increase
39	LZ Owl	Rare	14	Rare	14	No Change
40	LZ Peacock	Frequent	1,260	Rare	14	Decrease
41	LZ Phoenix	Rare	14	Average	420	Increase
42	LZ Pigeon	Rare	14	Rare	14	No Change
43	LZ Rail	Rare	14	Rare	14	No Change
44	LZ Raven	Rare	14	Rare	14	No Change
45	LZ Rook	Rare	14	Rare	14	No Change
46	LZ Starling	Average	420	Rare	14	Decrease

Table 2-8. Comparison of CH-46E and MV-22 Operations at Existing Landing Zones (con't)

#	LZ Designation	CH-46 Current Use[1]	CH-46 Current Operations[1]	MV-22 Proposed Use[3]	MV-22 Operations[3]	Net Increase or Decrease in Use
Central Training Area (con't)						
47	LZ Swallow	Average	420	Frequent	1,260	Increase
48	LZ Swan	Rare	14	Frequent	1,260	Increase
49	LZ Whippoorwill	Rare	14	Rare	14	No Change
50	LZ Wren	Average	420	Rare	14	Decrease
Administrative						
51	LZ Courtney	Non-Tactical	≤4	Non-Tactical	≤4	No Change
52	LZ Foster	Non-Tactical	≤4	Non-Tactical	≤4	No Change
53	LZ Futenma HQTR	Non-Tactical	≤4	Non-Tactical	≤4	No Change
54	LZ Futenma VIP	Non-Tactical	≤4	Non-Tactical	≤4	No Change
55	LZ Hansen 2	Non-Tactical	≤4	Non-Tactical	≤4	No Change
56	LZ Kadena Charlie Pad	Non-Tactical	≤4	Non-Tactical	≤4	No Change
57	LZ Kadena Echo Pad	Non-Tactical	≤4	Non-Tactical	≤4	No Change
58	LZ Kadena Rescue Pad	Non-Tactical	≤4	Non-Tactical	≤4	No Change
59	LZ Kadena VIP	Non-Tactical	≤4	Non-Tactical	≤4	No Change
60	LZ Kadena VTOL Pad	Non-Tactical	≤4	Non-Tactical	≤4	No Change
61	LZ Kinser 1	Non-Tactical	≤4	Non-Tactical	≤4	No Change
62	LZ Lester Hospital	Non-Tactical	≤4	Non-Tactical	≤4	No Change
63	LZ Lester School	Non-Tactical	≤4	Non-Tactical	≤4	No Change
64	LZ Plaza	Non-Tactical	≤4	Non-Tactical	≤4	No Change
65	LZ Torii 1	Non-Tactical	≤4	Non-Tactical	≤4	No Change
66	LZ Torii 2	Non-Tactical	≤4	Non-Tactical	≤4	No Change
67	LZ Torii Beach	Non-Tactical	≤4	Non-Tactical	≤4	No Change
68	LZ White Beach	Non-Tactical	≤4	Non-Tactical	≤4	No Change
69	New Hospital LZ[6]			Non-Tactical	≤4	

Notes:

[1]Use designations and operations for current conditions based on pilot interviews (Wyle 2012; personal communication, Holden 2011).
[2]Ie Shima LZs considered a complex; all operations combined for all 6 LZs.
[3]Proposed use designations based on pilot interviews (Wyle 2012; personal communication, Holden 2011).
[4]The ISTF represents a complex of a runway, an LHD Deck, LZs, and a Drop Zone all used for LZ operations to varying degrees in concert and combination. The LHD Deck receives use for FCLPs by the CH-46s and other helicopters as well as by AV-8B Harriers. The AV-8Bs account for 37 percent of operations. KC-130Js use the Coral Runway for 784 operations annually.
[5]At the ISTF, MV-22s would perform 4,228 CAL operations and an additional 2,532 FCLP operations. MV-22s would not use the Coral Runway LZ. Operations at this complex by the existing helicopters, AV-8B Harriers, and KC-130Js would continue.
[6]This LZ is under construction and will not be completed until 2012.

Proposed Action

CALs at Existing LZs. Under the proposed action, CAL operations by MV-22 squadrons would emphasize different locations than the CH-46Es although the categories of use (Frequent, Average, and Rare) would remain the same (refer to Table 2-7). Use of the ISTF complex for CAL operations would increase by 103 percent (2,148 operations annually) since it includes a complex of tactical LZs and other facilities that enhance MV-22 aircrew training. Also, it contains a high fidelity LHD Deck for FCLPs. In contrast, operations in the NTA and CTA would decrease, dropping by 15 and 42 percent, respectively. Out of the 12 tactical LZs in the NTA, 2 would receive Frequent use (versus 4 under current conditions), 3 would be Average (versus 4 under current conditions), and 7 Rare (versus 4 under current conditions). This shift would reduce overall emphasis on this training area for CAL operations. A shift in the use of LZs would also affect the CTA where the number of Frequent LZs would decrease from 8 to 5. However, more (8 versus 4 under current conditions) LZs would be designated Average use. The ISTF complex would be subject to the greatest change, with 3 of the LZs supporting Frequent use (versus 0 under current conditions).

On average, the CH-46 aircrews conduct operations about 300 days per year. The MV-22 squadrons likely would continue this tempo of days of use, but would emphasize different LZs from the CH-46Es. Deployments could alter this average tempo, but would emphasize different LZs from the CH-46Es.

Of the 69 total existing LZs, 19 consist of Administrative sites within the developed portions of installations on Okinawa. None of these Administrative LZs receives tactical training use under current conditions; this would not change with the proposed action. Some of these LZs do not get used every year. This analysis estimates that the CH-46Es fly four or less operations at each Administrative LZ; no change would occur under the proposed action. Since use of these Administrative LZs would remain negligible, and all occur in developed areas, no potential for impacts to the environment would result from the proposed action. Therefore, these Administrative LZs warrant no further detailed examination in this ER.

SC LZs. The six SC LZs in the NTA would, when constructed, also support tactical training. At this time, these SC LZs cannot be integrated into training operations, so use levels remain undefined. SC LZs would replace LZs 1, 3, and Firebase Jones, thus eliminating two Rare use and one Frequent use LZ (a total of 1,288 annual operations). For the purposes of analysis, this ER assumes that each SC LZ would be an Average use LZ with 420 operations annually (Table 2-9). Therefore, use of the SC LZs would add about 1,200 operations annually. If these LZs are actually developed and use differs from the level assessed here, the USMC would undertake an appropriate environmental evaluation.

<table>
<tr><th colspan="8">Table 2-9. Comparison of CH-46E and MV-22 Annual Operations at the SC LZs</th></tr>
<tr><th>#</th><th>SC LZ Designation</th><th>GoJ Designation[1]</th><th>CH-46 Current Use[2]</th><th>CH-46 Current Operations[3]</th><th>MV-22 Proposed Use</th><th>MV-22 Proposed Operations</th><th>Net Increase or Decrease in Use[4]</th></tr>
<tr><td></td><td colspan="7">Northern Training Area</td></tr>
<tr><td>1</td><td>SC LZ G</td><td>G</td><td rowspan="6"></td><td rowspan="6">1,288</td><td>Average</td><td>420</td><td rowspan="6">Increase
(1,232 operations)</td></tr>
<tr><td>2</td><td>SC LZ H</td><td>H</td><td>Average</td><td>420</td></tr>
<tr><td>3</td><td>SC LZ N-1A</td><td>N1.2</td><td>Average</td><td>420</td></tr>
<tr><td>4</td><td>SC LZ N-1B</td><td>N1.3</td><td>Average</td><td>420</td></tr>
<tr><td>5</td><td>SC LZ 17</td><td>N4.1</td><td>Average</td><td>420</td></tr>
<tr><td>6</td><td>SC LZ 17B</td><td>N4.2</td><td>Average</td><td>420</td></tr>
</table>

Notes:
[1]Former Naha DFAB 2006
[2]SC LZs are currently under construction and receive no usage. [3]LZs to be replaced (1, 3, and Firebase Jones) account for 1,288 CH-46E operations. [4]The net increase reflects the difference between current operations at LZ 1, 3, and Firebase Jones and assumed future operations at the SC LZs.

FCLPs. Due to its features and capacity, the LHD Deck at the ISTF would receive increased use by MV-22s for FCLPs. FCLP training is essential for pilots to operate from amphibious ships (e.g., LHA, LHD). The CH-46Es currently perform about 1,580 FCLP operations at the ISTF; under the proposed action, FCLP operations would increase to 2,532 annually. Other users of the LHD Deck would continue to include AV-8B Harriers conducting 780 FCLP operations annually.

Night Training. Based on training and readiness requirements, the CH-46E aircrews conduct about 33 percent of their tactical LZ training during darkness. Accordingly, MCAS Futenma estimates that 32 percent of the LZ training operations currently occur in environmental evening (1900 to 2200), and 1 percent performed at environmental night (2200 to 0700). Similarly, the MV-22s require after-dark training with approximately 28 percent of the LZ operations occurring during environmental evening (although after dark) and 4 percent during environmental night.

Multi-Ship Landings. The survey and evaluation revealed that several LZs can accommodate multi-aircraft landings (refer to Table 2-6). Such sites offer sufficient space to accommodate safety zones around each aircraft. The number of aircraft Landing Points at these LZs ranges from 2 to 10, although 2 to 4 points are most common. Within the 50 Tactical LZs, the 12 that offer the capacity to support multi-ship landings occur on ISTF (2 LZs), and in the NTA (2 LZs), and CTA (8 LZs). The lack of LZs supporting multi-ship landings in the NTA reflects the density of vegetation in that area. In contrast, the open and developed nature of ISTF allows for these landings in the complex. None of the SC LZs is projected to accommodate multi-site landings.

2.2.2.3 Terrain Flight and Transit Routes

Linked to LZ operations, the CH-46E squadrons also conduct TERF flights using terrain and vegetation to enhance survival by reducing the enemy's ability to visually and electronically acquire and target the helicopter. Flown at low altitudes varying from 50 to 200 feet AGL, and at airspeeds of 80 to 120 knots, a TERF route provides substantial realistic low altitude training. On Okinawa, the CH-46E aircrews conduct operations along a single TERF route (Figure 2-12) located over the U.S. facilities and areas of the NTA. Extending for approximately 13 nm, this TERF route starts at LZ 17 and ends at LZ Firebase Jones.

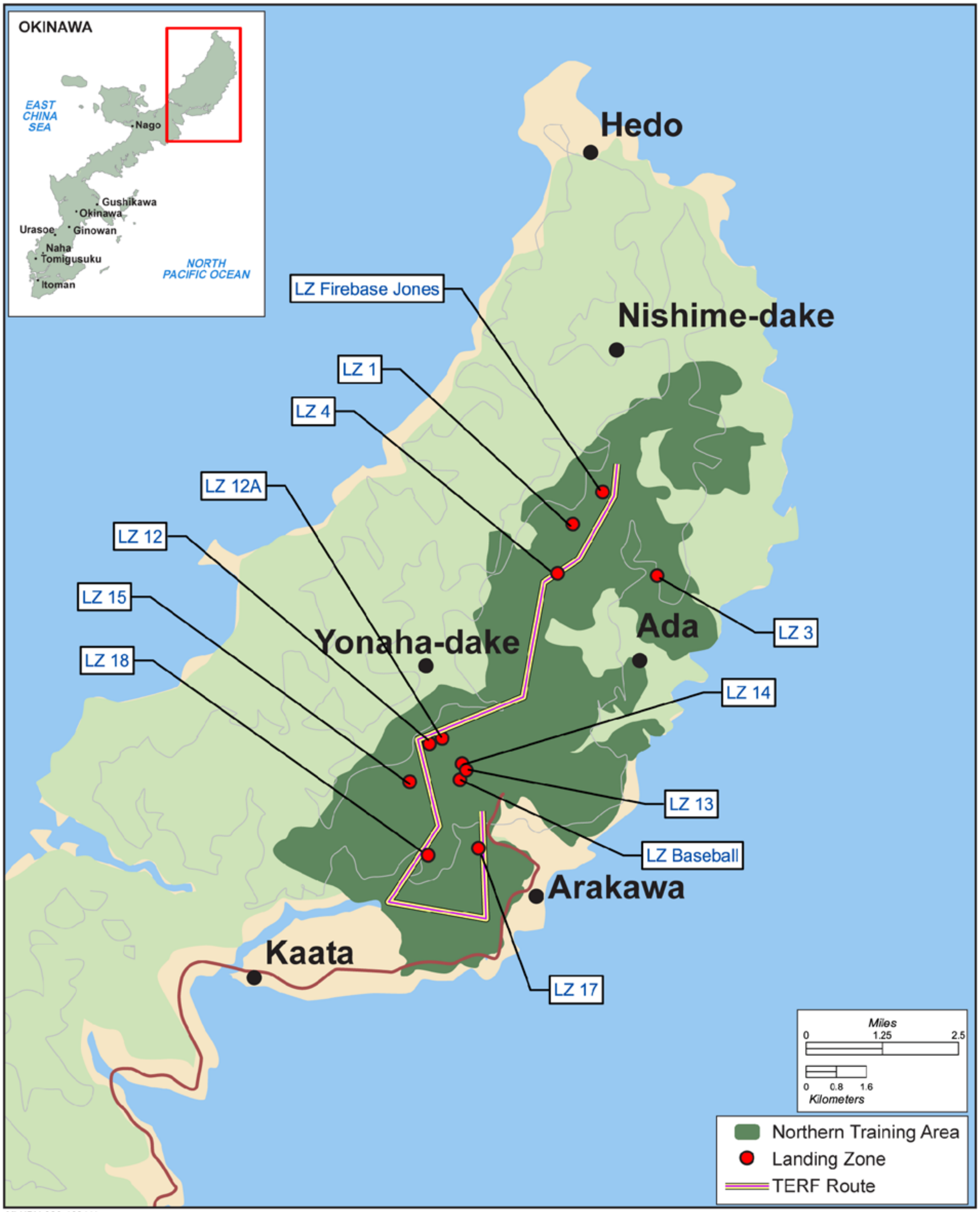


Figure 2-12. TERF Route over the Northern Training Area

Often when the CH-46E aircrews fly a sortie into the NTA LZs, they also conduct TERF training by flying one or both directions on the route. MCAS Futenma pilots estimate that the CH-46E squadrons conduct 13 percent of their sorties (or 548 operations) along this TERF route annually. While the CH-46Es account for most of the total operations under the current conditions, other Okinawa-based helicopters perform the remainder. The proportions of day, evening, and night operations are consistent with those on the LZs.

Although the MV-22 squadrons need low-altitude training, the aircrews would rarely fly along the TERF route. Most of this type of training would be achieved through the use of simulators. However, circumstances may arise when an MV-22 aircrew needs to use the TERF route. An estimated 25 MV-22 operations annually would involve flying this TERF route. MV-22 pilots would tend to fly, on average, higher than the CH-46Es. Actual low-altitude training for the MV-22 aircrews would predominantly be achieved by transiting between LZs and during deployments. Under the proposed action, the remainder of the based helicopter crews would continue to fly the TERF route at the same frequency (about 1,200 operations per year).

MV-22 squadrons would use the same basic transit routes to the training areas and among the LZs as the CH-46Es. However, since the MV-22 can convert to airplane mode, it would fly faster on these routes. Although not formalized, most of the transit routes occur above the U.S. facilities and areas. Outside those areas, the aircraft would adhere to Okinawan air traffic control routing and Japanese airspace management rules.

2.2.2.4 Mainland Japan Training Activities and Locations

Most of the proposed MV-22 training would occur on or near Okinawa, which would be the home base for aircrews. However, the USMC anticipates that certain training would be performed at two bases – Camp Fuji and MCAS Iwakuni - and along six NAV routes over mainland Japan and the Pacific north of Okinawa (Figure 2-13). In addition, detachments from the MV-22 squadrons may occasionally fly to other U.S. facilities. Under the proposed action, the USMC would send a detachment of two to six MV-22s to Camp Fuji and MCAS Iwakuni each month for 2 to 3 days. On occasion, the detachments (and more aircraft) may operate out of these "additional" bases for a longer period of time depending upon training and national security considerations. While there, training would occur at the installations including LZ landings. Navigation training would be conducted on the routes, with one or more used daily during these deployments. Although the CH-46E squadrons currently deploy via ship to many locations including Thailand and Australia, the MV-22s (in airplane mode) could fly to mainland Japan. The following describes the installations and the routes on mainland Japan, and provides more details on the level of operations anticipated for the MV-22s.

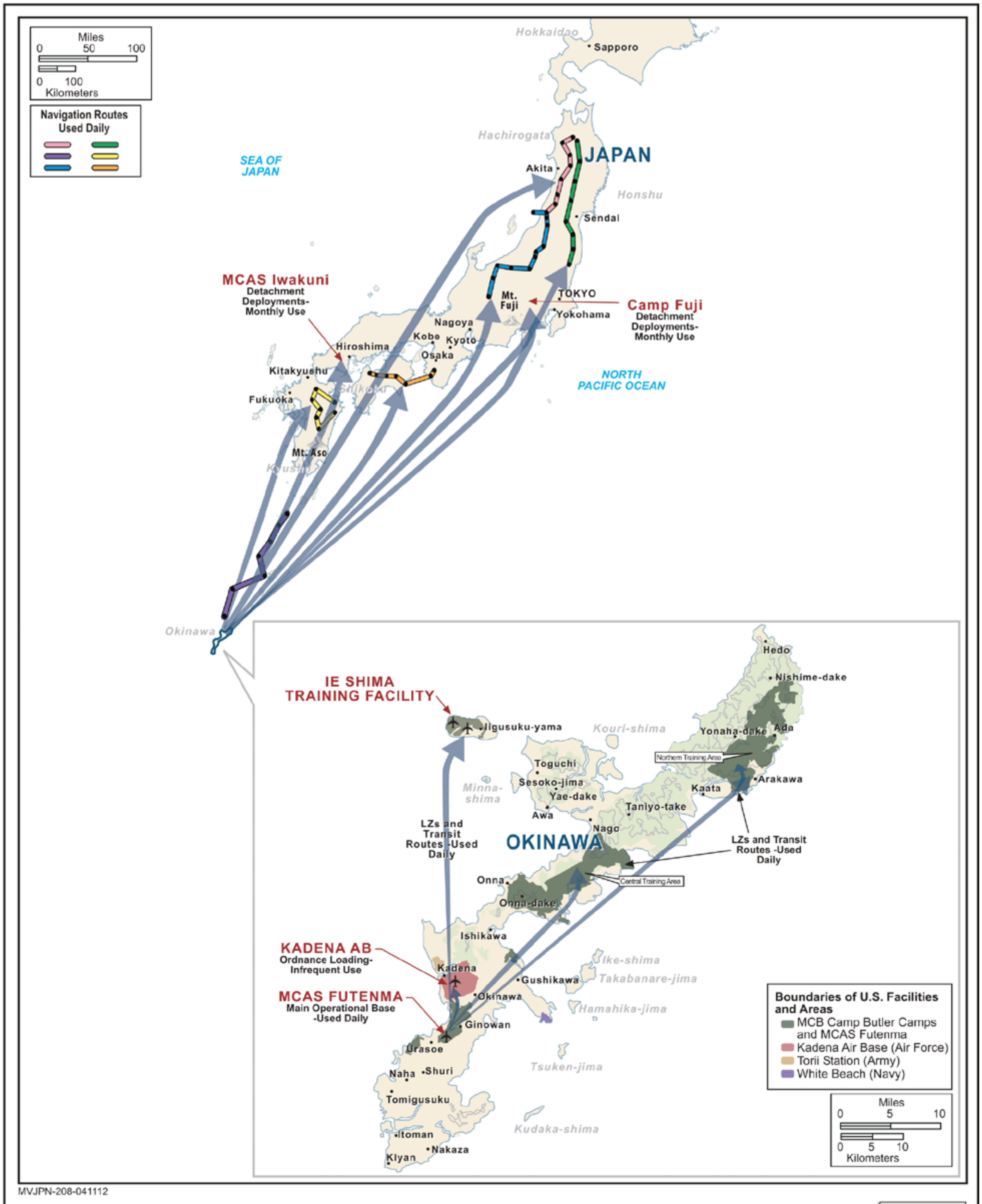


Figure 2-13. Locations of Proposed MV-22 Operations on Mainland Japan and Okinawa

Camp Fuji

Camp Fuji, one of several camps included in U.S. facilities and areas in Japan, lies southwest of Tokyo, 8 miles from Mount Fuji and 800 miles from Okinawa. The 309-acre installation contains facilities considered simple compared to most military bases, with no family housing, limited military exchange, recreation facilities, and limited medical facilities (Figure 2-14). An adjacent helicopter runway is shared with the Japan Ground Self-Defense Force (JGSDF). Camp Fuji's mission is to support military training by U.S. forces in the adjacent 34,000-acre Fuji Maneuver Area, the premier training ground in Japan. The Camp provides garrison facilities, administrative, communications, and logistical support to units that deploy there for training. Camp Fuji coordinates the use of training areas and training facilities within the Fuji Maneuver Area. Units from across the Pacific come to Camp Fuji to train.

Currently, the runway and airspace overlying Camp Fuji are used by U.S. forces aircraft and JGSDF aircraft. JGSDF activities predominate, accounting for 94 percent of the operations, which include take-offs, landings, touch-and-goes, and flights through the overlying airspace (Table 2-10). Aircraft used by the JGSDF include helicopters (CH-47, UH-1, AH-1, OH1, OH-6, and UH-60) and transports (KC-130J and C-1). U.S. forces helicopters (SH-60, UH-60, and UH-1) and transport (C-130) aircraft each generate about half the operations by U.S. forces at the installation. A rare FA-18 operation (two per year) has been documented in the past. Standard operations consist of take-offs, landings, touch-and-goes, LZ landings plus touch-and-goes, and cargo airdrops (KC-130Js). After dark training can be performed at the Camp Fuji airfield, but it requires coordination. Typically, the airfield is closed from 5:00 p.m. to 6:00 a.m. To conduct operations between 5:00 and 10:00 p.m., a pilot must submit a request to Range Control by 3:00 p.m. the previous day. For operations between 10:00 p.m. and 6:00 a.m., the request requires three to six months of coordination with the JGSDF.

Table 2-10. Current and Proposed Operations at Camp Fuji

	Annual Operations	
	Current	***Proposed***
U.S. Forces	285	285
JGSDF	4,744	4,744
MV-22	-	500
Total	**5,029**	**5,529**
	Percent Increase	**10**

Source: Wyle 2010

Under the proposed action, MV-22 detachments would conduct operations out of the airfield for two to three days per month. The USMC anticipates each aircraft would perform 1 to 2 sorties per day, and a total of about 42 operations per visit for all aircraft.[1] Longer deployments with more aircraft may occur on occasion. MV-22 after dark operations would need to be coordinated according to current practices. In total, the MV-22 detachment deployments would fly approximately 500 annual operations at the Camp Fuji runway for a 10-percent increase in overall activity. Such a small increase commonly falls within the normal year-to-year variation in operations at an airfield. As a result of deployments, humanitarian relief efforts, weather, training exercises, fuel, and maintenance cycles.

[1] 4 MV-22s would arrive (four landing operations) from MCAS Futenma, conduct two sorties for 2 days (16 take-off operations, 16 landing operations, and an average of 9.6 touch-and-goes or LZ operations), and depart to MCAS Futenma (16 take-off operations).

Figure 2-14. Camp Fuji

MCAS Iwakuni

Founded by the Japanese military as a base in 1940, the area of MCAS Iwakuni has supported flight operations for more than 70 years. MCAS Iwakuni lies on the Seto Inland Sea coast about 600 miles southwest of Tokyo. The 1,800-acre installation contains all facilities (Figure 2-15) to support operations by 49 USMC aircraft including FA-18 Hornets, EA-6B Prowlers, AV-8B Harriers, and UC-12B Huron turboprops. Of this total, FA-18s account for 36 aircraft. The Japan Maritime Self-Defense Force (JMSDF) operates 37 aircraft including 22 helicopters, 13 P-3 Orion patrol and reconnaissance turboprops, and 2 Learjets. To reduce noise effects and enhance safety, MCAS Iwakuni completed a new 8,000-foot runway situated on constructed land, extending about 0.5-mile out to sea on a peninsula.

Current operations total almost 60,000 annually at the airfield (Wyle 2010), with the JMSDF accounting for 48 percent of the total (Table 2-11). Specifically, P-3 Orion aircraft contribute 31 percent of the airfields annual operations. Of the total USMC activities (38 percent), the FA-18s fly 20 percent of the operations. U.S. transient aircraft (e.g., KC-10, C-130, helicopters) and civil aviation (e.g., MD-11) aircraft perform 13 and 1 percent of the total operations, respectively. A commercial aviation terminal is being developed at MCAS Iwakuni, so civil aviation is anticipated to increase substantially in the future. Most (91 percent) of the operations consist of take-offs and landings; pattern work and touch-and-goes are minimal (9 percent). Only 1 percent of the total operations occur during environmental night (2200 to 0700 hours) and USMC aircraft perform essentially all of these operations.

Table 2-11. Current and Proposed Operations at MCAS Iwakuni

	Annual Operations	
	Current	***Proposed***
USMC	22,738	22,738
JMSDF	28,682	28,682
U.S. Transient	7,815	7,815
Civil Aviation	104	104
MV-22	-	500
Total	**59,339**	**59,839**
	Percent Increase	**0.8**

Source: Wyle 2010

The USMC expects MV-22 detachment deployments at MCAS Iwakuni to match those proposed for Camp Fuji, with these aircraft generating about 42 operations per deployment and 500 operations per year. On occasion, detachments (and more aircraft) could stay longer for training. Since after dark operations represent an important part of MV-22 training (where allowed), the detachments would conduct such flights at the same levels currently performed at MCAS Iwakuni. Addition of the few MV-22 operations to the busy MCAS Iwakuni airfield would fall well within year-to-year variations (Wyle 2010) resulting from deployments, training exercises, humanitarian relief responses, fuel, maintenance cycles, and weather.

Figure 2-15. MCAS Iwakuni

Navigation Routes

To ensure successful ingress and egress for a combat mission, the MV-22 squadrons may, at times, fly along predetermined and defined routes for NAV training. Flight proficiency requires consistent, realistic training, including navigation and tactics. The MV-22 squadrons would conduct a portion of their required NAV training along a suite of six existing NAV routes. Five of these routes extend as corridors over portions of mainland Japan, and one extends north of Okinawa over small islands and the East China Sea (Figure 2-16). Currently, these six NAV routes receive use primarily from the AV-8B Harriers and FA-18 Hornets stationed at MCAS Iwakuni and, to a lesser degree by KC-130J Hercules transports. Flight altitudes average 500 feet AGL. Table 2-12 documents the annual hours flown on these routes as reported by Marine Air Group – 12 (personal communication, Holden 2011).

Table 2-12. Current Annual Flight Hours on NAV Routes and Estimated Operations

NAV Route	Reported Flight Hours	Estimated Operations
Blue	159	238
Green	80	132
Orange	169	467
Pink	49	100
Yellow	111	255
Purple	203	343

For this analysis, an operation consists of a single transit of an aircraft along a route in one direction. Any transit, therefore, represents an operation irrespective of direction or aircraft type. To estimate the number of operations, the length (nm) of each NAV route was calculated. Using the average airspeeds of the primary aircraft flying these routes (AV-8B: 300 knots; FA-18: 500 knots; KC-130J: 250 knots) (Wyle 2010), the duration that each aircraft type requires to complete a flight along each route was calculated. Use was estimated by allocating 40 percent of the total hours to the AV-8Bs, 40 percent to the FA-18s, and 20 percent to the KC-130Js. By dividing the total flight hours by the single operation duration for each aircraft type along every route, the number of operations was estimated. Although actual operations by these aircraft would vary in duration, thereby altering the total estimate number of operations, this approach provides a means to place the proposed MV-22 activities in context.

The USMC expects that the MV-22 squadrons would use these NAV routes during the detachment deployments to Camp Fuji and MCAS Iwakuni (or other mainland Japan bases), likely flying on one or more during each day of deployment. Based on expected training activities, MV-22 aircrews would fly approximately 55 annual operations along each route for a total of 330. These added operations would result in increases in use averaging 21 percent for all routes. MV-22 aircrews would fly altitudes of 500 feet AGL or greater, and at airspeeds of 120 to 250 knots, depending upon the flight mode. Meeting training and readiness standards would require the MV-22 squadrons to conduct 28 percent and 4 percent of these NAV route operations during environmental evening and environmental night, respectively.

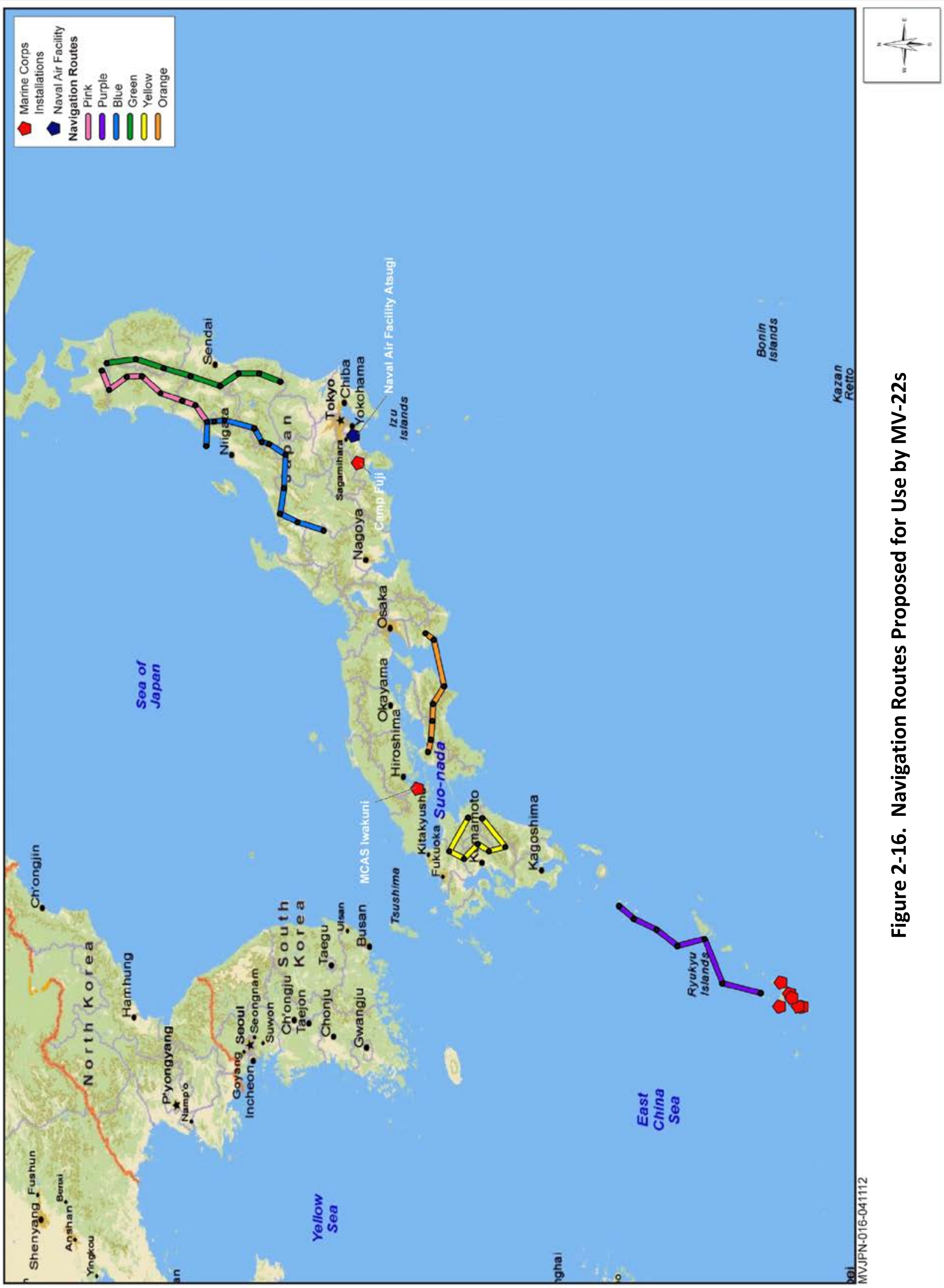


Figure 2-16. Navigation Routes Proposed for Use by MV-22s

2.2.2.5 Kadena Air Base

Kadena AB, located on Okinawa, comprises the largest U.S. Air Force installation in the Pacific region and is home to the 18th Wing, the largest combat air wing in the Air Force. The 18th Wing and 40 tenant units represent six Air Force major commands, as well as elements of the U.S. Army, Navy, and USMC. The main base covers 4,930 acres and, together with an additional 6,280-acre munitions storage area, the installation's size totals more than 11,000 acres (Figure 2-17). Kadena AB supports two parallel, 12,100-foot runways, more than 1,000 industrial buildings, 1,550 housing-related structures, 15 protective aircraft shelters, and 25 security revetments.

Kadena AB's current fleet of aircraft represents a broad spectrum of combat capability. The 18th Wing flies F-15C/D air-to-air fighters, KC-135 refueling tankers, E-3 AWACS airborne command and control aircraft, and HH-60 combat search and rescue helicopters. Air Force Special Operations Command's 353rd Special Operations Group operates MC-130P refueling aircraft and MC-130H aircraft that provide infiltration, exfiltration, and resupply of special operations forces and equipment in hostile or denied territory. Other Air Force aircraft operating out of the base include RC-135 reconnaissance aircraft and WC-135 atmospheric collection aircraft. In addition, the U.S. Navy and USMC operate a detachment of P-3 maritime reconnaissance and anti-submarine warfare planes and FA-18 aircraft, respectively. These aircraft conduct tens of thousands operations annually.

The MV-22 squadrons propose to occasionally fly the short distance (about 4.5 nm) from MCAS Futenma to Kadena AB in order to load live ammunition for use by the aircraft or troops. All loading would occur in existing authorized areas off the flightline and would adhere to all safety procedures. Three guns used for defense are mounted on the MV-22s, a GAU-17 7.62 millimeter mini-gun in a remote controlled belly turret, a 7.62 millimeter M240D machine gun that can be placed on the aircraft’s ramp, and a .50 caliber machine gun that can be placed on the aircraft’s ramp. Based on training requirements, the MV-22 aircrews would need to practice firing these guns three times per month on average.[2] The MV-22 squadrons would conduct this training at authorized overwater ranges, just like the CH-46E aircrews train currently. As such, the squadrons would conduct a total of approximately 1,200 operations (landings and take-offs) at Kadena AB each year for ordnance loading. Ordnance loading at Marine Wing Liaison Kadena (MWLK) to support troops would be far less frequent, perhaps only two dozen times per year. The CH-46E helicopters support the same weapons, including two 7.62 millimeter guns and two .50 caliber machine guns. Since the CH-46E squadrons also currently perform these ordnance loading activities with the same caliber munitions, the USMC anticipates that replacement by the MV-22s would not result in changed conditions at Kadena AB or at the authorized ranges where these munitions are expended. The 1,200 to 1,250 operations per year represent about 5 percent of total activity at the airfield.

[2] All firing training would take place in overwater “Warning” training areas approved for this activity and situated far from land.

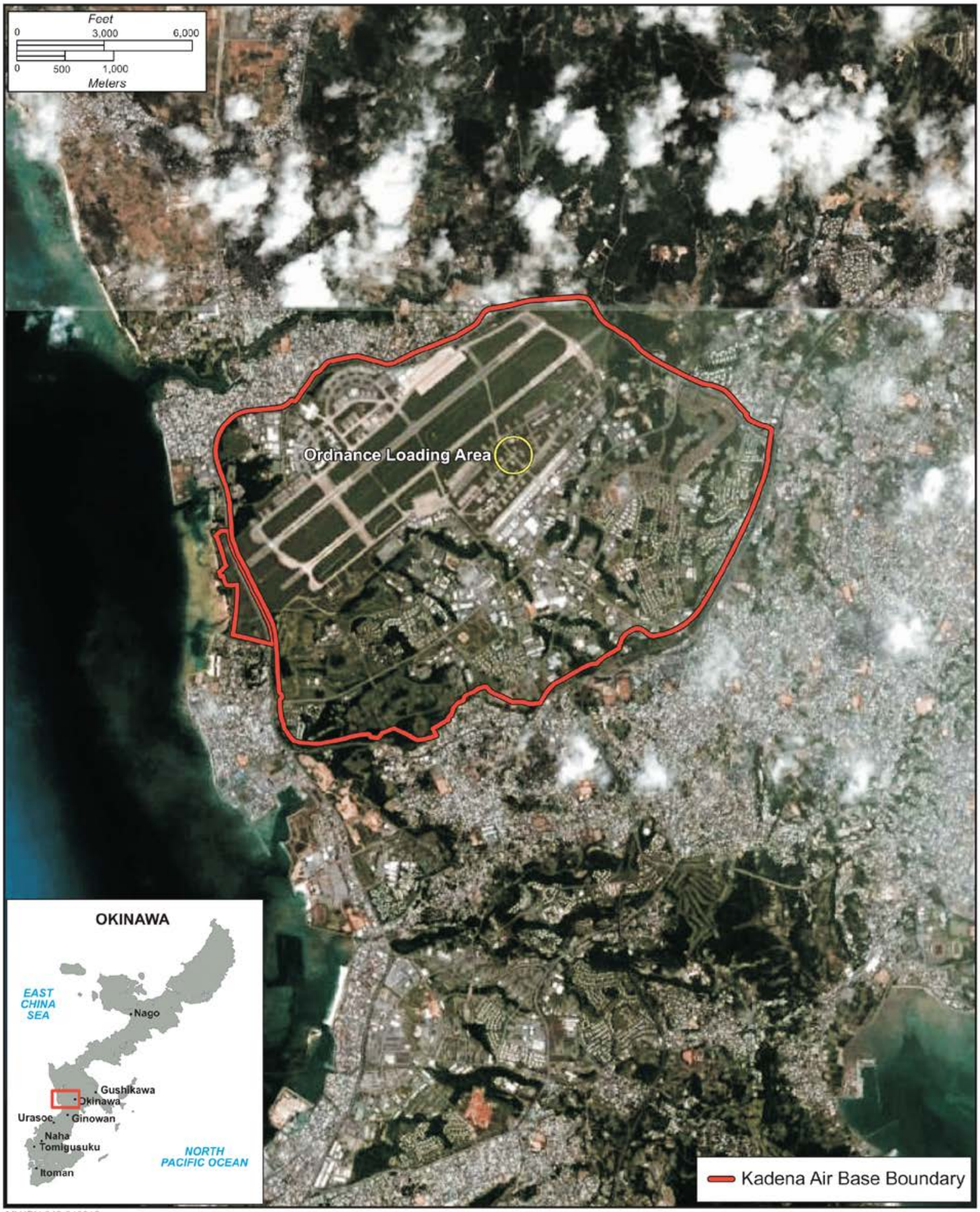


Figure 2-17. Kadena AB: Current CH-46E and Proposed MV-22 Ordnance Loading Area

2.3 SUMMARY

2.3.1 Resources Analyzed

Under E.O. 12114 and DoD Directive 6050.7, *Environmental Effects Abroad of Major Department of Defense Actions* (2004), an ER consists of a "survey of the important environmental issues" related to DoD actions outside the U.S. The DoD component, in this case the USMC, prepares the ER unilaterally since it affects the environment of U.S. facilities and areas in Japan, but Japan is not involved in the action. Based on the requirements of DoD Directive 6050.7, this ER must identify important environmental issues and provide a review of potential significant environmental impacts. Such a review needs to consider reasonably available information on the environment. The ER must also consider potential impacts of the proposed action to enable DoD officials to be informed and take account of environmental considerations when authorizing or approving certain major Federal actions that may do significant harm to the environment of places outside the U.S.

In terms of process, an ER differs in many ways from environmental documentation prepared under the National Environmental Policy Act (NEPA) of 1969 (Public Law 91-190). For example, while E.O. 12114 requires that the natural and physical environment be considered, it excludes social, economic, and other environments. In addition, unlike the NEPA process, E.O. 12114 does not require public involvement in the ER process or, analysis of alternatives. Topics analyzed can be limited due to availability of information, security issues, or foreign relations sensitivities.

An essential method to identify the potential for significant harm is to compare the environment under current conditions to expected conditions after implementing the proposed action. For this ER, current conditions broadly reflect the natural and human environment in the affected areas today or as close as possible based on best available information. Operations data also represent the best available complete information that depicts normal circumstances. Since USMC squadrons can be deployed at any time and for a variety of reasons (e.g., conflict, humanitarian support, and training exercises), the actual number of operations can vary in any given year. As such, using an average of three or four years produces "current conditions" reasonably representative of normal circumstances.

The bases and training areas comprising the affected environment often undergo upgrades and changes to facilities and infrastructure. This on-going activity alters the conditions to varying degrees on a regular basis. Therefore, current conditions reflect a point in time that includes existing facilities and infrastructure, as well as authorized projects that would exist by the time the USMC implements the proposed action.

In contrast, the natural and human environment under the proposed action simply comprises those conditions that would result from implementation of the specific components of the action. Comparison of the proposed action conditions and current conditions provides a means to analyze impacts.

In terms of content, an ER should comprise a focused survey and analysis of only the important environmental issues; not all possible issues should be included or addressed. The information presented in the ER can be limited due to availability or sensitivity of information. Although the content of the ER is flexible, it must describe the action, its timetable, and basic features along with identification of the important environmental issues considered and ways to reduce impacts, if any. Given that the proposed action would affect different locations in different ways, this ER analyzes the resources accordingly, as shown in Table 2-13. Four levels of analysis apply to different resources at the six locations affected by the proposed action. Assignment of each level of analysis correlates to the nature of expected environmental issues. Detailed analysis provides an in-depth description of the resources and presents a comprehensive assessment of potential impacts. Quantitative comparisons of the proposed action to current conditions are used where data are available. Inclusion of resources in detailed analysis is based on the potential for the proposed action to generate an important environmental issue.

Table 2-13. Resource Analyses and Affected Areas

Resources	Affected Areas and Level of Analysis					
	MCAS Futenma	***Landing Zones[1]***	***Camp Fuji***	***MCAS Iwakuni***	***NAV Routes***	***Kadena Air Base***
Airfield/Airspace Management	**Detailed**	**Detailed**	**Limited**	**Limited**	**Minimal**	**Minimal**
Noise	**Detailed**	**Detailed**	**Limited**	**Limited**	**Minimal**	**Minimal**
Land Use	**Detailed**	**Detailed**	**Limited**	**Limited**	**Minimal**	**Minimal**
Air Quality	**Detailed**	**Detailed**	**Limited**	**Limited**	**Minimal**	**Minimal**
Safety	**Detailed**	**Detailed**	**Limited**	**Limited**	**Minimal**	**Minimal**
Biological Resources	**Limited**	**Detailed**	**Limited**	**Limited**	**Minimal**	**None**
Cultural Resources	**Limited**	**Detailed**	**Limited**	**Limited**	**Minimal**	**None**
Geology and Soils	**None**	**Detailed**	**None**	**None**	**None**	**None**
Water Resources	**None**	**Detailed**	**None**	**None**	**None**	**None**

Note:
[1]Includes LZs to be constructed for which limited data exist.

Resources receiving "limited" analysis were initially assessed in the same manner as those assigned to detailed analysis. However, these assessments demonstrated that no aspect of the proposed action had the potential to raise important environmental issues. Limited analysis, therefore, entailed a brief description of the basic resource characteristics in a given location (e.g., MCAS Futenma) and presented the rationale as to why no impacts would result. Summary quantitative data, where available, provides a context for explaining the lack of impacts.

Minimal analysis applies to those locations where the proposed action would involve only a single aspect of the proposed action (i.e., aircraft operations). In addition, that aspect would form such a minor part of existing activities that its potential effects would be subsumed under or overshadowed by current conditions. For these areas and resources, the ER presents a single summary describing these conditions and the rationale for the lack of impacts.

Resources classified as "none" warranted no further consideration in the ER since the elements of the proposed action lacked the potential to interact with them.

Chapter 3

3.0 MCAS FUTENMA

3.1 INTRODUCTION

Under the proposed action, two MV-22 squadrons (24 aircraft) would be based at Marine Corps Air Station (MCAS) Futenma on Okinawa (refer to Figure 1-1), replacing two CH-46E helicopter squadrons (24 aircraft) currently at the installation. The action would also include expansion of a concrete pad for two containerized simulators and replacement of approximately 400 military personnel authorizations at MCAS Futenma to operate, maintain, and support the MV-22 aircraft (no net change in total personnel). The CH-46E aircraft would be demobilized, demilitarized, and processed for recycling at Camp Kinser as described in Chapter 2. Training and readiness operations would occur at MCAS Futenma, as well as in training areas, Landing Zones (LZs), and navigation (NAV) routes in U.S. facilities and areas in Japan. Refer to Section 2.2 for a detailed description of the proposed action.

In this Chapter (3), the Environmental Review (ER) focuses on MCAS Futenma. Using best available data, it compares existing environmental conditions and important environmental issues due to the proposed action on airfield use and management, noise, land use, air quality, safety, biological resources, and cultural resources at MCAS Futenma and the surrounding area. A discussion of the use of training areas and other facilities on mainland Japan used for training are addressed in Chapter 4.

3.2 AIRFIELD USE AND MANAGEMENT

This section analyzes airfield use at MCAS Futenma. MCAS Futenma forms the home base for the aircraft performing training and readiness operations at other military facilities and areas on Okinawa and mainland Japan. In terms of use, the analysis considers both the nature and number of on-going and proposed activities. Airfield management addresses the control and structure of airspace encompassing the airfield.

3.2.1 Current Environment

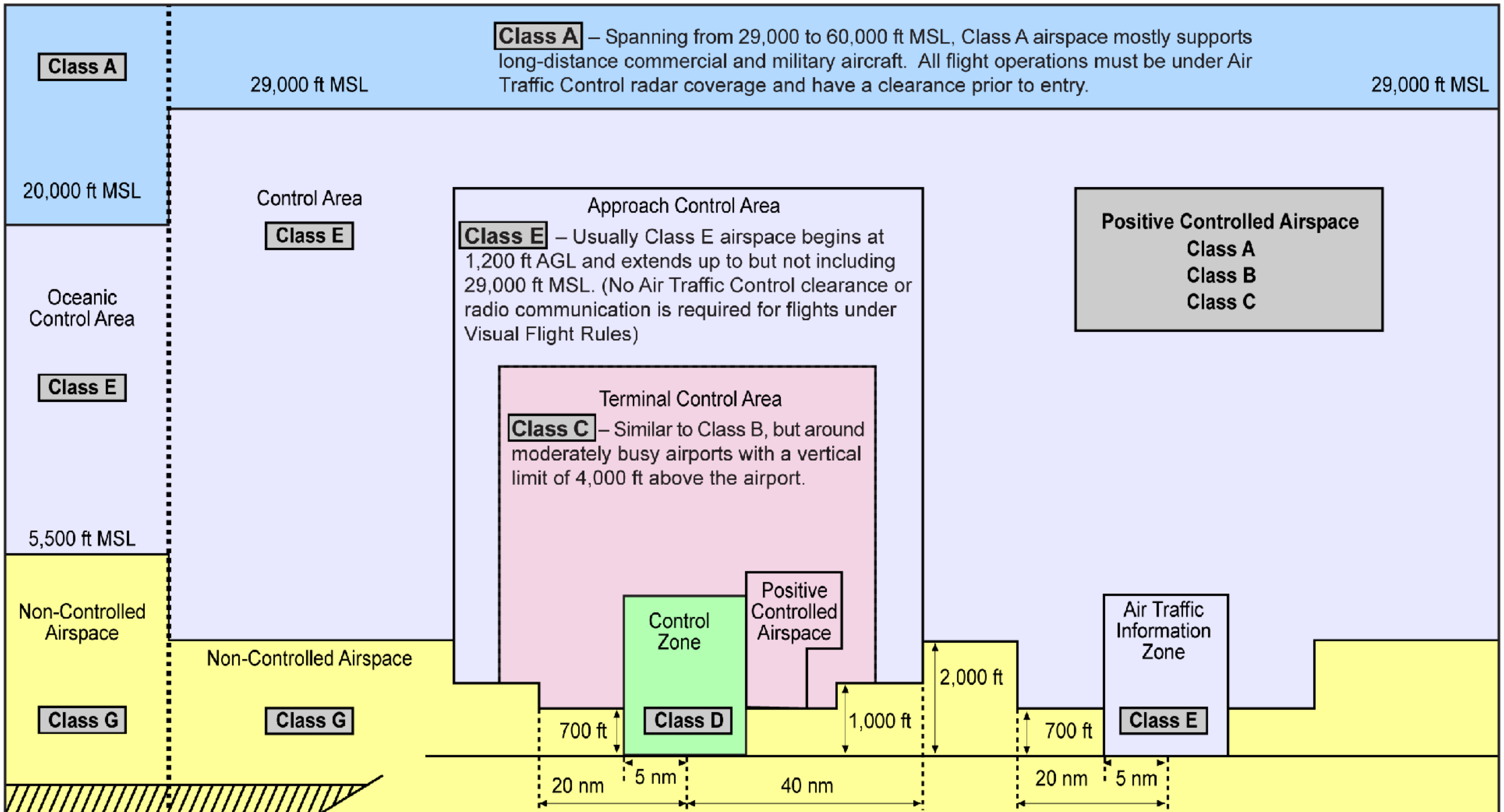
MCAS Futenma includes one 9,000 foot runway designated 06/24, three helipads, and one Confined Area Landing (CAL) site. The First Marine Aircraft Wing (1st MAW) currently operates 38 based rotary-wing aircraft at MCAS Futenma including 24 CH-46Es (refer to Table 2-1). Fixed-wing operational support aircraft at MCAS Futenma include three small turbo-prop cargo/Very Important Person (VIP) transports and 15 KC-130J transports. The latter will be moving to MCAS Iwakuni in 2014. Transient aircraft, listed by frequency of use, include: FA-18 C/D, C-12, KC-135, C-5, H-60, and F-15 (refer to Table 2-2). Current operations at MCAS Futenma total about 23,000 annually. Recently (2001 through 2008) total annual operations ranged from a low of approximately 23,000 to a high of 38,000, and averaged almost 32,000 (Wyle 2012).

Aviation operations at MCAS Futenma occur year-round, and consist of a variety of training exercises involving landings, take-offs, and transport of personnel or material. Fixed-wing aircraft at MCAS Futenma confine their take-off and landing operations to the existing runways at the station, and primarily involve local pattern work in controlled airspace. Helicopters land and depart from the helipads on the runway in a way very similar to fixed-wing runway departures and arrivals. Seventy percent of rotary-wing arrivals occur on Runway 06 while 18 percent occur on Runway 24 and the remaining 12 percent occur on Helipad 2 (refer to Figure 2-1). All helicopter patterns are conducted to the north of the runway and stay almost entirely within the station boundary. Flight operations for helicopters are primarily conducted under Visual Flight Rules (VFR), subject to weather and air traffic conditions. In order to reduce noise in the surrounding area, aircraft flights occur primarily Monday through Friday between 0700 and 2200 and from 1000 to 1800 on Saturdays.

Helicopters use three visual points (Point Kilo, Point Tango, and Point Sierra), which apply to all departures and 90 percent of arrivals. When helicopters depart from Runway 06, they either make a 20 degree turn to the right to reach Point Tango on the east coast of Okinawa or a sharper 80 degree left turn to reach Point Sierra at the water treatment plant on the northern coast. When helicopters depart Runway 24, they reach the east coast by turning 140 degrees to the left to fly to Point Kilo or turn 180 degrees to the right to follow the helicopter pattern downwind before turning back left to reach Point Sierra. After departure, the helicopters can continue along the coast or overland to the training areas and LZs. Helicopter arrivals follow essentially the same tracks in reverse. However, they include a tactical air navigation system arrival which flies straight in to Runway 24 but is slightly offset to Runway 06 due to restrictions when flying near Naha Airport to the southwest. Additionally, aircraft departing from or landing at MCAS Futenma avoid the Law College, Ginowan City Hall, the police station on Highway 58, all school, college and hospital compounds, and the petroleum refinery on the coast.

Japan defines two categories of airspace, regulatory and non-regulatory. Within these two categories, there are four types of airspace, Controlled, Special Use, Other, and Uncontrolled airspace. *Controlled airspace* is airspace of defined dimensions within which air traffic control service is provided to Instrument Flight Rules (IFR) flights and to VFR flights in accordance with the airspace classification. Controlled airspace consists of five separate classes, A through E (Figure 3.2-1) that identify airspace that is controlled, airspace supporting airport operations, and designated airways affording *en route* transit from place-to-place. The classes also dictate pilot qualification requirements, rules of flight that must be followed, and the type of equipment necessary to operate within that airspace. Unless otherwise authorized, each aircraft must establish two-way radio communications with the air traffic control facility prior to entering the airspace and maintain those communications while in the airspace. *Uncontrolled airspace* is designated Class G airspace. Almost all of Okinawa is under controlled airspace (Figure 3.2-2).

Class D, surface area controlled airspace, surrounds the MCAS Futenma airfield, and a control tower at the field directs all aircraft arriving, departing, or transiting the airspace. This tower ensures positive control at all times when the field is open. Class D airspace at MCAS Futenma extends from the surface up to 2,246 feet mean sea level (MSL). The MCAS Futenma Class D airspace is curtailed in size due to the close proximity of Naha International Airport and Kadena Air Base (AB). Because of this close proximity, runway use at MCAS Futenma, Kadena AB, and Naha International Airport are coordinated at all times through Naha Radar Approach Control.



Class B – Normally beginning at the surface in the immediate airport area and extending higher as the distance from the airport increases, up to an upper limit of 10,000 ft MSL.

Class D – This class extends from the surface to 2,500 ft AGL around airports with a control tower and not otherwise within Class C or Class D airspace.

Class G – Includes all airspace not otherwise classified below 60,000 ft MSL. Class G airspace is typically the airspace very near the ground (2,000 ft AGL or less), beneath Class E airspace.

Notes: ft = feet; MSL = mean sea level ; AGL = above ground level; nm = nautical mile

Source: MLIT 2011

MVJPN-047-102411

Figure 3.2-1. Cross Section of Airspace Classes and their Relationships

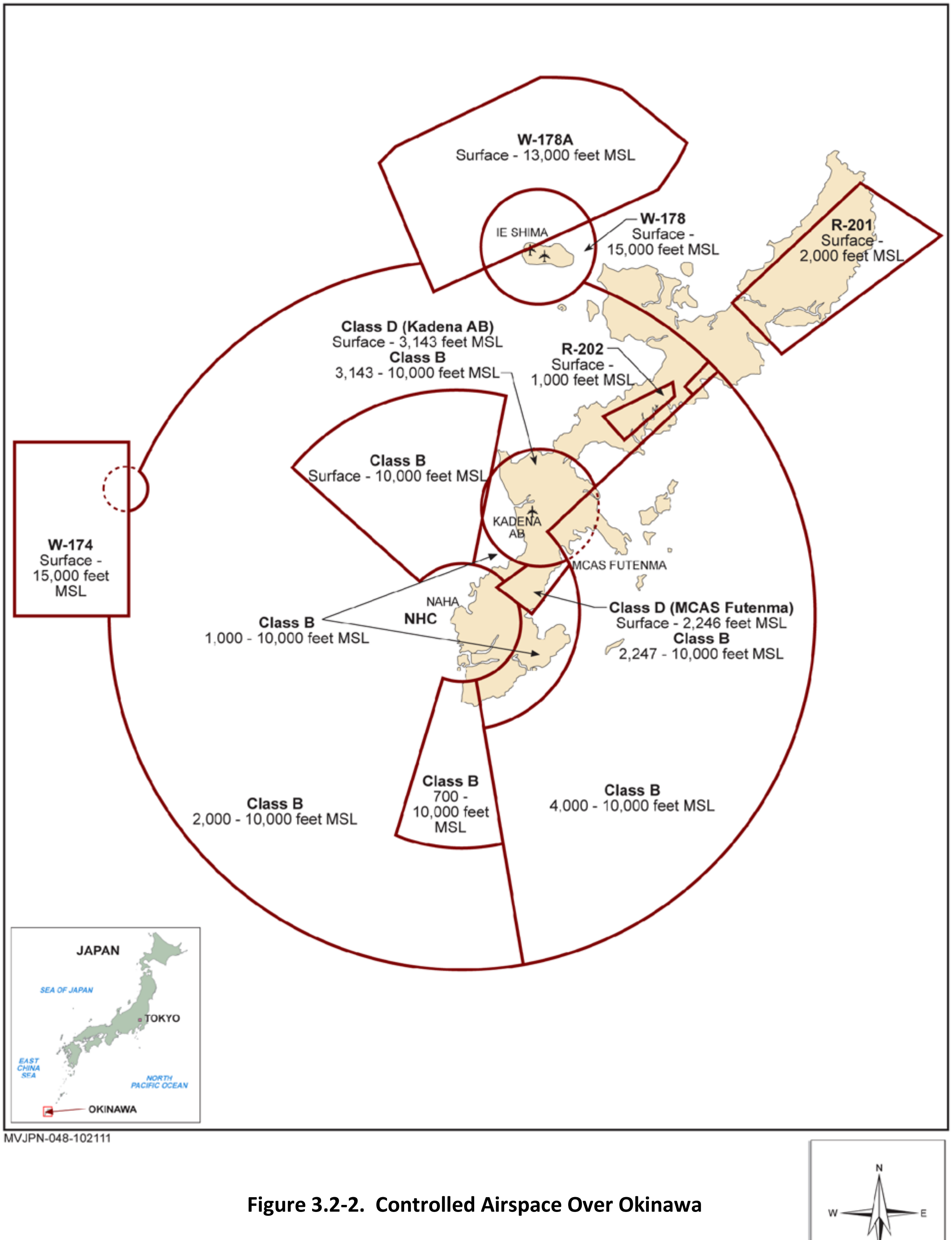


Figure 3.2-2. Controlled Airspace Over Okinawa

Above the Class D airspace, Class B airspace is controlled by the Government of Japan (GoJ), although the United States (U.S.) government is responsible for providing the arrival control function for U.S. airfields in Okinawa (SPAWAR 2011) through the Kadena Arrival Control. The GoJ provides space, equipment, and supplies in the Naha Radar Approach Control for U.S. controllers manning the Kadena Arrival Control.

3.2.2 Environmental Impacts

The proposed action would base two squadrons totaling 24 MV-22 aircraft at MCAS Futenma, replacing CH-46E squadrons (24 aircraft) currently based at MCAS Futenma on a one-for-one basis. This would result in no change to the total aircraft based at MCAS Futenma, but would result in a net decrease of approximately 2,600 airfield operations per year (refer to Table 2-3) or a 11 percent decrease in operations from existing conditions (the annual average from 2008 to 2011). The MV-22 aircrews would operate in the same airfield environment as the CH-46Es and would follow established local approach and departure patterns. Existing avoidance areas and procedures would remain in effect. No impacts or important environmental issues would arise from the proposed action.

The Futenma Air Traffic Control Tower personnel are aware of the speed differential between existing aircraft and the MV-22 with regard to departures and arrivals. Normal airspace de-confliction by Air Traffic Control would resolve the issues of dissimilar aircraft operations within the airspace. In addition, a minimum separation of 500 feet is maintained between aircraft during maneuvers or training operations. Therefore, MCAS Futenma airspace management around the airfield would not change as a result of the new aircraft, and no significant harm to the airspace environment would occur**.**

3.3 NOISE

The main sources of noise within the affected environment consist of rotary- and fixed-wing aircraft operations at the airfield. The following sections discuss the existing noise environment at MCAS Futenma, describe changes in the noise environment resulting from MV-22 basing, and assess the potential effects of those changes should the proposed action be implemented. Appendix C consists of a noise study (Wyle 2012) performed in support of evaluation of the MV-22 basing proposal.

3.3.1 Noise Metrics and Modeling

3.3.1.1 Definition of Resource

Noise is unwanted sound. Sound is all around us; sound becomes noise when it interferes with normal activities, such as sleep or conversation. Sound is a physical phenomenon consisting of minute vibrations that travel through a medium, such as air, and are sensed by the human ear. Whether that sound is interpreted as pleasant (e.g., music) or unpleasant (e.g., jackhammers) depends largely on the listener's current activity, past experience, and attitude toward the source of that sound.

The loudest sounds that can be detected comfortably by the human ear have intensities that are a trillion times higher than those of sounds that can barely be detected. Because of this vast range, using a linear scale to represent the intensity of sound becomes very difficult. As a result, a logarithmic unit known as the decibel (dB) is used to represent the intensity of a sound. Such a representation is called a sound level. A sound level of 0 dB is approximately the threshold of human hearing and is barely audible under extremely quiet listening conditions. Normal speech has a sound level of approximately 60 dB; sound levels above 120 dB begin to be felt inside the human ear as discomfort. Sound levels between 130 to 140 dB are felt as pain (Berglund and Lindvall 1995).

The minimum change in the sound level of individual events that an average human ear can detect is about 3 dB. Changes in cumulative noise levels less than 3 dB are not considered perceptible (Appendix C). On average, a person perceives a change in sound level of about 10 dB as a doubling (or halving) of the sound's loudness, and this relation holds true for loud and quiet sounds. A decrease in sound level of 10 dB actually represents a 90 percent decrease in sound intensity, but only a 50 percent decrease in perceived loudness because of the nonlinear response of the human ear (similar to most human senses). Additional details are provided in Appendix C.

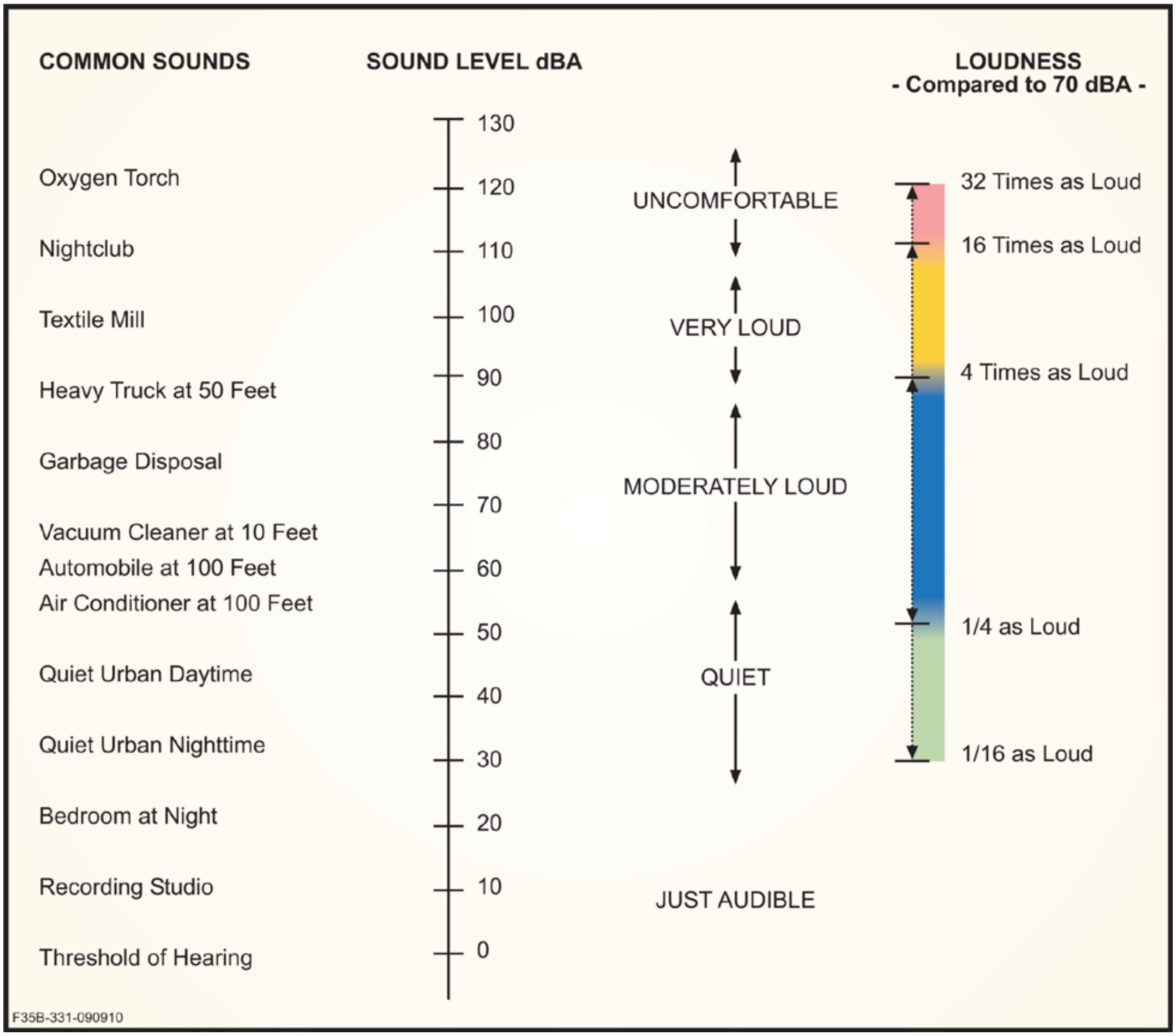
A-Weighted Sound Level

Sound frequency is measured in terms of cycles per second (cps), or hertz (Hz), which is the standard unit for cps. The normal human ear can detect sounds that range in frequency from about 20 Hz to about 15,000 Hz. All sounds in this wide range of frequencies, however, are not heard equally by the human ear, which is most sensitive to frequencies in the 1,000 to 4,000 Hz range. Weighting curves have been developed to correspond to the sensitivity and perception of different types of sound. A-weighted sound accounts for frequencies by adjusting the very high and very low frequencies (below 500 Hz and above 10,000 Hz) to approximate the human ear's lower sensitivities to those frequencies.

Sound levels that are measured using A-weighting, called A-weighted sound levels, are often denoted by the unit dBA or dB(A) rather than dB. When the use of A-weighting is understood, the adjective "A-weighted" is often omitted and the measurements are expressed as dB. In this report (as in most environmental impact documents), dB units refer to A-weighted sound levels.

Noise potentially becomes an issue when its intensity exceeds the ambient or background sound pressures. Ambient background noise in metropolitan, urbanized areas like that around MCAS Futenma typically varies from 60 to 70 dB and can be as high as 80 dB or greater; quiet suburban neighborhoods experience ambient noise levels of approximately 45 to 50 dB (U.S. Environmental Protection Agency [USEPA] 1974).

Figure 3.3-1 is a chart of A-weighted sound levels from typical sounds. Some noise sources (air conditioner, vacuum cleaner) are continuous sounds for which levels are constant for some time. Some (automobile, heavy truck) are the maximum sound during a vehicle pass-by. Some (urban daytime, urban nighttime) are averages over extended periods. A variety of noise metrics have been developed to describe noise over different time periods, as discussed below.



Sources: Harris 1979 and FICAN 1997

Figure 3.3-1. Typical A-Weighted Sound Levels of Common Sounds

Aircraft noise at a base generally consists of two major types of sound events: aircraft take-offs and landings, and engine maintenance operations. The former can be described as intermittent sounds and the latter as continuous. Noise levels from flight operations exceeding background noise typically occur beneath main approach and departure corridors, in local air traffic patterns around the airfield, and in areas immediately adjacent to parking ramps and aircraft staging areas. As aircraft in flight gain altitude, their noise contribution drops to lower levels, often becoming indistinguishable from the background.

Low-Frequency Noise

Low-frequency noise (LFN) was considered by the GoJ in an unrelated environmental analysis that compared CH-53 and MV-22 noise profiles (ODB 2011). This GoJ analysis is the only known study of LFN for the MV-22. Noise data prepared to support this ER are consistent with the standards and process used in other DoD MV-22 environmental impact analyses that studied A-weighted sound levels that adjust for very high and very low frequencies based on human hearing. However, in preparation of this ER, MCIPAC reviewed the data produced by the GoJ on this topic and it is discussed herein for informational purposes.

Definition of Low-Frequency Noise

Pure tones do not occur naturally. What people hear in the real world consists of "complex tones" composed of multiple sounds across the frequency spectrum; some components of the perceived sound have high frequencies and some have low frequencies. LFN generally correlates to the components of a noise with frequencies of 200 Hz or lower, although variations in the upper LFN threshold differ among researchers (e.g., 100 Hz, 80 Hz). At frequencies below 20 Hz, noise components are referred to as "infrasound;" such noise often is described as felt rather than heard (e.g. the bass of a stereo system). Neither the atmosphere nor walls/structures attenuate LFN as well as they attenuate high-frequency noise. LFN travels farther from its origin, often making it difficult to locate the source, and more of it is transmitted from the outside of a building to the inside (PARTNER 2007). LFN often represents the cause of structural vibrations, such as the rattling of windows. However, no research has unequivocally established demonstrable evidence for structural or household damage due to LFN.

Sound in this low-frequency range occurs throughout the modern, developed environment. A diesel engine or the distant rumble of thunder represent sounds with most of their energy in the low-frequency range. Almost all noise in such an environment includes components in the LFN frequency range, although predominantly these components occur at such a low level that they remain unnoticeable to all. At these low frequencies, sounds must occur at very high sound pressure levels to be perceived by the ear. Common sources of noises that contain significant LFN components include traffic, trains, rock concerts, aircraft, and industrial machinery. Evidence indicates that airplanes emit the highest levels of LFN during the take-off roll, runway acceleration, and thrust reversal during landing (PARTNER 2007). In the case of jets, LFN propagates behind the aircraft for hundreds of feet. The size and shape of the affected area depends upon the aircraft type and engines. Rotary-wing aircraft produce higher levels of LFN during their vertical take-off and landing, as well as while hovering.

The nature and effects of LFN remain incompletely understood, and in some cases, inconsistently defined. The thresholds defining LFN and its effects on people vary among countries and researchers (e.g., Hansen 2007). Moreover, detecting and measuring LFN poses difficulties, especially using conventional equipment. As such, the majority of LFN studies are laboratory based. A review of available literature suggests that few studies pertaining to the effects of LFN from the aviation industry have been conducted. Most are based on annoyance due to stationary sources.

Reported Effects of LFN

Controversy surrounds attributing physiological or psychological effects to long-term exposure to LFN, with the spectrum of opinions ranging from no actual effects to substantial deterioration of health. Sensitivity to LFN varies greatly from individual to individual, so one person may be able to hear low-frequency noises that another may not. Alternately, the threshold at which two people begin to hear a certain noise may be the same, but the "threshold of annoyance" of one person may be much lower than that of the other. Effects that individuals allege experiencing include annoyance, stress, headaches, or frustration that the people around them cannot hear what they do. Other alleged physical consequences include chest wall vibration, respiratory impairment, abdominal wall vibration gagging, visual field vibration, ear pressure and pain, fatigue, headache, possible nausea, and disturbed sleep. Many complaints concerning LFN come from people past middle age. This may be due to age-related hearing loss (presbycusis), in which high-frequency sounds become harder to hear, thus sounds at lower frequencies are more readily noticed (PubMed Health 2010). Some studies have reported that lengthy exposure to infrasound can have physical effects on people, such as increase in heart rate and feelings of discomfort (Qibai and Shi 2004). It has been shown that annoyance with noise increases more rapidly with increasing loudness for low frequencies than high frequencies. In other words, it takes a smaller increase in the loudness of a low-frequency noise to annoy a person than it does a mid- or high-frequency noise.

Japanese Assessment of LFN

In 2011, the Okinawa Defense Bureau (ODB) released an Environmental Impact Assessment (EIA) that considered potential effects of establishing a new installation with an airfield to replace MCAS Futenma in the future (ODB 2011). Noise emitted by aircraft anticipated to be based at the Futenma Replacement Facility (FRF) comprised an important topic in the ODB's EIA, and the analysis focused attention on LFN. As detailed below, the ODB study collected LFN data on AH-1, UH-1, and CH-53 helicopters using a test location on the existing airfield at MCAS Futenma as a surrogate for the FRF.

In the analysis of LFN, the ODB EIA examined its potential effects on people according to two criteria: (1) annoyance, particularly in regards to the rattling of building fixtures, such as windows; and (2) feelings of mental or physical discomfort. Discomfort can occur when sound pressure levels are high enough at certain frequencies such that parts of the body, such as the chest cavity, begin to vibrate (Leventhall 2009). The ODB reviewed other noise studies and presented threshold curves for the above two criteria in their EIA, shown below in Figure 3.3-2. According to the studies reviewed by the ODB, the threshold curves define the approximate sound pressure levels at which the average person may begin to feel discomfort due to LFN for frequencies between 5 and 80 Hz, and the approximate sound pressure levels at which Japanese building fixtures will begin to rattle for frequencies between 5 and 50 Hz. The EIA makes note, however, that the thresholds were developed through studies that addressed stationary long-duration noise sources such as factories and building equipment, not transitory noise sources like aircraft.

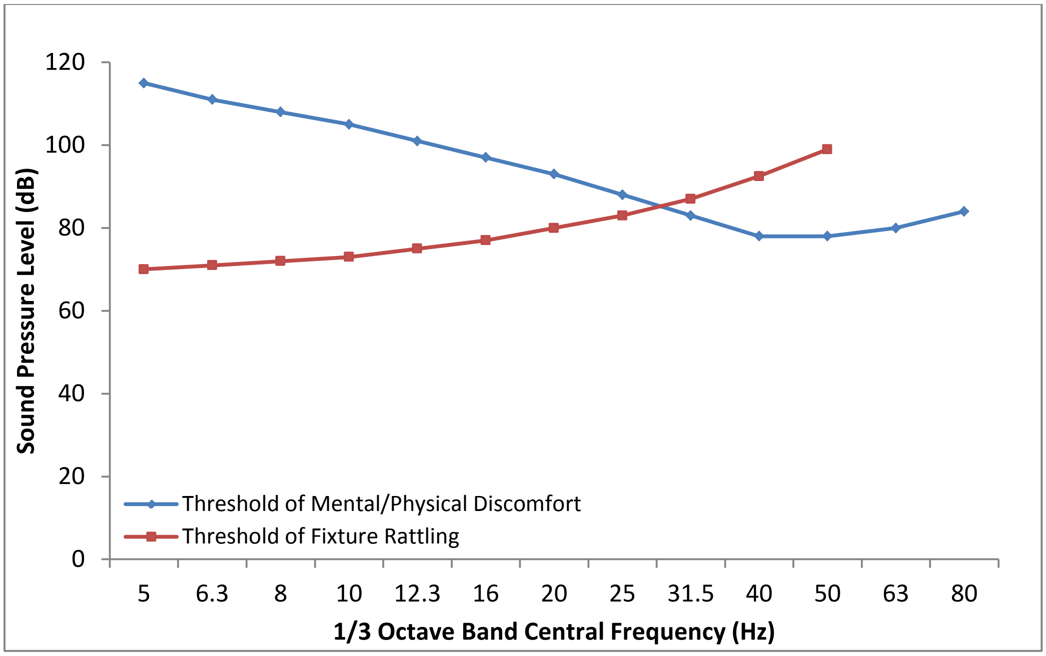


Figure 3.3-2. Okinawa Defense Bureau Thresholds for LFN Effects

3.3.1.2 Noise Metrics

A noise metric quantifies the noise environment. For this analysis, two families of noise metrics apply – one for single noise events such as an aircraft flyby and one for cumulative noise events such as a day's worth of aircraft activity. Within the single noise event family, metrics described below include Maximum Sound Level (L_{max}) and Sound Exposure Level (SEL). Within the cumulative noise events family, metrics described below include Day-Night Average Sound Level (DNL) and several others.

Maximum Sound Level

The highest A-weighted integrated sound level measured during a single event in which the sound level changes value with time (e.g., an aircraft overflight) is called the maximum A-weighted sound level or L_{max}. During an aircraft overflight, the noise level starts at the ambient or background noise level, rises to the maximum level as the aircraft flies closest to the observer, and returns to the background level as the aircraft recedes into the distance. The L_{max} indicates the maximum sound level occurring for a fraction of a second. For aircraft noise, the "fraction of a second" over which the maximum level is defined is generally one-eighth of a second, and is denoted as "fast" response (ANSI 1988). Slowly varying or steady sounds are generally measured over a period of one second, denoted "slow" response. The L_{max} is important in judging the interference caused by a noise event with conversation, TV or radio listening, sleep, or other common activities. Although it provides some measure of the intrusiveness of the event, it does not completely describe the total event, because it does not include the period of time that the sound is heard.

Sound Exposure Level

SEL is a composite metric that represents both the intensity of a sound and its duration. Individual time-varying noise events (e.g., aircraft overflights) have two main characteristics: a sound level that changes throughout the event and a period of time during which the event is heard. SEL provides a measure of the net impact of the entire acoustic event, but it does not directly represent the sound level heard at any given time. During an aircraft flyover, SEL would include both the L_{max} and the lower noise levels produced during onset and recess periods of the overflight.

SEL is a logarithmic measure of the total acoustic energy transmitted to the listener during the event. Mathematically, it represents the sound level of a constant sound that would, in one second, generate the same acoustic energy as the actual time-varying noise event. For sound from aircraft overflights, which typically lasts more than one second, the SEL is usually greater than the L_{max} because an individual overflight takes seconds and the L_{max} occurs instantaneously. SEL represents the best metric to compare noise levels from overflights.

Day-Night Average Sound Level and Community Noise Equivalent Level

DNL and Community Noise Equivalent Level (CNEL) are composite metrics that account for all noise events in a 24-hour period. DNL forms the base metric and CNEL is used herein as a metric commonly used in the U.S. that is similar to the Japanese Weighted Equivalent Continuous Perceived Noise Level (WECPNL). In order to account for increased human sensitivity to noise at night, a 10 dB penalty is applied to nighttime events (2200 to 0700 time period). A variant of the DNL, the CNEL also includes a 5 dB penalty on noise during the 1700 to 2200 time period (evening). The penalties in both DNL and CNEL account for the added intrusiveness of sounds that occur during normal sleeping hours, both because of the increased sensitivity to noise during those hours and because ambient sound levels during nighttime are typically about 10 dB lower than during daytime hours. The evening penalty in CNEL accounts for the added intrusiveness of sounds during a period when people are commonly at home.

DNL and CNEL without their penalties are average quantities, mathematically representing the continuous sound level that would be present if all of the variations in sound level that occur over a 24-hour period were smoothed out so as to contain the same total sound energy. These composite single-measure time-average metrics account for the SELs, L_{max}, the duration of the events (e.g., sorties or operations), and the number of events that occur over a 24-hour period but do not provide specific information on the number of noise events or the individual sound levels that occur during the 24-hour day. Like SEL, neither DNL nor CNEL represent the sound level heard at any particular time, but quantify the total sound energy received. While they are normalized as an average, they represent all of the sound energy, and are therefore, a cumulative measure. Also, the logarithmic nature of the decibel unit causes the noise levels of the loudest events to control the 24-hour average. The averaging of noise over a 24-hour period does not ignore the louder single events and tends to emphasize both the sound levels and number of those events.

Daily average sound levels are typically used for the evaluation of community noise effects (i.e., long-term annoyance), and particularly aircraft noise effects. In general, scientific studies and social surveys have found a high correlation between the percentages of groups of people highly annoyed and the level of average noise exposure measured in DNL (USEPA 1974 and Schultz 1978).

Onset-Rate Adjusted Monthly Day-Night Average Sound Level (L_{dnmr}) and Onset-Rate Adjusted Monthly Community Noise Equivalent Level ($CNEL_{mr}$)

Military aircraft utilizing training airspace such as Navigation (NAV) routes or Restricted Areas generate a noise environment that is somewhat different from that associated with airfield operations. As opposed to patterned or continuous noise environments associated with airfields, flight activity in training airspace is highly sporadic, and often seasonal ranging from ten per hour to less than one per week. Individual military overflight events also differ from typical community noise events in that noise from a low-altitude, high-airspeed flyover can have a rather sudden onset, exhibiting a rate of increase in sound level (onset rate) of up to 150 dB per second.

To represent these differences, the conventional SEL metric is adjusted to account for the "surprise" effect of the sudden onset of aircraft noise events on humans with an adjustment ranging up to 11 dB above the normal SEL (Stusnick *et al.* 1992). Onset rates between 15 to 150 dB per second require an adjustment of 0 to 11 dB, while onset rates below 15 dB per second require no adjustment. The adjusted SEL is designated as the Onset-Rate Adjusted Sound Exposure Level (SEL_r).

Weighted Equivalent Continuous Perceived Noise Level

WECPNL is a Japanese metric primarily used for the evaluation of community noise effects for GoJ projects. WECPNL characterizes its flyover and run-up noise events with metrics known as the perceived noise level and effective perceived noise level (see Appendix C), whereas the modeling implementations of CNEL/DNL characterize their flyover and run-up noise events with A-weighted SEL and L_{max}, respectively. WECPNL, like CNEL, averages aircraft sound levels at a location over a complete 24-hour period, with a 5 dB adjustment added to those noise events which take place between 1700 and 2200 and a 10 dB adjustment added to those noise events which take place between 2200 and 0700. This analysis presents WECPNL for comparative purposes only; CNEL represents the metric applicable for U.S. Department of Defense projects such as this ER.

3.3.1.3 Noise Standards and Guidelines

The USMC employs programs that address adherence to the Noise Control Act of 1972 and USEPA Guidance. These include the Range Air Installations Compatible Use Zones (RAICUZ) for air-to-ground operations at training areas (Office of the Chief of Naval Operations Instruction [OPNAVINST] 3550.1A), and the Air Installations Compatible Use Zones (AICUZ) for airfield operations (OPNAVINST 11010.36C). The RAICUZ and AICUZ programs: 1) help military installations in determining noise generated by military training and operations, 2) evaluate how the noise from these operations may impact adjacent communities and associated activities, and 3) assist military planners to assess existing and proposed land uses on an installation. The Department of Defense (DoD) uses L_{max}, SEL, and CNEL, while the GoJ uses WECPNL and its input metrics. As a DoD document, this ER employs L_{max}, SEL, and CNEL, but does present WECPNL results at MCAS Futenma for comparison.

Community response to aircraft noise has long been a concern in the vicinity of airfields. In an effort to manage airport and community growth, noise has been considered a key factor in land-use planning in and around the world. In general, noise exposure zones are divided into three categories, as follows:

- **Noise Zone 1:** Defined as an area of minimal impact, refers to A-weighted CNEL values less than 65 dB CNEL. This is also an area where social surveys show less than 15 percent of the population likely to be highly annoyed.
- **Noise Zone 2:** Defined as an area of moderate impact, refers to A-weighted CNEL values from 65 dB up to, but not including 75 dB. This is the area where social surveys show between 15 percent and 39 percent of the population is likely to be highly annoyed and an area of moderate impact where some land use controls are needed.
- **Noise Zone 3:** Defined as an area of most severe impact, refers to A-weighted CNEL values of 75 dB and greater. This is the area where social surveys show greater than 39 percent of the population likely to be highly annoyed and requires the greatest degree of compatible use controls.

Based on DoD standards, this ER only addresses Zones 2 and 3 since Zone 1 noise levels are less than 65 dB CNEL.

3.3.1.4 Airfield Noise Modeling

CNEL and WECPNL contours were calculated using the annual average daily operations, which were found by dividing the total number of operations by 365, then by dividing the closed pattern operations by two. This second division was performed because Air Traffic Control counts closed patterns as two operations—a departure and an arrival—but the noise modeling program sees them as one operation, since they are connected on a single flight track. The noise analyses for MCAS Futenma (e.g., numbers of operation, noise exposure, etc.) for existing conditions and proposed action are based upon the 2012 noise study (Wyle 2012). This study utilized the DoD NOISEMAP computer model for the estimation of noise exposure.

3.3.2 Current Environment

Military aircraft operations represent the primary source of noise at and near MCAS Futenma. Of the 23,366 total operations that represent the average operations at MCAS Futenma (refer to Table 2-3), 79 percent are performed by based military aircraft, with the CH-46E performing half of the total. The remaining 21 percent consist of transient (non-based) military and civilian aircraft. The single largest contributor to the overall noise levels is the transient FA-18C/D Hornet, despite comprising only about 4 percent of the annual operations. This is because the FA-18C/D Hornet is 10 to 15 dB louder on a single-event basis than any other aircraft operating at MCAS Futenma.

Community Noise Equivalent Level

Using these operations and flight track data, the analysis developed noise contours to illustrate the extent of noise on and off the installation. Figure 3.3-3, which shows the CNEL contours for 65 dB through 85 dB, demonstrates that the 70 through 85 dB contours remain primarily within the MCAS

Futenma station boundary. The 65 and 70 dB contours extend beyond the station boundary at both ends of the airfield. Figure 3.3-4 shows the WECPNL contours for 80 dB through 100 dB. These higher noise levels reflect the additional penalties associated with the metric. The area affected by the 90 through 100 dB WECPNL contours lie almost wholly within the station boundaries. Although the area subject to noise levels of 80 to 90 dB WECPNL extends off-station, it covers less area than defined under the CNEL contours. Table 3.3-1 presents the on- and off-station acreage affected by aircraft noise under existing conditions. As these data demonstrate, the highest noise levels (≥75 dB CNEL/≥90 dB WECPNL) affect no off-station lands.

Table 3.3-1. Existing Acreage of Land Affected by Aircraft Noise Levels above 65 dB CNEL/80 dB WECPNL

	CNEL			WECPNL			
	Zone 2 (65-74 CNEL)	***Zone 3 (≥75 CNEL)***	***Total Acreage CNEL***	***80-84 WECPNL***	***85-89 WECPNL***	***≥90 WECPNL***	***Total Acreage WECPNL***
On-Station	678	306	984	311	231	344	886
Off-Station	205	0	205	113	13	0	126
Total	**883**	**306**	**1,189**	**424**	**244**	**344**	**1,012**

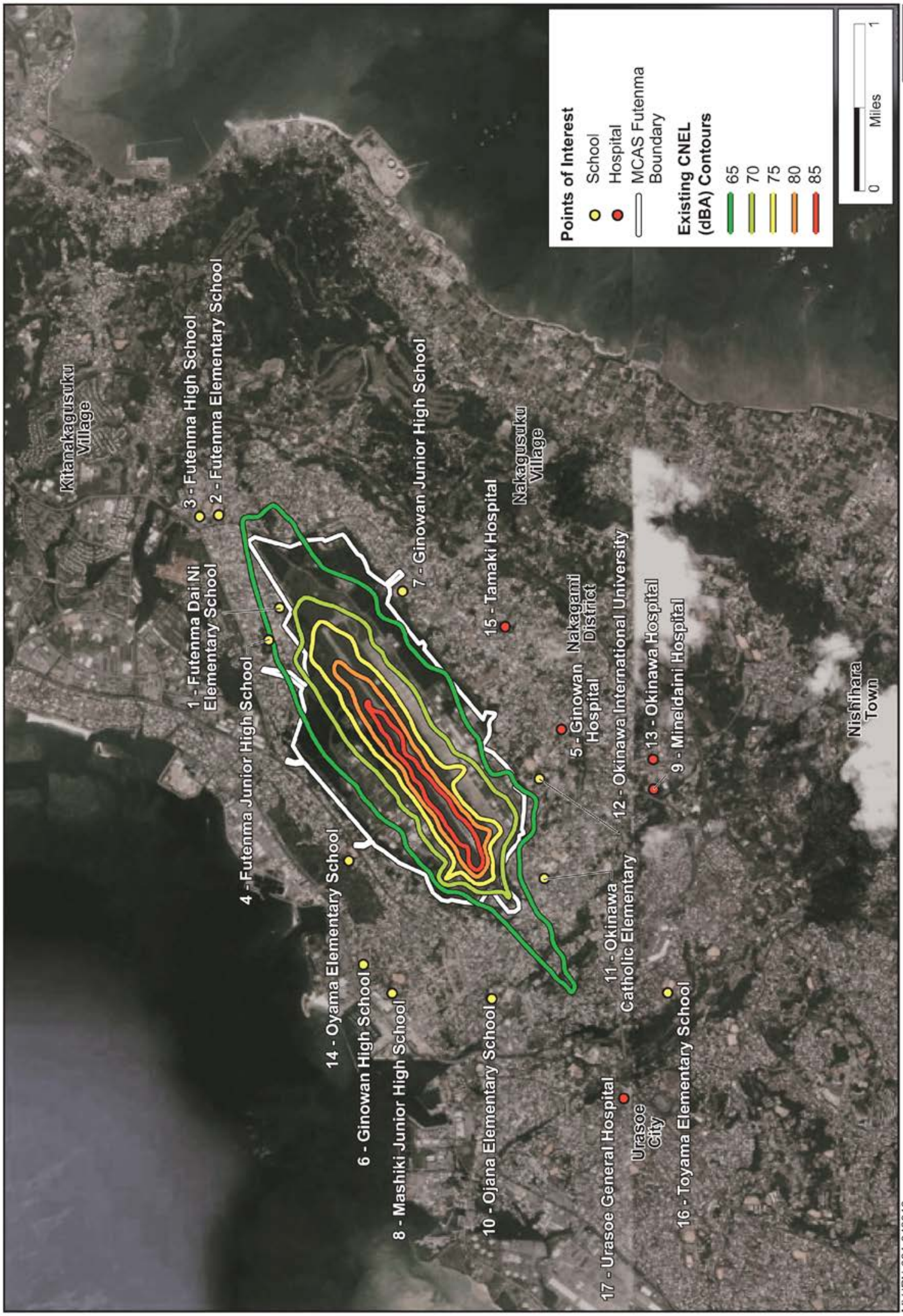


Figure 3.3-3. CNEL Contours for Existing Average Daily Aircraft Operations at MCAS Futenma

Source: Wyle 2012

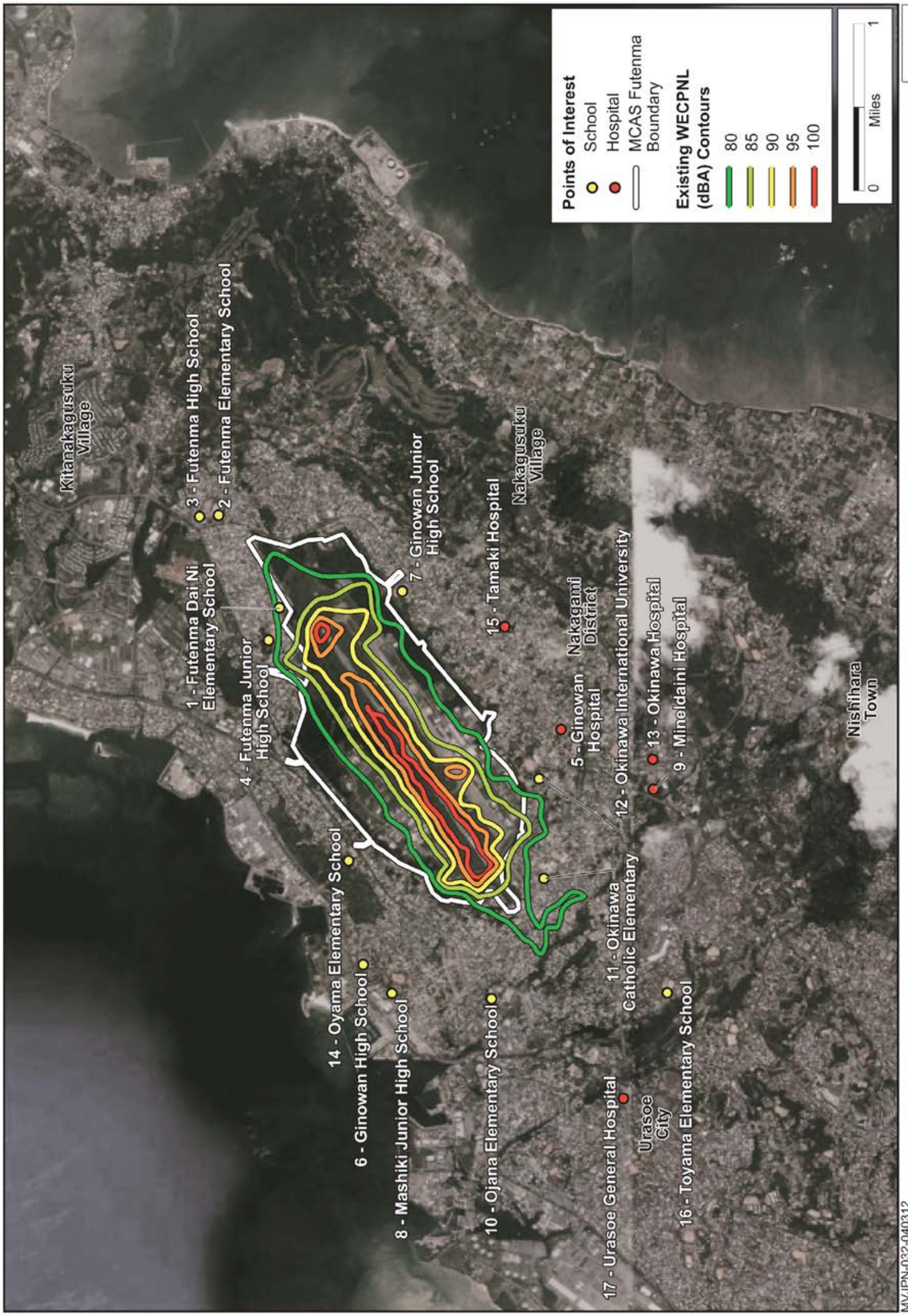


Figure 3.3-4. WECPNL Contours for Existing Average Daily Aircraft Operations at MCAS Futenma

Source: Wyle 2012

Seventeen representative points of interest were identified in the surrounding communities and were analyzed for the noise levels they experience. Of these points of interest, 4 were hospitals, 1 was a university, and 12 were elementary and high schools. These points of interest and their estimated noise exposure are tabulated in Table 3.3-2. None of the points of interest are exposed to CNEL greater than 70 dB (WECPNL of 81 dB), two are exposed to CNEL between 65 and 70 dB, and three exposed to WECPNL between 76 and 81 dB under existing conditions. The major contributor to noise under existing conditions at MCAS Futenma is the FA-18 aircraft with a single-event noise level 10 to 15 dB louder than any other aircraft at the base.

Table 3.3-2. Estimated Noise Exposure at MCAS Futenma Points of Interest for Existing Conditions

Point of Interest		CNEL	WECPNL
ID #	***Name***		
1	Futenma Dai Ni Elementary School	68	81
2	Futenma Elementary School	63	75
3	Futenma High School	60	72
4	Futenma Junior High School	65	78
5	Ginowan Hospital School	54	65
6	Ginowan High School	51	63
7	Ginowan Junior High School	60	72
8	Mashiki Junior High School	51	62
9	Mineidaini Hospital	55	66
10	Ojana Elementary School	56	68
11	Okinawa Catholic Elementary School	61	77
12	Okinawa International University	58	70
13	Okinawa Hospital	55	66
14	Oyama Elementary School	58	69
15	Tayaki Hospital	55	66
16	Toyama Elementary School	57	69
17	Urasoe General Hospital	59	71

Source: Wyle 2012

Low-Frequency Noise

In the evaluation of noise in the EIA recently published by the ODB, LFN is defined as noise with frequencies of 80 Hz and below. LFN data was collected for the AH-1, UH-1, and CH-53 during engine tests and hovering conducted at a test location on a standard take-off pad located at the western end of the runway at MCAS Futenma (Figure 3.3-5). ODB researchers made noise measurements at distances of 164, 328, 656, and 1,640 feet (50, 100, 200, and 500 meters, respectively) to either side of the test location, and at a hover height of 66 feet (20 meters).

For the ODB EIA, LFN measurements were also taken at three off-base locations situated very close to MCAS Futenma's base boundary. Those three points were located 2,581 (LSt-9), 2,535 (LSt-10), and 6,813 (LSt-11) feet, (787, 773, and 2,077 meters), respectively from the aircraft test location (refer to Figure 3.3-5). When compared to the thresholds for fixture rattling and for mental or physical discomfort, no data point at any of the measured frequencies for any of the tested aircraft exceeded the threshold for mental or physical discomfort for any of the three off-base locations. The AH-1 and UH-1

Figure 3.3-5. ODB Test Location and ODB Measurement Sites for LFN at MCAS Futenma

slightly exceed the threshold for fixture rattling at certain frequencies for the two off-base locations closest to the test site (LSt-9 and LSt-10). The data for the CH-53 demonstrates its LFN does not exceed this threshold for the defined frequencies.

The EIA also described the ODB's estimate for the likelihood of awakening due to LFN. It uses a G-weighted value (G) of 100 dB as the estimated level at which people can be expected to be awaken. None of the three helicopters generated G-weighted noise levels that exceeded 100 dBG at any of the three off-base locations at which measurements were taken for the ODB's EIA.

All 17 representative points of interest examined in this ER lay farther from the test location on MCAS Futenma than the two off-base locations discussed in the ODB's EIA where the LFN generated by the AH-1 and UH-1 exceeded the threshold for fixture rattling (LSt-9 and LSt-10). Beyond the distance to these points, LFN would fall below the threshold. Therefore, LFN levels generated by the AH-1 or UH-1 are not an issue at these locations.

The ODB's EIA concludes that the current effects due to LFN generated by the based helicopters are minimal and environmental conservation measures are still met because the actions performed by the discussed aircraft are brief and transitory.

3.3.3 Environmental Impacts

Despite replacing the 24 CH-46Es on a one-for-one basis, the MV-22s are expected to perform approximately 2,600 fewer operations than the CH-46Es (refer to Table 2-3). This change would result in an 11 percent decrease in the total operations compared to the existing conditions.

Because the MV-22 is a tiltrotor aircraft and can operate either as a fixed-wing aircraft or helicopter, it would utilize both fixed-wing and rotary-wing flight tracks. It would conduct 80 percent of departures and 77 percent of non-break arrivals along fixed-wing flight tracks in a manner similar to the C-130 cargo plane. The remainder of those operations would occur on the rotary-wing flight tracks currently used by the CH-46E. There would be a 17 percent decrease in run-ups relative to the existing conditions.

Community Noise Equivalent Level

As seen in Figures 3.3-6 (CNEL) and 3.3-7 (WECPNL), the noise levels produced by the proposed action would vary minimally from the existing conditions. A few areas would expand fractionally and others would decrease. This lack of change stems primarily from the fact that the number of operations performed by the FA-18C/D Hornet—the single largest contributor to the noise levels—would not change. Because the Hornet is 10 to 15 dB louder than either the CH-46E or the MV-22 on a single exposure level, the MV-22 would not perceptibly contribute to proposed cumulative noise conditions at MCAS Futenma.

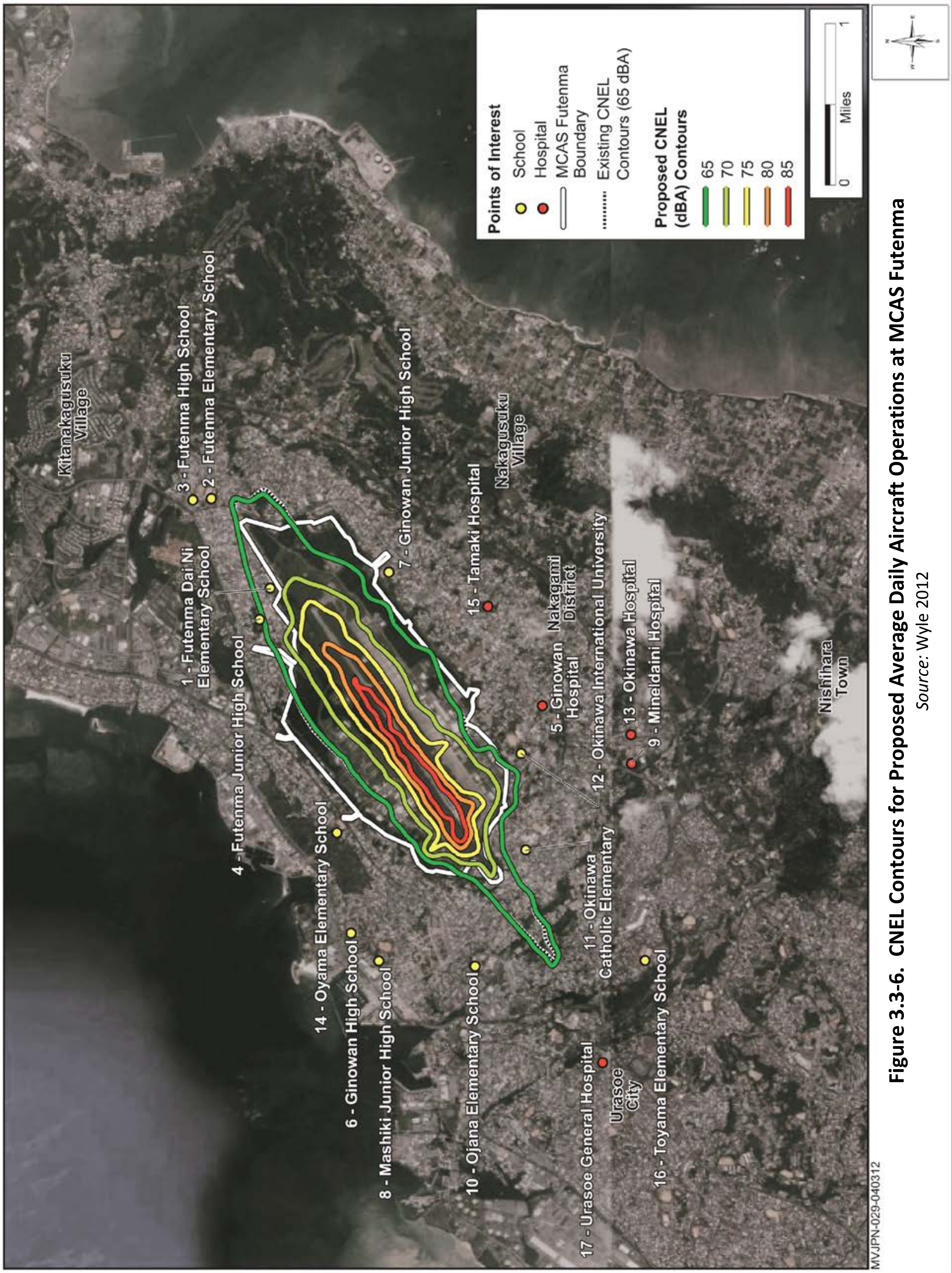


Figure 3.3-6. CNEL Contours for Proposed Average Daily Aircraft Operations at MCAS Futenma

Source: Wyle 2012

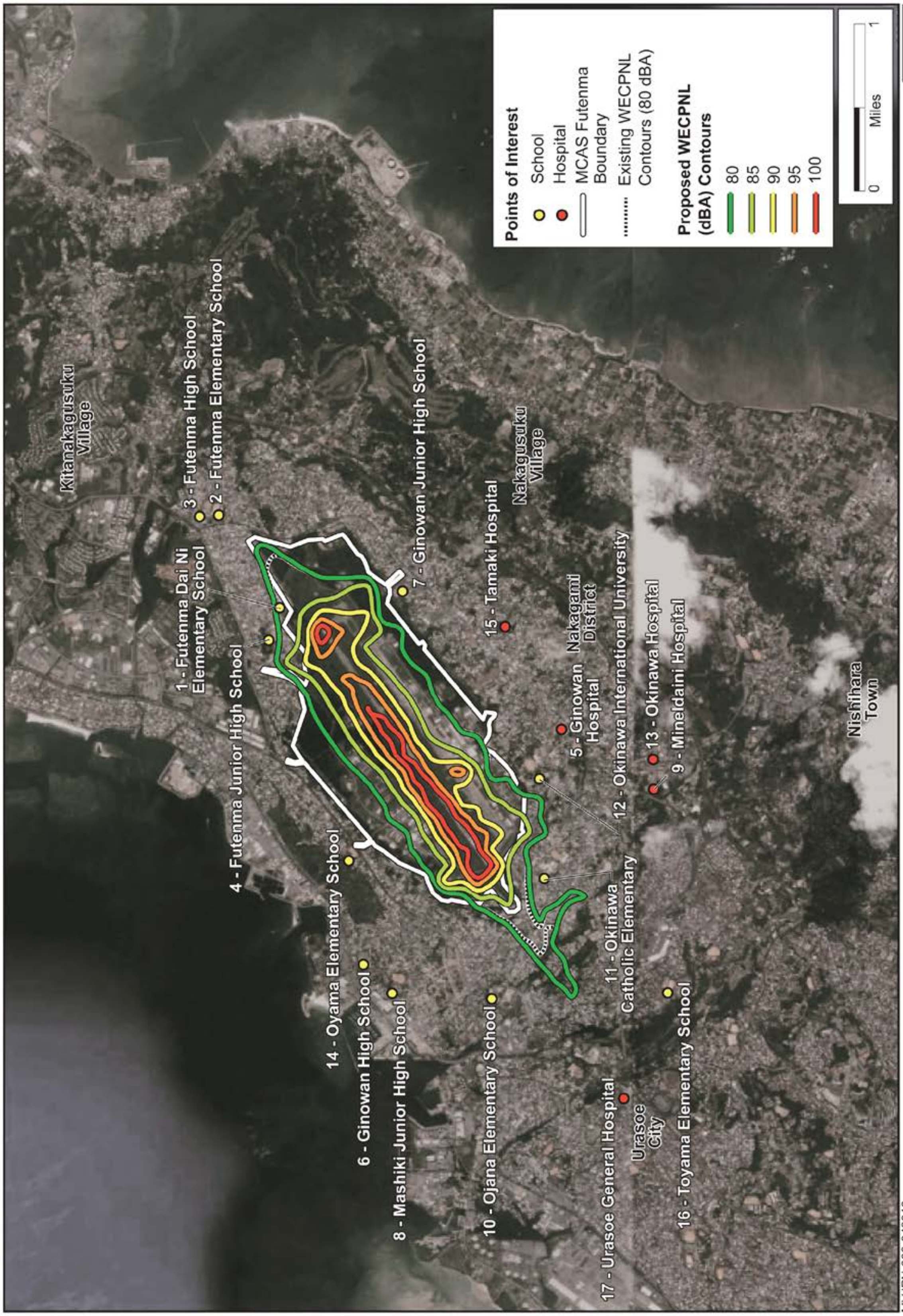


Figure 3.3-7. WECPNL Contours for Proposed Average Daily Aircraft Operations at MCAS Futenma

Source: Wyle 2012

Table 3.3-3 establishes that the areas affected by noise under either metric would change so minimally as to represent no real difference in conditions. For off-station, the CNEL metric indicates the area within Zone 2 would increase by 7 acres, mostly to the northeast (Table 3.3-4). For WECPNL, an increase in off-station affected acreage (+41 acres) would result from the change in operations. Overall, shifts in affected acreage comprise a 0.3 percent decrease for the CNEL and 5 percent increase for the WECPNL. The increase in WECPNL would occur primarily off-station to the southwest.

Table 3.3-3. On-Station Acreage Affected by Aircraft Noise Levels of 65 dB CNEL/80 dB WECPNL or Greater

	CNEL			WECPNL			
	Zone 2 (65-74 CNEL)	***Zone 3 (≥ 75 CNEL)***	***Total Acreage 65 CNEL or Greater***	***80-84 WECPNL***	***85-89 WECPNL***	***≥ 90 WECPNL***	***Total Acreage 80 WECPNL or Greater***
Current	678	306	984	311	231	344	886
Proposed	668	305	973	310	239	344	893
Total	**-10**	**-1**	**-11**	**-1**	**8**	**0**	**7**

Table 3.3-4. Off-Station Acreage Affected by Aircraft Noise Levels of 65 dB CNEL/80 dB WECPNL or Greater

	CNEL			WECPNL			
	Zone 2 (65-74 CNEL)	***Zone 3 (≥ 75 CNEL)***	***Total Acreage 65 CNEL or Greater***	***80-84 WECPNL***	***85-89 WECPNL***	***≥ 90 WECPNL***	***Total Acreage 80 WECPNL or Greater***
Current	205	0	205	113	13	0	126
Proposed	212	0	212	152	15	0	167
Total	**7**	**0**	**7**	**39**	**2**	**0**	**41**

In general, the noise analysis shows the introduction of the MV-22 (and retirement of the CH-46Es) operations would change little, resulting in a decrease of up to 1 dB in CNEL exposure relative to current levels. This occurs because the noise is dominated by FA-18 aircraft but also because the number of operations decrease with the MV-22 compared to the CH-46E, and because, when it is in airplane mode, the MV-22 would be slightly quieter than the CH-46E.

Table 3.3-5 compares the single-event noise levels of a CH-46E and an MV-22 for various altitudes, in terms of SEL and L_{max}. It demonstrates that at cruising speeds (i.e., when the MV-22 is in airplane mode), the CH-46E is the louder of the two aircraft. When hovering, as for a landing, the MV-22 is slightly louder.

Of the 17 points of interest, two would experience a reduction in noise levels of 1 dB CNEL, and two would experience a reduction of 3 dB, while the remaining sites would experience no change (Table 3.3-6). Under the proposed action, two points of interest would be within the 65 to 70 dB range. None of the points of interest are exposed to a CNEL greater than 68 dB. The WECPNL at Futenma Elementary School, Toyama Elementary School, and Ginowan High School would increase by an imperceptible 1 dB because of the MV-22 overhead break arrivals and a tonal component of those operations affecting the WECPNL. The WECPNL of the Urasoe General Hospital, Ojana Elementary School, and Mashiki Junior High School would increase by an imperceptible 2 dB due to the MV-22 overhead break arrivals. Therefore, little to no change from existing noise levels would occur as a result of the replacement of the CH-46E with the MV-22 aircraft.

Table 3.3-5. Comparison of SEL and L_{max} between CH-46E and MV-22				
Altitude (feet AGL)	SEL (dBA)		L_{max} (dBA)	
	CH-46E	*MV-22*	*CH-46E*	*MV-22*
Cruise[1]				
250	101	93	97	88
500	96	92	90	88
1,000	94	88	86	81
1,500	92	86	82	78
2,000	89	84	78	74
2,500	88	82	76	72
3,000	87	81	74	70
3,500	86	80	73	68
4,000	85	79	72	67
4,500	85	78	72	66
5,000	84	77	69	64
Arrival (at or near touchdown)[2]				
-	95	94	79	83

Notes:
[1]Estimates CH-46E cruising speed of 110 knots and MV-22 cruising speed of 220 knots.
[2]Measured at a distance of 500 feet abeam of the aircraft on the left side.
Source: Wyle 2012

Table 3.3-6. Estimated Noise Exposure at Points of Interest for MCAS Futenma for Proposed Action					
Point of Interest		CNEL		WECPNL	
ID #	*Name*	*Proposed*	*Change from Existing*	*Proposed*	*Change from Existing*
1	Futenma Dai Ni Elementary School	68	0	81	0
2	Futenma Elementary School	63	0	76	1
3	Futenma High School	60	0	72	0
4	Futenma Junior High School	65	0	78	0
5	Ginowan Hospital School	54	0	65	0
6	Ginowan High School	51	0	64	1
7	Ginowan Junior High School	60	0	72	0
8	Mashiki Junior High School	51	0	64	2
9	Mineidaini Hospital	52	-3	65	-1
10	Ojana Elementary School	56	0	70	2
11	Okinawa Catholic Elementary School	61	0	77	0
12	Okinawa International University	58	0	70	0
13	Okinawa Hospital	52	-3	64	-2
14	Oyama Elementary School	57	-1	69	0
15	Tayaki Hospital	54	-1	65	-1
16	Toyama Elementary School	57	0	70	1
17	Urasoe General Hospital	59	0	73	2

Source: Wyle 2012

Low-Frequency Noise

The ODB EIA (ODB 2011) anticipated that the MV-22 would operate out of the proposed FRF. Therefore, in addition to the LFN data measurements collected for the AH-1, UH-1, and the CH-53, the ODB's EIA incorporated LFN data for the MV-22 for 80 Hz and below. These data were gathered in Atlantic, North

Carolina under different climatic conditions than those under which the other three helicopters were tested. Data measurements during engine testing and hovering used the same distances as the other three aircraft out to 1,640 feet (500 meters). In addition, data were gathered from directly below the aircraft as it flew at an altitude of 410 feet (125 meters). The EIA does not specify what mode the aircraft was in when the “during flight” data were taken.

The data collected for the MV-22 indicated that LFN exceeded the thresholds for fixture rattling and mental or physical discomfort at certain frequencies (Figure 3.3-8). The data, however, are for locations closer to the aircraft than anyone other than military personnel, who wear hearing protection, would ever get. At distances like those of the three off-base locations considered for the aircraft tested at MCAS Futenma, the LFN levels of the MV-22 would be much lower than the thresholds and are unlikely to exceed the thresholds by much, if at all. However, the thresholds were produced to describe long-term effects due to noise from stationary noise sources, not brief, transitory occurrences such as the actions performed by aircraft.

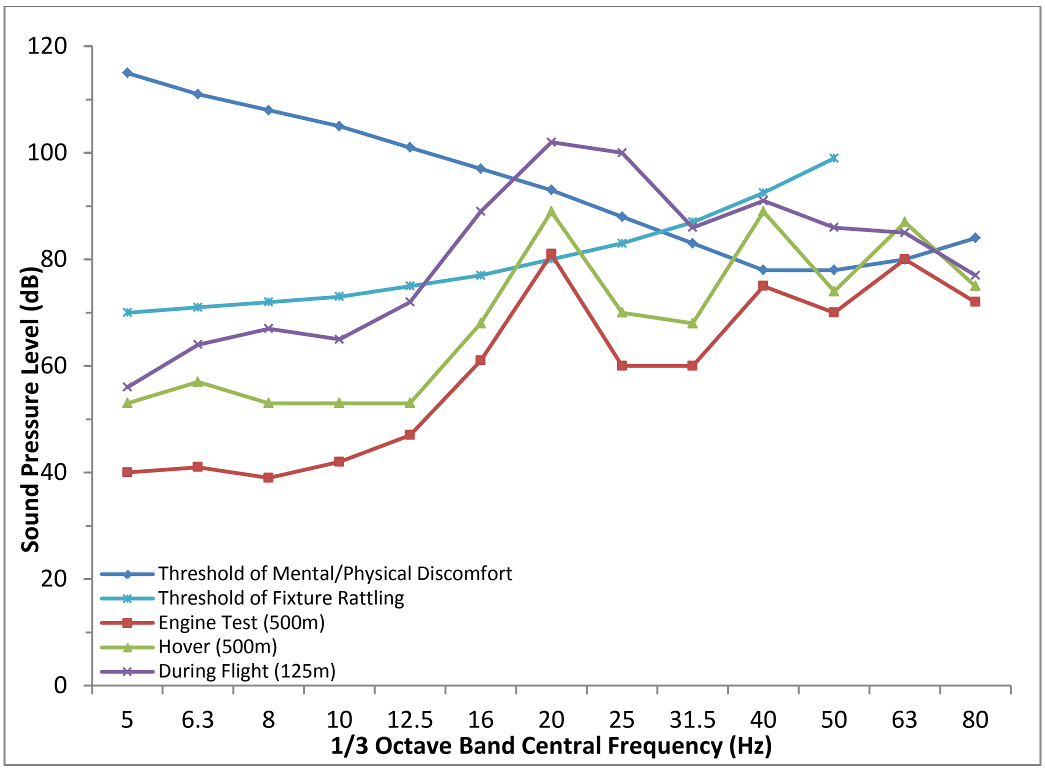


Figure 3.3-8. Comparison of MV-22 LFN Levels to Thresholds from ODB EIA

Note: The data presented above were collected from the left side of the aircraft

The EIA also described the likelihood of awakening due to LFN from MV-22 operations. It used a G-weighted value of 100 dB as the estimated level at which people can be expected to be awaken. At 1,640 feet (500 meters) from the aircraft, LFN levels reached 100 dBG as it hovered. During flight at an altitude of 410 feet (125 meters), the MV-22 produces an LFN level of approximately 112 dBG. However, the MV-22 would perform night operations only a small part of the time, so the likelihood of a person awakening due to this aircraft is low.

All 17 representative points of interest examined in this ER lay much farther from the test location on MCAS Futenma than the furthest data collection point used in the ODB's EIA where LFN thresholds would be exceeded, thus LFN levels generated by the MV-22 would not be an issue at these locations.

The ODB's EIA concludes that the impacts due to LFN generated by the MV-22 would be minimal and environmental conservation measures would still be met because the actions performed by the discussed aircraft are brief and transitory.

3.4 LAND USE

Land use generally refers to human modification of the land, often for residential or economic purposes. It also refers to use of land for preservation or protection of natural resources such as wildlife habitat, vegetation, or unique features. Human land uses include residential, commercial, industrial, agricultural, or recreational uses. The attributes of land use include general land use and ownership, land management plans, and land use management areas. For this analysis, land use focuses on U.S. facilities and areas in Japan within MCAS Futenma and its surrounding environs on Okinawa.

3.4.1 Current Environment

MCAS Futenma is located within the city of Ginowan, approximately 16 miles northeast of Naha City. The air station covers 1,188 acres, and is completely surrounded by the urbanized development of Ginowan City (Department of the Navy [DoN] 2011). Ginowan City population was 91,856 in 2010 with a density of over 12,000 people per square mile (City Population 2011). The area surrounding MCAS Futenma has been densely developed all the way to the air station fence line. This development includes residential and commercial uses, often intermixed. Industrial land use occurs to the northwest.

On-station, approximately 40 percent of the land is utilized for runways, Clear Zones (CZs), taxiways and aircraft parking aprons. The remaining portions of the air station are dedicated to air operations, facilities, personnel support facilities, bachelor housing, and administrative functions. CZs are required for all fixed-wing active runways and extend from both ends of Runway 06/24; Accident Potential Zone (APZ) I and APZ II areas are not justified for this runway due to insufficient fixed-wing aircraft operations. APZs associated with helicopter LZs are located completely on-station. The CZs, which extend off-station, appear to include areas of incompatible off-station residential and commercial use (refer to Section 3.6 for additional details). Three military facilities located within the MCAS Futenma CZ area are classified as incompatible under Standard Land Use Coding Manual guidelines (DoN 2011).

Aircraft noise forms a principle driver of land use management for military installations like MCAS Futenma. The Navy and USMC promote land use compatibility standards for noise zones (OPNAVINST 11010.36C *Air Installations Compatible Use Zones Program*) for the development of land uses in and around their air installations. As noted in Section 3.3 (Noise), noise levels are grouped into three zones to evaluate land use compatibility. Noise Zone 1 (less than 65 dB CNEL) is generally considered an area of no impact to land use. Noise Zone 2 (65 to 74 dB CNEL) comprises an area where some land use controls are required. Noise Zone 3 (greater than 75 dB CNEL) requires the greatest degree of land use control. Although the GoJ uses WECPNL to evaluate community noise effects, that metric correlates to no land use standards applicable to DoD actions. However, the DNL metric is similar to the WECPNL in that it has a penalty for evening operations. Therefore, assessment of the relationship of noise and land use for the existing conditions and the proposed action employs CNEL.

Current noise levels on MCAS Futenma range from less than 70 dB CNEL to 85 dB CNEL. Using compatibility recommendations identified in the *Standard Land Use Coding Manual* (DoN 2008), the MCAS Futenma Base Planning Report (DoN 2011) classified, on-station, 101 military facilities as compatible, 169 facilities as compatible with restrictions, 11 facilities as incompatible with exceptions, and 7 facilities as incompatible with noise levels in Noise Zone 3. It also identified three facilities as incompatible with noise levels in Noise Zone 2 (DoN 2011). MCAS Futenma employs an existing program to resolve incompatible land uses affected by noise. However, the 10 facilities noted above remain incompatible.

Noise Zone 2 (65 to 74 dB CNEL) extends off-station covering about 205 acres northeast and southwest of MCAS Futenma. The affected areas consist of densely-populated lands, containing approximately 12,000 people per square mile, which include residential, commercial and institutional uses. Two schools are located within Noise Zone 2 (see Section 3.5, Noise, for further discussion of points of interest, including schools). Given that MCAS Futenma has supported more annual operations in recent years, the areas exposed to aircraft noise have likely been the same or larger.

3.4.2 Environmental Impacts

Overall, the noise from MV-22 operations would not alter land use on- or off-station. Under the proposed action, the area within MCAS Futenma affected by aircraft noise would remain essentially identical to current conditions. No changes to the compatibility of facilities would occur; 10 facilities in Zones 2 and 3 would remain incompatible. MV-22 operations would not affect the structure or size of the CZs.

Off-station acreage affected by noise levels would increase slightly in Noise Zone 2. No off-station areas would be exposed to noise greater than 74 dB CNEL (refer to Table 3.3-4). Under standard DoD metrics and guidelines, the proposed action would not be expected to result in impacts to land use beyond those already affecting off-station areas.

3.5 AIR QUALITY

Air quality in a given location is commonly defined by pollutant concentrations in the atmosphere and is generally expressed in units of parts per million (ppm) or micrograms per cubic meter ($\mu g/m^3$). Different concentrations and accumulation time periods apply to different criteria pollutants such as carbon monoxide (CO) and nitrous oxides (NO_x). Comparison of a criteria pollutant concentration generated by an action to the GoJ and/or Okinawan prefectural ambient air quality standards provides a measure of the potential impacts from that action. These standards represent the maximum allowable atmospheric concentrations that may occur and still protect public health and welfare with a reasonable margin of safety. While these standards offer a context for understanding the potential effects of air emissions in an area, neither the GoJ Japan nor the prefectural standards apply to any DoD installations.

Similarly, the U.S. Clean Air Act (42 U.S.C. § 7401 et seq., as amended) does not apply to overseas installations. Although the Japan Environmental Governing Standards (JEGS) (U.S. Forces Japan [USFJ] 2010) contain criteria for air quality sampling and air emission standards for DoD installations like MCAS Futenma, these standards specifically exclude: military aircraft (C1.3.3); and off-installation deployments and operations (C1.3.3). In addition, JEGS Chapter 2 (Air Emissions) does not provide criteria specific to aircraft.

Although the proposed action is not subject to regulatory review in order to evaluate potential impacts of the proposed action on air quality, this section briefly describes the existing air quality of the project region around MCAS Futenma, and compares the basic emissions of the CH-46Es and the MV-22. The analysis employs a generic operational scenario in which each aircraft departs, flies a 1 hour sortie, and lands without any pattern work. For the purposes of this comparison, the analysis assessed five standard criteria pollutants associated with aircraft operations: CO, NO_x, hydrocarbons (HC) as measure of volatile organic compounds (VOCs), sulfur dioxide (SO_2), and suspended particulate matter less than or equal to 10 microns in diameter (PM_{10}). For greenhouse gases (GHGs), the analysis calculated equivalent carbon dioxide (CO_2e) which represents a combined emission rate for all GHGs. To calculate the basic emissions from the CH-46E operations, the analysis derived the times in each flight mode and emissions per 1,000 pounds of fuel used from the Aircraft Environmental Safety Office (AESO) Memorandum Report No. 9816, Revision F, January 2001, *Aircraft Emission Estimates: H-46 Landing and Takeoff Cycle and In-Frame, Engine Maintenance Testing Using JP-5.*

3.5.1 Current Environment

Air quality problems in the country of Japan (including Okinawa) are primarily centered around urban areas, with Tokyo being the primary location for high emissions of pollutants. Primary causes of air pollution in Japan include mobile sources (vehicular traffic), heavy industry, and combustion of waste – both in stationary source settings and open burning. Based on a 2006 Annual Report on the Environment in Japan (Ministry of the Environment 2006), Japan's air quality has been assessed in regard to compliance with Environmental Quality Standards (EQS):

- **Photochemical Oxidants**: In almost all regions of Japan, photochemical oxidants (including ozone and NO_x, VOCs, and other primary pollutants emitted from factories, businesses, or automobiles) continue to exceed the EQS of 0.06 ppm or less per hour.
- **Nitrogen Oxides**: Achievement rates for NO_x in Fiscal Year (FY) 2005 improved slightly from FY 2004. Achievement rates of the ambient pollution monitoring stations were 100 percent and the roadside monitoring stations were 89.2 percent.
- **Suspended Particulate Matter:** Rates of suspended particulate matter (those floating particles with a diameter of 10 µm or less) fell from FY 2003 to FY 2004.
- **Hazardous Air Pollutants:** Various chemical substances, though low in concentration, have been detected in the atmosphere, raising concerns about the long-term exposure to these chemicals. Of the 4 chemicals that have EQSs, benzene rates improved in 2004 with 5.5 percent of monitoring stations recording data exceeding the EQSs. The other three chemical substances with EQSs also improved in 2004.

Additionally, there is an issue with dust storms that originate in China and Mongolia. These mostly occur in the spring and are increasing in frequency primarily due to intensified desertification in China causing longer and more frequent storm occurrences. The GoJ has established a dust and sandstorms monitoring system to assist in exploring effective measures to deal with dust and sandstorms in the future.

Sources of emissions at MCAS Futenma include aircraft operations, vehicles, and stationery sources such as boilers and generators. Although no specific studies to define the emissions for the station are available, its sources represent a relatively minor part of the overall emissions for the surrounding area with its dense population and traffic. According to the Okinawa Prefectural Government's FY 2006[1] monitoring data of ordinary ambient air quality, all standards under the GoJ and the prefecture were met along the west coast of the island where MCAS Futenma lies. Table 3.5-1 presents the emissions for the operations per sortie for each aircraft type. The older CH-46Es generate high rates of CO and HC as VOCs. Operational parameters and emission factors for the MV-22 came from AESO Memorandum Report No. 9946, Revision E, January 2001, *Aircraft Emission Estimates: V-22 Landing and Takeoff Cycle and In-Frame, Engine Maintenance Testing Using JP-5*. Information on the emission factors for the CH-46E was derived from AESO Memorandum Report No. 9816, Revision F, January 2001.

Table 3.5-1. Comparison of Air Emissions (pounds) from a Sortie by a CH-46E and MV-22

Flight Operation	CO	NO_x	HC as VOC	SO_2	PM_{10}	CO_2e
CH-46E						
Take-off	7.81	0.53	2.41	0.06	0.51	496
Cruise	22.11	4.41	3.84	0.45	1.99	3,557
Land	5.09	0.32	1.48	0.04	0.37	329
Total	**35.01**	**5.26**	**7.73**	**0.55**	**2.87**	**4,382**
MV-22						
Take-off	2.41	6.12	0.03	0.30	1.04	2,403
Cruise	2.42	35.62	0.03	1.22	4.83	9,829
Land	0.83	2.30	0.01	0.12	0.41	930
Total	**5.66**	**44.04**	**0.07**	**1.64**	**6.28**	**13,163**
Change	***-29.35***	***38.78***	***-7.66***	***1.09***	***3.41***	***8,780***

3.5.2 Environmental Impacts

Sources of emissions from the proposed action at MCAS Futenma would include construction of paving for the containerized simulators, vehicles driven by personnel, and aircraft operations. All other aspects and activities at the station would remain unaffected. Similarly, the construction related to the simulators would only involve minimal construction equipment and exposed soils and dust but would not lead to substantial long-term vehicle use. Therefore, no noticeable contribution to the air emissions of the area would result. While personnel changes would accompany the MV-22 basing, no net increase is expected to total people or cars producing additional emissions.

[1] Best available data at the time of publication. MCB Camp Butler Environmental (personal communication, Barron 2011) indicated it had no air emissions studies.

Comparison of the two aircraft reveals that the MV-22 would generate substantially less CO and HC as VOCs per average sortie. The remaining criteria pollutants would increase by approximately 39 pounds per sortie of NO_x and lesser amounts for SO_2 and PM_{10} per sortie. Basing and operations of the MV-22 at MCAS Futenma would not be expected to degrade air quality conditions for the following reasons. First, operations would decrease by 11 percent, thereby decreasing the amount of time emissions would be generated. Second, the MV-22 aircraft would fly faster, on average, again reducing the amount of time that emissions could be produced. Third, increases in NO_x per sortie would be offset by decreases in CO. Lastly, as noted previously, the Prefectural standards for the area encompassing MCAS Futenma have been met, even with dense traffic and industry emissions. Emissions by aircraft would continue to represent a negligible influence on air pollutant concentrations.

3.6 SAFETY

The USMC practices Operational Risk Management as outlined in OPNAV 3500.39A and Marine Corps Order (MCO) 3500.27A. Requirements outlined in these documents provide for a process to maintain readiness in peacetime and achieve success in combat while safeguarding people and resources. The safety analysis contained in the following sections addresses issues related to potential risks to both military personnel and civilians living on or in the vicinity of MCAS Futenma. Specifically, this section provides information on hazards associated with aircraft mishaps, emergency and mishap response, bird-aircraft strikes, and safety zones for the airfield.

3.6.1 Current Environment

3.6.1.1 Aircraft Mishaps

The primary concern with regard to military training flights is the potential for aircraft mishaps (i.e., crashes) to occur; these could be caused by mid-air collisions with other aircraft or objects, weather difficulties, mechanical failures, pilot error, or bird-aircraft strikes. Aircraft mishaps are classified as A, B, C, or D (Table 3.6-1). Class A mishaps are the most severe with total property damage of $2 million or more and a fatality and/or permanent total disability. Calculating Class A mishaps can be used for comparing mishap rates for various aircraft types, as shown below.

Table 3.6-1. Aircraft Mishap Classes

Mishap Class	Total Property Damage	Fatality/Injury
A	$2,000,000 or more damage or total aircraft loss	Fatality and/or permanent total disability
B	$500,000 to $2,000,000 damage	Permanent disability or hospitalization for three or more individuals
C	$50,000 to $500,000 damage	Loss of worker productivity of one or more days
D	Minor incident not exceeding $50,000	Minor injury not meeting above criteria

Source: DoD 2011

Class A Mishap Rates for CH-46E and MV-22

The following table shows mishap rates for the legacy H-46 helicopter (all models). This aircraft conducts operations on Okinawa under current conditions. Mishap data for the H-46 are included in Table 3.6-2. Class A rates for these helicopters have remained very low since the mid-1990s, and average 5.74 Class A mishaps per 100,000 flying hours. From 2004 to 2011, this rate was 1.14 Class A mishaps per 100,000 flying hours.

Table 3.6-2. Historic Class A Flight Mishaps for Department of the Navy/USMC

Year	H-46 (all types)		
	Class A Mishaps	***Flight Hours***	***Mishap Rate***
FY 64	0	147	0
FY 65	1	9,034	11.07
FY 66	2	33,442	5.98
FY 67	17	75,236	22.60
FY 68	24	92,108	26.06
FY 69	29	161,595	17.95
FY 70	21	140,406	14.96
FY 71	9	132,350	6.80
FY 72	9	96,042	9.37
FY 73	6	93,971	6.38
FY 74	6	68,509	8.76
Jul-Dec 74	4	41,170	9.72
Calendar Year 75	5	86,428	5.79
Calendar Year 76	5	87,319	5.73
Calendar Year 77	3	93,500	3.21
Calendar Year 78	5	97,307	5.14
Calendar Year 79	3	92,390	3.25
Jan-Sep 80	4	66,689	6.00
FY 81	8	88,951	8.99
FY 82	5	92,300	5.42
FY 83	3	99,406	3.02
FY 84	3	106,039	2.83
FY 85	2	106,883	1.87
FY 86	7	110,743	6.32
FY 87	5	118,331	4.23
FY 88	4	112,606	3.55
FY 89	4	112,365	3.56
FY 90	4	98,775	4.05
FY 91	3	110,122	2.72
FY 92	4	96,834	4.13
FY 93	5	106,743	4.68
FY 94	2	98,796	2.02
FY 95	1	96,115	1.04
FY 96	5	90,401	5.53
FY 97	3	81,816	3.67
FY 98	1	87,321	1.15
FY 99	1	84,346	1.19
FY 00	1	92,849	1.08
FY 01	2	91,708	2.18
FY 02	2	90,287	2.22
FY 03	2	79,390	2.52
FY 04	1	63,436	1.58
FY 05	1	71,758	1.39
FY 06	0	59,676	0.00
FY 07	1	56,330	1.78
FY 08	1	41,032	2.44
FY 09	0	36,558	0
FY 10	0	29,388	0
Total	**234**	**4,078,948**	**5.74**

Source: Navy Safety Center 2011

3.6.1.2 Bird-Aircraft Strike Hazard (BASH)

Bird-aircraft strikes and the hazards they present form another safety concern for aircraft operations. Bird-aircraft strikes constitute a safety concern because of the potential for damage to aircraft or injury to aircrews or local populations if an aircraft crash should occur in a populated area. Aircraft may encounter birds at altitudes of 3,000 feet MSL or higher. Over 95 percent of reported bird strikes occur below 3,000 feet above ground level (AGL). Approximately 50 percent of bird strikes happen in the airport environment, and 25 percent occur during low-altitude flight training (Worldwide BASH Conference 1990). BASH plans account for seasonal migrating patterns where risks to aircraft can increase. The Office of the Chief of Naval Operations requires DoN and USMC commands to develop a BASH plan to reduce hazardous bird/animal activity relative to airport flight operations.

The airfield located at MCAS Futenma, although not along any major migratory paths, is an attractive location for several species of birds. Each species presents a different hazard to aircraft, both in the likelihood of a strike and in the severity of damage expected. Therefore, MCAS Futenma must maintain an aggressive an on-going effort and commitment to reduce these hazards. Two important aspects of the Futenma BASH Plan include the Bird Hazard Working Group, and a Bird Hazard Condition (BHC). The Bird Hazard Working Group is a committee of local personnel and Station organizations concerned with bird hazards. They execute and make recommendations to the BASH program. The Bird Hazard Condition is a bird hazard alert system relating to the level of bird activity on or near the airfield used to increase pilots' awareness of the potential danger. A BHC of Heavy indicates a severe concentration of birds (more than 20) on or immediately adjacent to the runway, presenting an immediate threat to flight operations. Air Traffic Control immediately notifies bird displacement and reduction teams. A Moderate condition indicates concentrations of birds (11 to 20) in locations that present a probable threat to flight operations. The BHC Light indicates sparse bird activity (zero to 10 birds) on the airfield and a low probability of hazard. MCAS Futenma remains in at least BHC Light at all times.

3.6.1.3 Emergency and Mishap Response

The MCAS Futenma military fire department provides both fire and crash response. In addition, under a Mutual Emergency Operations Agreement with the Fire Department, the MCB Camp Butler and Ginowan Fire Department provide mutual aid in the event of fires or other emergencies.

Under current operations, and with the present inventory of aircraft and personnel, the MCAS Futenma Fire Department fully meets its requirements. No identified equipment shortfalls or limiting factors exist. To respond to a wide range of potential incidents, the station maintains detailed mishap response procedures, providing responsibilities and procedures for "preparing for, responding to and conducting" investigation of major aircraft, ground, or weapons mishaps. It also assigns agency responsibilities and prescribes functional activities necessary to react to major mishaps, whether on- or off-station. Initial response to a mishap considers such factors as rescue, evacuation, fire suppression, safety, elimination of explosive devices, ensuring security of the area, and other actions immediately necessary to prevent loss of life or further property damage. Investigation follows the initial response.

3.6.1.4 Accident Potential Zones

The DoD AICUZ Instruction (DoD Instruction 4165.7 [DoD 2005]) defines CZs and APZs for airfields as probable impact areas if a mishap were to occur, but does not predict the probability of an accident occurring. Although the likelihood of an aircraft mishap is remote, the USMC identifies APZs around fixed- and rotary-wing runways and helipads and provides land use recommendations in order to promote development compatible with airfield operations. APZs, which are based on historical aircraft mishap data, include CZs, APZ I, and APZ II sub-areas corresponding to areas of increased accident potential and land-use planning restrictions. Outside the CZ, APZ I, and APZ II, the risk of aircraft mishaps is not significant enough to warrant special consideration in land-use planning. OPNAVINST 11010.36C provides APZ dimensions for fixed-wing runways and rotary-wing VFR landing pads/runways.

Under Section 2C of the DoD AICUZ instruction, these requirements are for on-base planning purposes only and subject to the requirements of any applicable international agreement if the installation is located outside of the U.S. At MCAS Futenma, APZs are defined according to the runway class or helipad type, number and types of aircraft operations (see Section 3.2), and date of runway construction. Figure 3.6-1 illustrates the current zones for MCAS Futenma. The large CZs, required for all fixed-wing active runways, extend off-station from both ends of Runway 06/24. Due to insufficient fixed-wing aircraft operations, Runway 06/24 warrants no APZ I or APZ II for safety purposes. Small rotary-wing CZs and APZ I extend parallel to the runway for Helipads 1, 2, 3 and the CAL site. These narrow and short zones apply only to rotary-wing aircraft operations. Additionally, in accordance with OPNAVINST 11010.36C, APZ I and APZ II are not designated for Administrative LZs at MCAS Futenma.

3.6.2 Environmental Impacts

3.6.2.1 Aircraft Mishaps

The MV-22 is a highly-capable aircraft with an excellent operational safety record. During the development and testing phase more than a decade ago, the MV-22 recorded two Class A mishaps. All MV-22's were grounded for 17 months after the second mishap in December 2000. As a result of these incidents, a major re-engineering of the aircraft's electrical and hydraulic systems allowed the aircraft to return to flight in May 2002. It was given operational status in 2004. Since that time, additional safety, reliability and maintainability improvements along with additional capabilities have been implemented in the modified MV-22s flown by the Marines and Naval Air Systems Command's test squadron.

Figure 3.6-1. Accident Potential Zones and Clear Zones at MCAS Futenma

Since the USMC resumed flight operations in 2004, these aircraft have logged more than 100,000 flight hours having successfully assisted in humanitarian assistance/disaster relief operations in Haiti, participated in the recovery of a downed U.S. pilot in Libya, supported combat operations in Iraq and Afghanistan, and conducted multiple Marine Expeditionary Unit deployments. Between 2004 and 2011 the MV-22 has flown for 89,215 hours with one Class A mishap in 2008. In order to present a realistic picture of the actual mishap rate for the MV-22, the number of Class A mishaps during the testing phase of the aircraft (prior to reaching operational status) versus the number of mishaps after reaching operational status is broken out in Table 3.6-3. The total mishap rate (including the Class A mishaps during the developmental phase) for the MV-22 is 3.32 per 100,000 flight hours—low compared to 5.74 for the H-46. However, since reaching operational status in 2004, the MV-22 has demonstrated a safety record that is consistently better than USMC averages with a rate of 1.12 mishaps per 100,000 flight hours. The CH-46 has a mishap of 1.14 per 100,000 flight hours for the same period.

Table 3.6-3. Class A Flight Mishaps for the MV-22

Fiscal Year	Flight Hours	Mishaps	Class A Mishap Rate per 100,000 Flight Hours
Prior to Reaching Operational Status			
1999	416	0	0
2000	221	1	452.5
2001	470	1	212.8
2002[1]	None	0	-
2003[1]	None	0	-
Operational Status			
2004[2]	1,986	0	0
2005	3,921	0	0
2006	5,767	0	0
2007	9,398	0	0
2008	14,034	1	7.13
2009	13,188	0	0
2010	16,668	0	0
2011	24,256	0	0
Total	**90,322**	3	3.32

Notes: [1]Aircraft Grounded [2]Aircraft Returns to Flight Status
Source: Navy Safety Center 2011

The pilots arriving with the MV-22 aircraft would be experienced in flying the aircraft. Additionally, unlike the CH-46 that it is replacing, pilots flying the MV-22 use simulators extensively. These simulators provide training for all facets of flight operations, especially emergency procedures that used to be conducted in the actual aircraft. This in-depth simulator training minimizes risk associated with mishaps due to pilot error. The sophistication and fidelity of current simulators and related computer programs are commensurate with the advancements made in aircraft technology.

3.6.2.2 Bird-Aircraft Strike Hazard

The risks of bird-aircraft strikes in the MCAS Futenma airfield environment would not change measurably from existing conditions. Primarily, this is due to the 11 percent reduction in total operations associated with MV-22 basing. Additionally, operations by the MV-22s would fall within current parameters, and existing BASH procedures would remain in effect.

3.6.2.3 Emergency and Mishap Response

Since the MV-22 has not been stationed at MCAS Futenma previously, station emergency and mishap response plans would be updated with aircraft-specific response actions. With this update, the MCAS Futenma airfield safety conditions would be similar to existing conditions. Existing mutual aid agreements concerning emergency responses would continue and no additional personnel or equipment would be needed. Therefore, basing MV-22s would not increase or change requirements for mishap response.

3.6.2.4 Accident Potential Zones

No aspect of the proposed action would involve construction, renovation, or infrastructure improvement projects within established APZs. The proposed action would result in an 11 percent decrease in airfield operations from existing conditions. The MV-22 would operate in an airfield environment similar to the current operational environment. The MV-22 would continue to follow established local approach and departure patterns, and no new flight tracks would be established. Proposed MV-22 operations at MCAS Futenma would not affect or create a need to change the existing APZs (Wyle 2012). Therefore, flight activity and subsequent operations would not result in any greater safety risk, and no impacts related to APZs or CZs would occur.

3.7 BIOLOGICAL RESOURCES

Biological resources include living, native, or naturalized plants and animals, and the habitats in which they occur. Plant associations are generally referred to as vegetation and animal species are referred to as wildlife. Habitat can be defined as the resources and conditions present in an area that produces occupancy of a plant or animal (Hall *et al.* 1997). Although the existence and preservation of biological resources are intrinsically valuable, these resources also provide aesthetic, recreational, and socioeconomic values to society. The JEGS requires “plans and programs needed to ensure proper protection, enhancement and, management of natural resources and any species (flora and fauna) declared endangered or threatened by either the U.S. or the appropriate GoJ authorities” (USFJ 2010). For the purposes of this ER, these resources are divided into three major categories: Vegetation, Wildlife, and Protected Species. The primary source of information on biological resources on MCAS Futenma consists of the *Integrated Natural Resources and Cultural Resources Management Plan* (MCB Camp Butler 2009a).

Vegetation types include all existing terrestrial plant communities as well as their individual component species. The affected environment for vegetation includes only those areas potentially subject to ground disturbance.

Wildlife generally includes all fish, amphibian, reptile, bird, and mammal species with the exception of those identified as Protected Species, which are treated separately. The GoJ has also designated certain flora and fauna species as *Extinct, Extinct in the Wild, Threatened, Near Threatened, or Local Populations* which are called the Red List of Japan. This list, composed of over 18,000 species, is published along with species specific habitats, life cycles, and related information in the Red Data Book of Japan. No legal protection is offered to Red List species under JEGS (MCB Camp Butler 2009a). The Red Data Book is published for helping people to understand which animals and plants are facing risk of extinction. Migratory birds are protected by the Convention between the GoJ and the U.S. under the Migratory Bird Treaty Act.

Protected species are defined as plant and animal species listed as endangered, threatened, or Natural Monuments and are subject to protection by either the U.S. or appropriate GoJ authorities. The Ministry of the Environment of the GoJ has decreed the *Law for the Conservation of Endangered Species of Wild Fauna and Flora* which aims to ensure the conservation of endangered species and natural surroundings.

Tennen-kinenbutsu, defined as “Natural Monuments,” includes flora and fauna that are designated and protected under *the Law for the Protection of Cultural Properties* of Japan. GoJ Natural Monuments are subject to protection nationwide, including the Okinawa Prefecture. In addition to GoJ Natural Monuments, the Okinawan Prefectural Government (OPG) has also designated “Prefectural Natural Monuments” which are only subject to protection within that jurisdiction.

3.7.1 Current Environment

MCAS Futenma, located on 1,180 acres in southern Okinawa, surrounded by highly developed and urbanized lands. The air station itself can be characterized as heavily maintained or landscaped with a small forested zone along the eastern installation boundary. Under the proposed action, MCAS Futenma would be the location where most MV-22 operations would originate, personnel would live, and basic maintenance would occur. These activities would represent a continuation of current use.

3.7.1.1 Vegetation

In 2000, the Ginowan City Board of Education conducted extensive natural resource studies for the City of Ginowan, including MCAS Futenma. A total of 49 vascular plant species, including 8 ferns, were identified during these flora studies. The vegetation at MCAS Futenma can be divided into two main groups: grasslands and woodlands. Grasslands occur primarily around existing structures and in central MCAS Futenma along the runway and taxiways, and are dominated by exotic grasses including windmill grasses (*Chloris* spp.) and dallis grasses (*Paspalum* spp.). The woodlands lie along the southeast and northern boundaries of MCAS Futenma, consisting of native species including blush Macaranga (*Macaranga tanarius*), bishop wood (*Bischofia javanica*), and woodland Elaeocarpus (*Elaeocarpus sylvestris*) (MCB Camp Butler 2009a). With an abundance of reptiles and insects, the southeastern woodland on the installation represents a sensitive habitat for these species (Figure 3.7-1).

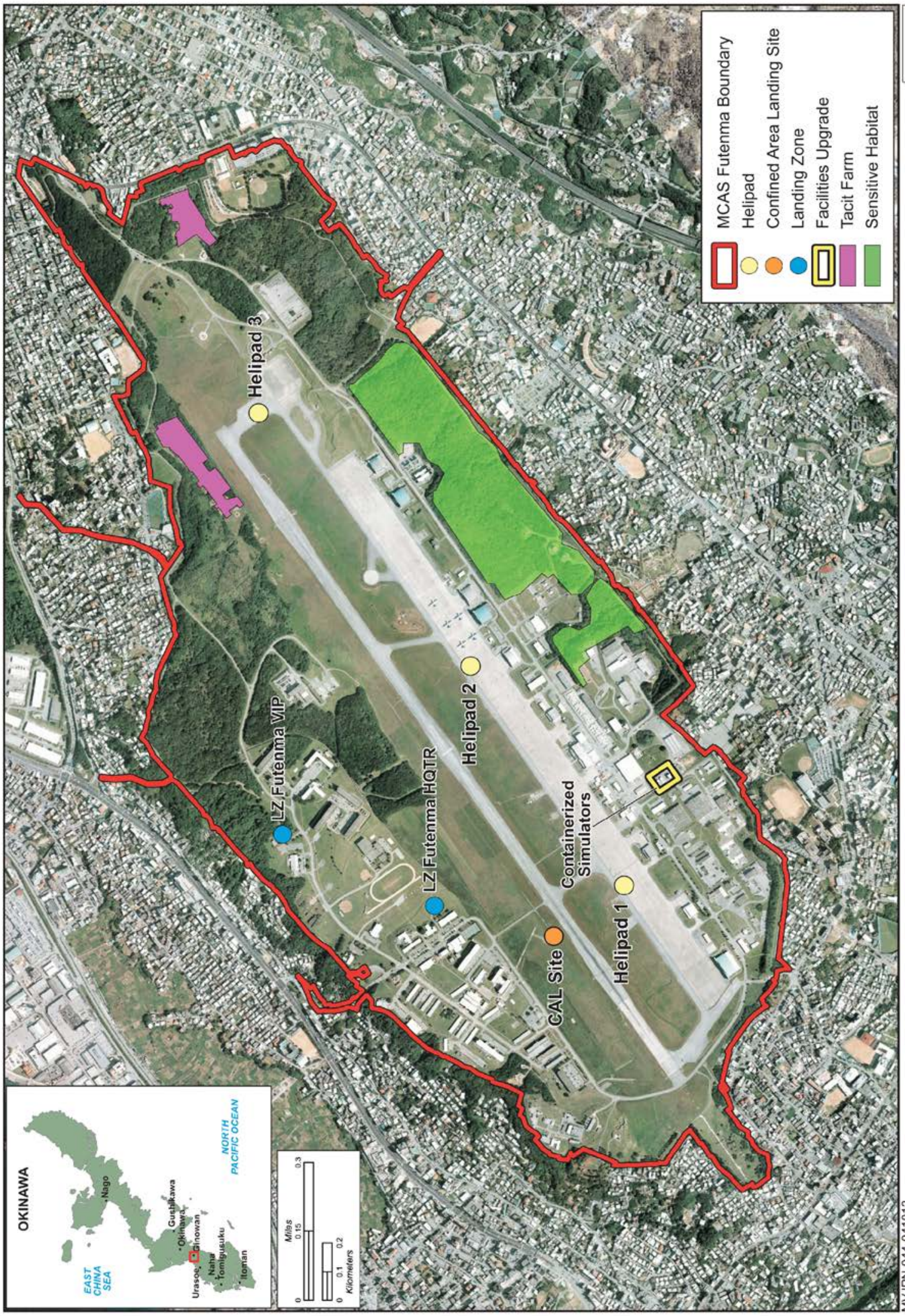


Figure 3.7-1. Sensitive Habitat Located on MCAS Futenma

3.7.1.2 Wildlife

Natural resource surveys conducted by the City of Ginowan resulted in identification of an abundance of fauna species at MCAS Futenma. A total of 26 avian species, 12 of which comprise migratory species, were found in and around both the northern and southeastern woodlands. Species observed include the Lesser Golden Plover (*Pluvialis dominica*), Pacific Swallow (*Hirundo tahitica*), and Japanese White-eye (*Zosterops japonica loochooensis*). Surveys noted seven reptile and five amphibian species in the northern and southeastern woodlands. A total of 252 insect species, including one designated as a Prefectural Natural Monument (see below), and 41 spider species were also documented at the installation (MCB Camp Butler 2009a). A Wildlife Hazard Assessment conducted between January and November 2010 identified 20 avian species not previously recorded at MCAS Futenma.

3.7.1.3 Protected Species

No nationally-protected floral species have been identified at MCAS Futenma during past natural resources studies. Surveys documented one Prefectural Natural Monument species, the Great Nawab butterfly (*Polyura endamippus weismanni*) known as *Futao-cho* in Japanese, in the woodland area along the southeast border of the installation (MCB Camp Butler 2009a). This woodland area, well away from the flightline and other active portions of MCAS Futenma, has been defined as being sensitive habitat for the butterfly (refer to Figure 3.7-1). The Integrated Natural Resources and Cultural Resources Management Plan (MCB Camp Butler 2009a), however, specifies no particular management or protection efforts for this area. The Wildlife Hazard Assessment survey in 2010 identified the Peregrine falcon (*Falco peregrinus*), a domestic endangered species and protected under the JEGS. In Japan, the Peregrine falcon is a resident breeder; although, individuals that inhabit areas north of Japan may migrate to, and reside in Japan during winter months.

3.7.2 Environmental Impacts

No new ground disturbance associated with the proposed action would occur and LZs at MCAS Futenma are on developed land. Construction of concrete pads for the containerized simulators would take place on previously disturbed ground. Therefore, no adverse effects to vegetation or flora species located on or near MCAS Futenma would result. As such, impacts to wildlife would be negligible, if any. Also, wildlife in the area has adapted to a developed, urban setting and is, therefore, less likely to be affected by any noise associated with the construction project.

Noise levels associated with aircraft operations at MCAS Futenma would not vary perceptibly from the existing conditions. Cumulatively, CNEL noise contours would affect the same areas with the same levels. Side-by-side comparison shows that under all but the hover mode, the departing CH-46Es generate higher noise levels than the MV-22s during every aspect of flight (refer to Table 3.3-5). Overall, the lack of change in noise levels would not have any effect on wildlife or Protected Species that are already habituated to similar or louder aircraft operations.

Although the known location of Protected Species (Great Nawab butterfly) habitat occurs along the southeastern border of MCAS Futenma, the closest portion of this area lies approximately 400 feet from a location for MV-22 take-offs or landings. At this distance, rotorwash associated with the MV-22 would not affect this species or habitat.

3.8 CULTURAL RESOURCES

The objective of cultural resource management is to provide optimal protection for cultural resources present on installations consistent with the mission of U.S. military forces in Japan and the GoJ. Section 402 of the National Historic Preservation Act of 1966, as amended in 2000, states that "Prior to the approval of any Federal undertaking outside the U.S. which may directly and adversely affect a property which is on the World Heritage List or on the applicable country's equivalent of the *National Register*, the head of a Federal agency having direct or indirect jurisdiction over such undertaking shall take into account the effect of the undertaking on such property for purposes of avoiding or mitigating any adverse effects" (16 United States Code [U.S.C.] §470a-2). Through negotiation, the U.S. and GoJ have agreed upon standards for the treatment of cultural resources on U.S. military facilities in Japan in the JEGS.

Chapter 12 of the JEGS requires consideration of adverse effects to historic or cultural resources during the planning phase of a project. Historic or cultural resources are defined by the JEGS as, "…artifacts, archeological resources, records, and material remains that are related to such a district, site building, structure, or object, and also includes natural resources (plants, animals, landscape features, etc.) that may be considered important as a part of a country's traditional culture and history" (USFJ 2010). According to the GoJ equivalent of the National Register of Historic Places, "important" resources must be at least 100 years old and be significant to world, national, or local history. GoJ separates these cultural properties into six categories: tangible cultural properties, intangible cultural properties, folk-cultural properties, monuments, cultural landscapes, and groups of historic buildings (MCB Camp Butler 2009b). Included in the category of tangible cultural properties are monuments that are historic sites such as shell mounds, ancient tombs, sites of palaces, castles, and monumental dwellings, and other sites that possess a high historical or scholarly value. Places of scenic beauty comprise another monument category that includes gardens, bridges, ravines, beaches, mountains, and other places of scenic beauty that possess a high artistic or aesthetic value. Natural monuments or *Tennen-kinenbutsu* include animals, plants, and geological features and minerals that possess a high scientific value.

The JEGS further state "If potential historic or cultural resources not previously inventoried are discovered in the course of a DoD action, the newly-discovered items will be preserved and protected pending a decision on final disposition by the installation commander. The decision on final disposition will be made by the installation commander after coordination with the appropriate GoJ authorities" (USFJ 2010).

3.8.1 Current Environment

The most current cultural resources inventory developed for MCAS Futenma was prepared in 1993 (MCB Camp Butler 2009b). This inventory reported 55 sites including 26 buried cultural properties, 9 historic sites, and 20 natural monuments at MCAS Futenma. Since 2000, the OPG and the Ginowan City Board of Education have been conducting archaeological testing at MCAS Futenma to develop a complete buried cultural property inventory map. At present, this map and associated Geographic Information System database document the locations of more than 80 identified sites including historic sites and natural monuments, such as springs, wells and cave sites that span from the Early Shellmound period (circa 3,500 years before present) to World War II (MCB Camp Butler 2009b). Due to ongoing test excavations by the Ginowan City Board of Education and OPG, the number of cultural resources documented at MCAS Futenma is continually increasing. MCB Butler now relies on the OPG and Ginowan City Board of Education inventories of cultural resources on MCAS Futenma since they have been conducting the most recent studies on-station.

MCAS Futenma has a number of areas that were noted in the Integrated Natural Resources and Cultural Resources Management Plan (MCB Camp Butler 2009a) as Areas of Concern for their high probability of containing archaeological sites. Specifically, the limestone hills and surrounding areas on the northwestern edge of the installation have been noted as having a high concentration of sites based on prehistoric inhabitants utilizing this area to shelter themselves from strong sea winds. There are also a substantial number of caves on the installation, which are identified as a category of Natural Monument. Many of these caves have ritual importance for local communities and contain archaeological resources indicating the persistence of this importance from prehistoric times to the present. Natural springs present on the installation have also been noted as having significant ritual and cultural importance. Many spring sites were altered historically, during the Kinsei Period (Historic modern period of Okinawa, dating to the 17th through 19th centuries), to prevent soil erosion and maintain pure drinking water. One archaeological site provides evidence of the earliest cultivation on Okinawa (MCB Camp Butler 2009b). The *Uehara-nuuribaru* Site contains Middle Shellmound Period (circa 2,500 years before present) pottery sherds, spade gouges, and a watering hole (MCB Camp Butler 2009b).

No World Heritage sites or GoJ equivalent National Register properties have been identified at MCAS Futenma (MCB Camp Butler 2009b). Natural Monument species such as the Great Nawab butterfly have been identified on the installation. See Section 3.7 for a discussion of Protected Species on MCAS Futenma.

3.8.2 Environmental Impacts

The proposed action would include the replacement of approximately 400 military personnel (no net change) at MCAS Futenma to operate, maintain, and support the MV-22 aircraft. MV-22 personnel at the installation would replace personnel associated with the CH-46E aircraft and there would not be a net increase in the personnel at MCAS Futenma. Operations at the airfield would decrease and resulting noise levels would remain very similar to the existing conditions. Therefore, the only potential impact that will be assessed in detail for cultural resources at MCAS Futenma is the construction of the new simulator pad near the current flight simulator.

Extension of a new concrete pad is proposed near the current flight simulator (see Figure 2-3), which would result in ground disturbance. Two containerized simulators would be placed on the concrete pad. In 2011, archaeological test excavations were conducted at the proposed pad location. Two 3-meter by 3-meter units were excavated with a backhoe to a depth of 2.4 meters. The excavation revealed disturbed post-World War II fill and modern period topsoil. The deposits found in this location do not qualify as a World Heritage Site, GoJ equivalent National Register property, or possess a high historical or scholarly value (Environmental Science 2011). Therefore, there would be no significant harm to cultural properties from the proposed action on MCAS Futenma.

Training and Readiness Operations

Chapter 4

4.0 TRAINING AND READINESS OPERATIONS

USMC pilots would conduct MV-22 training and readiness operations at 50 tactical Landing Zones (LZs)[1] and a Terrain Flight (TERF) route on Okinawa, at Combined Arms Training Center Camp Fuji (Camp Fuji), Marine Corps Air Station (MCAS) Iwakuni, and along Navigation (NAV) routes on mainland Japan, and at Kadena Air Base (AB). Comparatively, pilots currently conduct CH-46E helicopter operations within Okinawa at the LZs, TERF route, and Kadena AB.

4.1 LANDING ZONES

Training for both the CH-46Es and MV-22 aircrews involves use of tactical LZs. Tactical LZs represent those used solely for training purposes consisting of landings, take-offs, and approaches that would reflect combat situations. As detailed in Chapter 2, tactical LZs are located on the Ie Shima Training Facility (ISTF), the Northern Training Area (NTA), and the Central Training Area (CTA). Operations at these existing tactical training LZs focus on Confined Area Landings (CALs), and to a lesser degree, transit between LZs. During an average sortie, CH-46E squadrons currently conduct seven CALs, accounting for 14 operations (landings and take-offs). MV-22 squadrons would conduct a similar number of operations during an average sortie. At the ITSF, Field Carrier Landing Practice (FCLP) would be conducted at the simulated amphibious ship referred to as the Landing Helicopter Dock (LHD) Deck.

4.1.1 Introduction

This section describes the existing environmental conditions in the project area as well as the possible impacts due to the implementation of the proposed action. As noted in Chapter 2 of this Environmental Review (ER), no site improvements or construction of facilities would occur at any of the existing LZs, and they would not require any construction or clearance of approach-departure clearance zones. All of the LZs are currently in use and are subject to variable (limited to substantial) maintenance. A detailed description of current use and existing conditions at each tactical LZ is presented in Chapter 2, Table 2-6. In addition, this section assesses the LZs scheduled for construction in the NTA.

Under Department of Defense (DoD) Directive 6050.7 (DoD 2004), an ER identifies the important environmental issues and presents reasonably available information on the environment and potential impacts to determine whether the proposed action would result in significant harm to the environment. Aspects of the proposed action at the LZs that may affect resources include the frequency of aircraft operations, noise, rotorwash from landings and take-offs, and safety concerns (i.e., mishaps, fire). Accordingly, impacts resulting from MV-22 training and readiness operations at the LZs located on U.S. facilities and areas in Japan are examined in detail for nine resources—airspace management and use, land use, air quality, noise, safety, biological resources, cultural resources, geology and soils, and water resources.

4.1.2 Airspace Management and Use

Management of the airspace over the ISTF, the NTA, and the CTA allows military flight operations to occur without exposing civil aviation users, other military aircrews, and the general public to interaction

[1] A total of 19 Administrative LZs would also continue to receive use sporadically and for very few operations (≤4 per year).

with military training and operations. No changes to the airspace structure or management would result from the MV-22 basing, although change in use requires evaluation relative to current conditions.

All of the LZs underlie and the TERF route occurs within Special Use Airspace (SUA). SUA is airspace where activities must be confined because of their nature, or limitations may be imposed upon aircraft operations that are not a part of those activities. Activities that are considered to be incompatible with non-participating aircraft operations are conducted within SUA. While many types of SUA exist, training operations associated with LZs occur in two types: Restricted Areas and Warning Areas. A Restricted Area (designated with an R-) supports flight activities that separate participating military aircraft from non-participating civil and military aircraft. Entry into a restricted airspace without approval from the using or controlling agency is prohibited. Restricted Areas commonly overlie ranges or training areas and may extend to the surface. A Warning Area is generally 3 nautical miles (nm) outward from the main coast and can include international waters and islands. Warning Areas, which commonly extend from the surface, support military flight activities considered incompatible for non-participating aircraft. Entry into a Warning Area is restricted by the controlling agency.

4.1.2.1 Current Environment

Ie Shima Training Facility (1,981 acres)

Warning Area W-178 overlies the ISTF and surrounds the island for several miles (refer to Figure 3.2-2). Extending from the surface to 15,000 feet mean sea level (MSL), W-178 provides control of all users within that zone. In addition, W-178A covers the northwestern edge of Ie Shima, as well as a large training airspace block to the northwest. The ISTF provides positive control of aircraft operations within these Warning Areas.

The ISTF contains one runway that is 5,000 feet in length and a simulated LHD Deck that is currently used for FCLP training operations by USMC aircraft including AV-8B Harriers, CH-46Es, and other helicopters.

Currently, the CH-46Es conduct an average of 2,080 total CAL operations at the ISTF, accounting for 33 percent of all operations at this location. These operations include arrivals to ISTF, touch-and-go patterns, and departures from ISTF. FCLP operations using the LHD Deck also occur at the ISTF. CH-46Es perform about 800 FCLP operations annually, and the AV-8B aircraft are another primary user of this LHD training area. No aspect of these current operations exceeds the capacity or structure of the airspace over Ie Shima.

Northern Training Area (19,356 acres)

The NTA, also known as the Jungle Warfare Training Center (JWTC), consists of mostly mountainous terrain including jungle. While primarily a ground training area, aviation operations are authorized on NTA LZs, 12 of which would be used by the MV-22, and are controlled by MCB Camp Butler. R-201, a Restricted Area, overlies the NTA (refer to Figure 3.2-2) encompassing the existing LZs, TERF route, and LZs scheduled for construction (SC LZs). R-201 consists of restricted airspace extending from the surface to 2,000 feet MSL. Range Control provides de-confliction and advisory functions for aviation training activities. All flight operations within R-201 are conducted per DoD, Department of the Navy (DoN), and Federal Aviation Administration (FAA) policies and regulations.

The airspace over the NTA is restricted to DoD aircraft only. Aircraft operating within R-201 are required to check in and out with Range Control before entering/departing the airspace, and must maintain communications at all times. Range Control is responsible for clearing arrival and departure of aircraft landing on any NTA LZ or along the TERF route. It also provides a briefing to the aircraft informing them which LZs are open for use. Military Assumes Responsibility of Separation of Aircraft rules apply to operations conducted within the NTA airspace. Procedural control and “see and avoid” doctrine apply at all times to ensure separation from other exercise and non-exercise aircraft and fires. Unless arriving or departing a LZ as authorized by Range Control, a minimum altitude of 500 feet above ground level (AGL) must be maintained when flying over personnel and ground training areas. Current annual CH-46E operations at the 12 LZs total about 6,800; no issues exist with regard to the number of CAL operations.

Central Training Area (17,000 acres)

The CTA is primarily a ground training area, but aviation operations are authorized on LZs, 32 of which would be used for the MV-22 training. Restricted airspace R-202, which extends from the surface to 1,000 feet MSL, covers almost the entire CTA. R-202 accommodates air-to-ground, ground-to-ground, and ground-to-air training events. All procedures for SUA use, range communications, and Military Assumes Responsibility of Separation of Aircraft mentioned above for the NTA also apply to the CTA. CH-46E squadrons conduct almost 12,000 CAL operations on CTA LZs. Since these operations occur at low altitudes, no issues with the structure or management of R-202 have been noted.

Landing Zones Scheduled for Construction

All six SC LZs are located in the NTA under R-201. The same airspace management functioning for the existing LZs would apply to these new areas.

4.1.2.2 Environmental Impacts

No aspect of operating the MV-22 at U.S. facilities and areas in Japan would require alteration of the airspace structure, management, or use procedures. First, the nature and altitude of CAL operations at LZs would not differ appreciably from those conducted by CH-46E pilots. Such operations would not require expansion of the Restricted Areas or Warning Areas and existing control mechanisms would suffice. Second, only at the ISTF would operations increase. However, the amount of increase would not exceed the capacity of W-178 given its size and volume. Third, all SC LZs would underlie existing R-201, so no additional airspace would be required. Lastly, Range Control would continue to provide direct communications with all users so as to de-conflict aircraft and provide for safe training activities.

4.1.3 Noise

4.1.3.1 Noise Metrics and Modeling

Rotary-wing and tiltrotor aircraft conducting CAL operations at LZs and low-altitude flight along a TERF route generate a noise environment that differs from that associated with airfield operations. As opposed to patterned or continuous noise environments associated with airfields, flight activity for LZs and a TERF route is highly sporadic and variable ranging from 10 operations per hour to less than 1 per week. Individual military overflight events also differ from typical community noise events in that noise from a low-altitude, high-airspeed flyover (e.g., from a jet fighter) can have a rather sudden onset, exhibiting a rate of increase in sound level (onset rate) of up to 150 decibels (dB) per second. To represent these differences, the conventional Sound Equivalent Level (SEL) metric is adjusted to account for the “surprise” effect of the sudden onset of aircraft noise events on humans with an adjustment ranging up to 11 dB above the normal SEL. This analysis considers both SELs and cumulative noise metrics.

SEL comparison reveals the CH-46Es generate noticeably higher noise levels in all phases of flight except during touchdown for landings (refer to Table 3.3-5). As such, the analysis used a straightforward comparison of changes in the number of operations by the CH-46Es and MV-22s.

For cumulative noise that accounts for the sporadic characteristic of flight activity, the analysis evaluates the month with the most operations or sorties from a yearly tabulation for the given area, characterizing the busiest month. The cumulative exposure to noise in these areas is computed by the Day-Night Average Sound Level (DNL) over the busiest month, but using Onset-Rate Adjusted Sound Exposure Level (SEL_r) instead of Maximum Sound Level (L_{max}). This monthly average, denoted Onset Rate-Adjusted Monthly Day-Night Average Sound Level (L_{dnmr}), accounts for a penalty for operations during environmental night (2200 to 0700 hours). A variant of the L_{dnmr} includes a penalty for evening operations (1900 to 2200 hours), is denoted Onset-Rate Adjusted Monthly Community Noise Equivalent Level ($CNEL_{mr}$). Analogous to Section 3.3, this discussion also presents $CNEL_{mr}$ for airspace noise exposure. An analog to Weighted Equivalent Continuous Perceived Noise Level (WECPNL) is not available.

The cumulative noise analyses for most of the LZs for current conditions and the proposed action employ the results from the 2012 noise study (Appendix C and Wyle 2012). This study utilizes the DoD Military Operations Area and Range Noise Model (MR_NMAP) and Rotorcraft Noise Model for the estimation of noise exposure. The study considered existing noise conditions for a representative sample of LZs in the NTA and CTA. As listed in Table 4.1.3-1, current noise conditions were modeled for all eight LZs in the NTA that support Frequent or Average use and would be used by MV-22 aircrews. Similarly, the study modeled seven (of eight) Frequent use and three (of three) Average use LZs in the CTA for current noise conditions. Analysis focused on Frequent and Average use LZs in order to define the most extensive areas affected by noise from CH-46E operations. In general, noise at Rare use LZs with 14 or fewer operations per year did not warrant detailed modeling. However, one Rare use LZ (Falcon in CTA) was modeled to provide a representative example, and it proved the noise to be inconsequential (less than 60 dB).

Table 4.1.3-1. Representative Landing Zones Modeled for Current Noise Conditions	
Landing Zone	***Current CH-46E Use Level***
Northern Training Area	
LZ 1	Average
LZ 4	Average
LZ 13	Average
LZ 14	Average
LZ 17	Frequent
LZ 18	Frequent
LZ Baseball	Frequent
LZ Firebase Jones	Frequent
Central Training Area	
Curlew	Frequent
Dodo	Frequent
Falcon	Rare
Gander	Frequent
Goose	Frequent
Hawk	Frequent
Kiwi	Frequent
Peacock	Frequent
Starling	Average
Swallow	Average
Wren	Average

For the ISTF, the study modeled combined CAL and FCLP operations for all aircraft including the CH-46Es and AV-8B Harriers. Rather than single sets of noise contours around individual LZs, assessment of the ISTF centered the modeling around the dominant source of noise at the LHD Deck.

As detailed in the noise study, conservative estimates of operations were used for modeling CH-46E operations at the LZs. These estimated operations either matched or exceeded those defined for current conditions. Therefore, results from the modeling of representative LZs provide a scenario that reflects or exceeds actual conditions.

In addition to the CAL training, CH-46E helicopters also conduct TERF operations in the NTA. TERF requires low-altitude (50 to 200 feet AGL) flights generally at constant speeds from 80 to 120 knots. Based on available data, the study modeled a total of 840 helicopter operations annually along the TERF route, with 548 of these performed by the CH-46Es. The CH-46Es account for 65 percent of the total operations on the route.

4.1.3.2 Current Environment

Ie Shima Training Facility

Figure 4.1.3-1 presents CNEL contours from 65 to 85 dBA for the ISTF. Table 4.1.3-2 identifies the acres under each contour band for current conditions. As the data demonstrates, most (71 percent) of the affected area overlies the water, with only 0.2 percent consisting of land outside the boundaries of the ISTF. The latter (5 acres) contains no residences or sensitive receptors. Centered around the LHD Deck, the current contours reflect the dominant noise contribution by the AV-8B Harriers.

Table 4.1.3-2. Area Affected by Current Noise Conditions at ISTF				
$CNEL_{mr}$ dB	**On ISTF**	**Outside ISTF**	**Overwater**	**Total Acres Affected**
65	193	5	978	1,176
70	164	0	416	580
75	118	0	164	282
80	105	0	11	116
85	43	0	0	43
Total	**623**	**5**	**1,569**	**2,197**

Northern Training Area

Using the data and methods described above, the noise study calculated and plotted the 65 dB through 85 dB $CNEL_{mr}$ contours, in 5 dB increments, for the representative LZs in the NTA. Figure 4.1.3-2 shows the current $CNEL_{mr}$ contours for the eight modeled LZs in the NTA. Overall, the LZs subject to greater numbers of operations manifest larger areas affected by noise. Where more than one LZ occurs in close proximity (e.g., LZ 13/14/Baseball), the LZ with the greatest number of operations dominates the noise contours. However, the affected areas still remain small and close to the LZs themselves.

Of the eight modeled LZs, LZ 17 experiences the maximum $CNEL_{mr}$ of nearly 81 dB. Four of the modeled NTA LZs have a maximum $CNEL_{mr}$ above 75 dB (LZ 17, 18, Baseball, and Firebase Jones). However, most of the noise caused by CAL operations is confined to the vicinity directly surrounding each LZ, and the 65 dB $CNEL_{mr}$ contour around each LZ approximates a circle in shape with a radius ranging from 700 to 1,160 feet. In the case of LZs 13, 14, and Baseball, which lie near one another, the radius of the 65 dB contour does not exceed 1,300 feet. Of these modeled LZs, none of the 65 $CNEL_{mr}$ contours extend beyond the boundaries except for LZ 17. Land use around LZ 17 is heavily vegetated, uninhabited land. Therefore, no civilian population is affected by 65 dB $CNEL_{mr}$ or greater.

For the non-modeled Rare use LZs in the NTA, noise levels and the extent of the contours would be minimal and confined to the LZ area. The few CAL operations at these LZs would not generate noise levels approaching 60 dB $CNEL_{mr}$. Furthermore, all of the non-modeled LZs lie sufficient distances from the borders of the NTA that the contours would not extend outside DoD-managed lands (refer to Figure 4.1.3-1). Analysis of the TERF operations established that these activities generate less than 60 dB $CNEL_{mr}$ and noise remains within the confines of the NTA.

Central Training Area

Figure 4.1.3-3 shows the $CNEL_{mr}$ contours for the 11 modeled representative LZs in the CTA. LZ Hawk experiences the maximum of nearly 79 dB $CNEL_{mr}$. Although 10 of the modeled CTA LZs are subject to a maximum $CNEL_{mr}$ between 75 and 80 dB, the area affected by these levels is atop the landing point. Most of the noise caused by CAL operations is confined to the vicinity directly surrounding each LZ, and the 65 dB $CNEL_{mr}$ contour around each LZ approximates a circle in shape with a maximum radius of approximately 1,175 feet. Where two LZs occur in proximity, the noise contours cover larger areas. At LZ Hawk and Falcon, for example, the radius to the 65 dB $CNEL_{mr}$ contour is 1,400 feet. However, LZ Falcon (Rare use) contributes almost nothing to the noise environment. At LZ Wren, noise levels do not exceed 70 dB $CNEL_{mr}$ and the radius of the affected area is 750 feet.

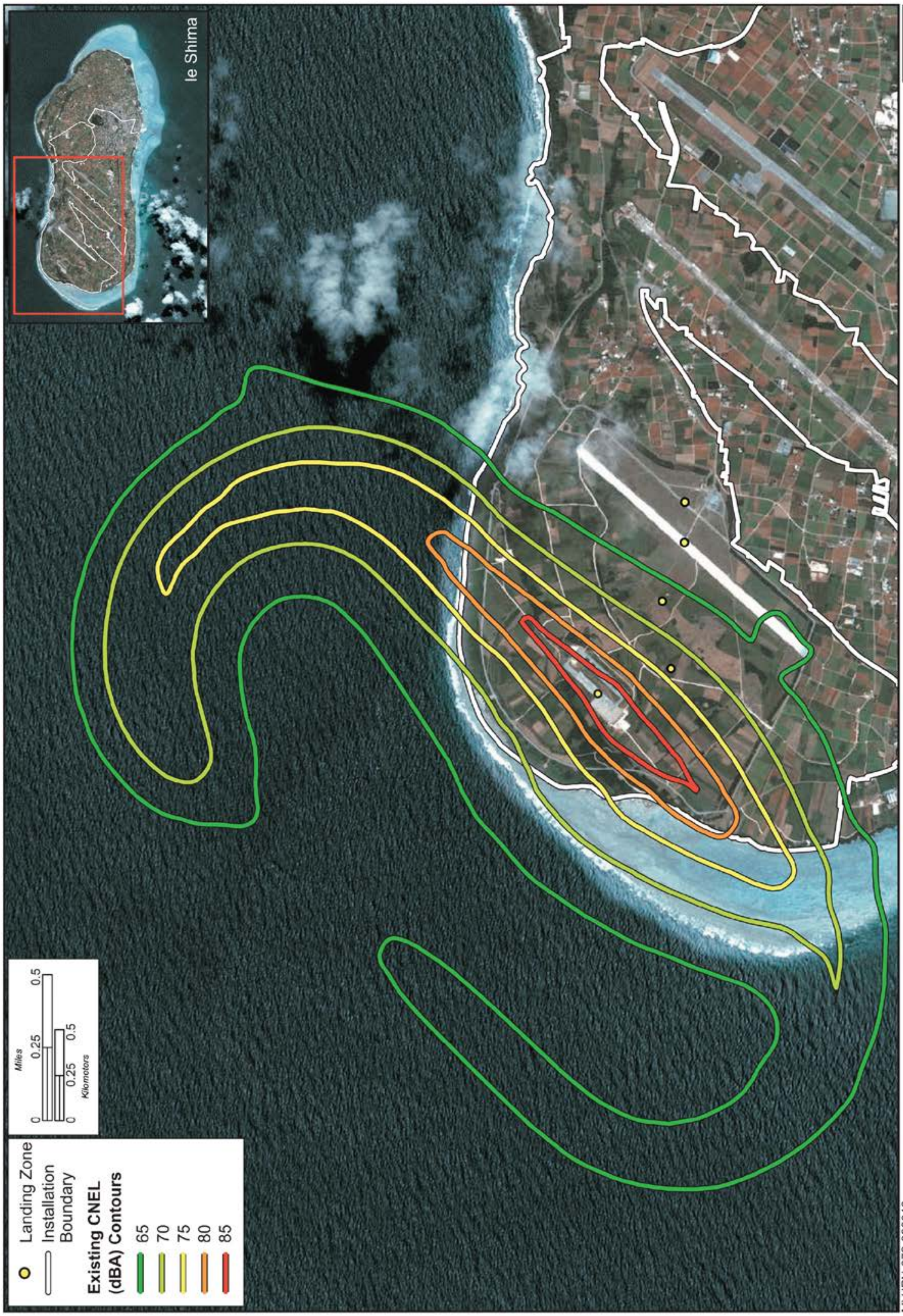


Figure 4.1.3-1. Existing CNEL Contours at ISTF

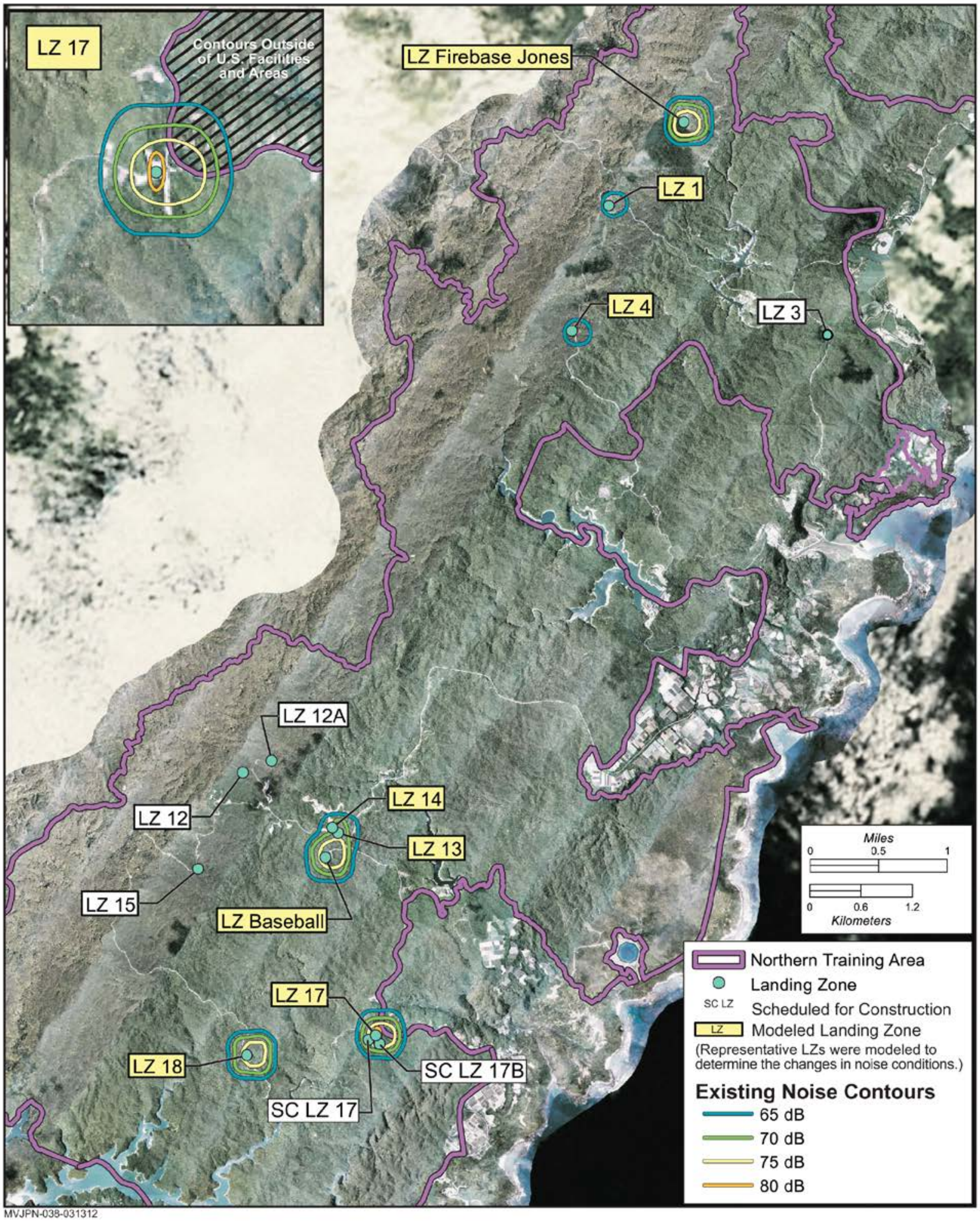


Figure 4.1.3-2. CNEL$_{mr}$ Contours for Current Aircraft Operations in the Northern Training Area for Representative Landing Zones

Note: U.S./GoJ designations for SC LZs: N-1A (U.S.) = N1.2 (GoJ); N-1B (U.S.) = N1.3 (GoJ); 17 (U.S.) = N4.1 (GoJ); LZ 17B (U.S.) = N4.2 (GoJ)

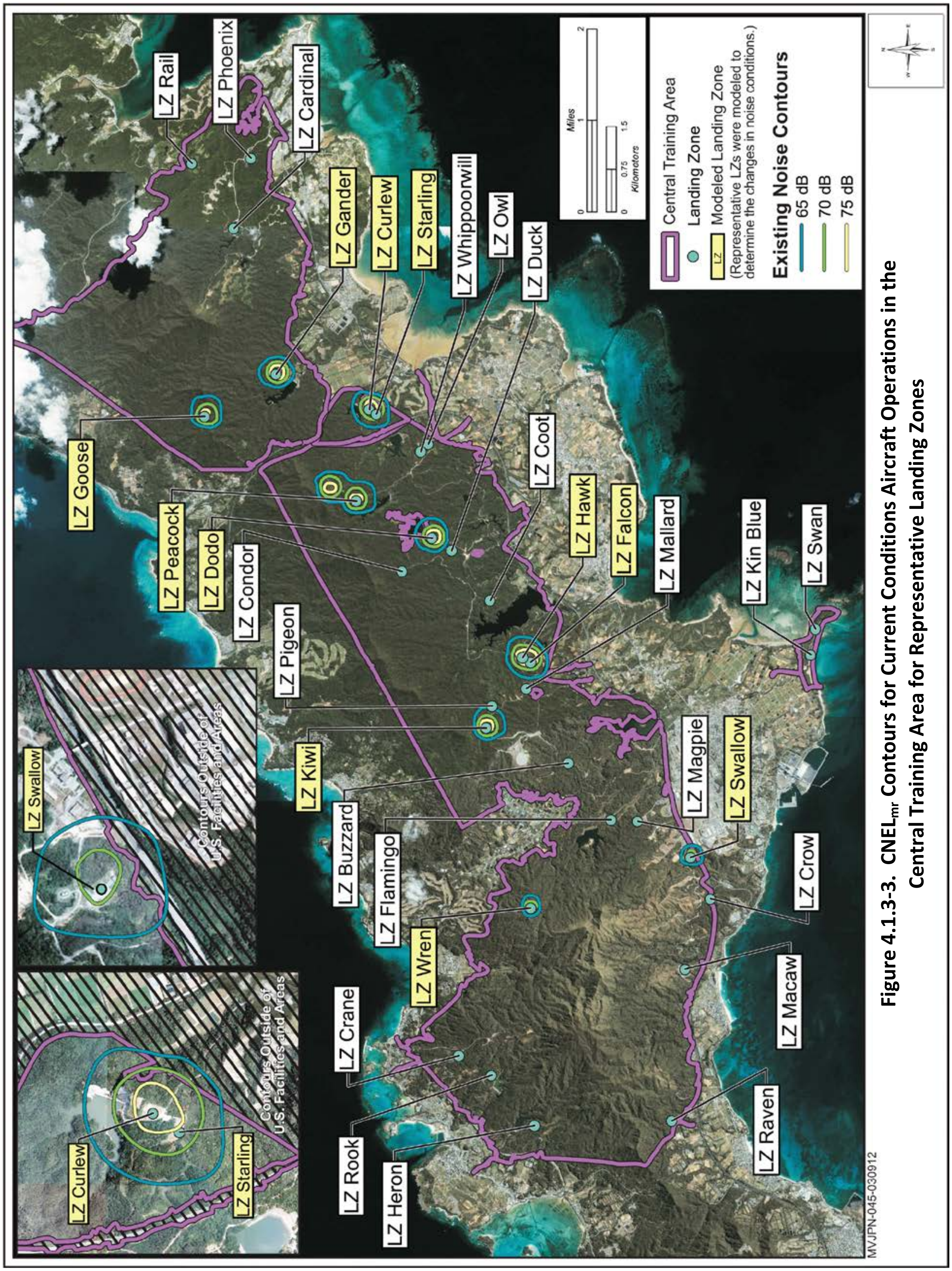


Figure 4.1.3-3. CNEL$_{mr}$ Contours for Current Conditions Aircraft Operations in the Central Training Area for Representative Landing Zones

The 65 $CNEL_{mr}$ contours extend beyond the boundaries of U.S. facilities and areas for the combined contours for LZs Starling, Curlew, and Swallow. The 65 to 70 dB $CNEL_{mr}$ contour band extends outside the CTA, but affects only a small area of unpopulated, vegetated lands.

For the non-modeled Rare LZs in the CTA, noise levels and the extent of contours would be minimal and confined to the LZ area. Noise levels would not approach 60 dB $CNEL_{mr}$. Although LZ Crow and LZ Raven lie on the CTA boundary, both receive Rare use (fewer than 14 operations per year), so noise levels would be negligible. In addition, the lands near these LZs consist of uninhabited and heavily vegetated areas.

Landing Zones Scheduled for Construction

No operations currently exist at four of the SC LZs (G, H, N-1A, N-1B). SC LZs 17 and 17B will be located near the existing LZ 17; current noise levels at that LZ reach a maximum of near 81 dB $CNEL_{mr}$ around the landing point, with noise levels of 65 dB $CNEL_{mr}$ extending out in a radius of 1,600 feet from the landing point. Current noise levels at LZ 17 extend beyond the boundaries of the NTA.

4.1.3.3 Environmental Impacts

As described above, representative LZs were modeled to determine the changes in noise conditions under the proposed action. The modeling used conservative estimates of MV-22 CAL, FCLP, and TERF operations. Table 4.1.3-3 lists the representative LZs modeled for the proposed action in the NTA and CTA. Modeling of noise focused on those LZs projected to receive Frequent use by the MV-22s. Given the limited effects of Average and, especially, Rare use noted under current conditions, the value of modeling those LZs proved negligible in terms of evaluating impacts. In addition, 11 LZs modeled for current conditions (refer to Table 4.1.3-1) were not modeled for the Proposed Action since all would receive less use (e.g., a reduction from Average or Rare use) and noise impacts would be reduced below current conditions.

Table 4.1.3-3. Representative Landing Zones Modeled for Proposed Noise Conditions

LZ	Proposed Use Level (Current)
Northern Training Area	
LZ 17	Frequent (Frequent)
LZ 18	Average (Frequent)
LZ Baseball	Average (Frequent)
LZ Firebase Jones	Frequent (Frequent)
Central Training Area	
Dodo	Frequent (Frequent)
Falcon	Frequent (Rare)
Hawk	Frequent (Frequent)
Swallow	Frequent (Average)
Swan	Frequent (Rare)

Ie Shima Training Facility

At the ISTF, the MV-22 would generate noise as a result of both FCLP and CAL operations. Figure 4.1.3-4 and Table 4.1.3-4 present the results of modeling proposed MV-22 operations at the ISTF. As these data demonstrate, the proposed action would produce almost no change in noise conditions with the exceptions of small expansions of the contours (85 dB not visible on figure due to scale) and a shift in a lobe of the 65 dB $CNEL_{mr}$ contour (southeast near Coral Runway), the contours remain identical with current conditions. MV-22 operations would affect 27 acres more than current operations but all would remain within the ISTF boundary. About 15 acres of this total would overlay water. Two factors explain this result. First, the noise contribution by the MV-22 would be minimal in comparison to the ongoing operations by aircraft such as the AV-8B Harriers. Second, and despite an increase in operations by the MV-22, the CH-46E produces more noise in almost every phase of flight than the MV-22. Overall, the MV-22s would contribute less than 1 dB to the CNEL contours.

Table 4.1.3-4. Area (in acres) Affected by Proposed Action Noise Conditions at ISTF

$CNEL_{mr}$ dB	On ISTF	Outside ISTF	Overwater	Total Acres Affected	Difference from Current Conditions
65	196	5	994	1,195	+19
70	166	0	420	586	+6
75	118	0	165	283	+1
80	105	0	11	116	0
85	44	0	0	44	+1
Total	**623**	**5**	**1,569**	**2,224**	**+27**

Northern Training Area

Based on the noise study (Appendix C), analysis of the four modeled LZs in the NTA revealed minimal change in the contours and areas affected. While the area directly at the landing point would experience almost 80 dB $CNEL_{mr}$, these levels would not perceptibly change from current conditions. For LZ 17 and Firebase Jones, the radius from the landing point to the 65 dB $CNEL_{mr}$ contour would expand by 15 to 25 feet; the total area within the contours would remain essentially unchanged. At LZ Baseball, the contour radius would decrease by 50 feet; no change would occur at LZ 18. The total area encompassed by the 65 dB $CNEL_{mr}$ contours would remain essentially unchanged (Figure 4.1.3-5). MV-22 operations at LZ 17, whose 65 dB $CNEL_{mr}$ and greater contours would continue to extend outside the NTA, would only impact vegetated and uninhabited lands. The MV-22s would generate slightly lower SELs than the CH-46Es during all phases of flight except during brief periods of hovering.

The eight non-modeled LZs within the NTA would support Average or Rare use, thus producing negligible noise levels and not affecting lands outside the NTA. Noise levels and the area affected at these LZs (1, 4, 13, and 14) would decrease relative to current conditions. At the other four LZs, no perceptible change from current conditions would be expected.

The MV-22s would use the TERF route rarely (about 25 operations or fewer annually) and far less than the CH-46Es. Since the CH-46E use did not generate noise levels of even 60 dB $CNEL_{mr}$, MV-22 operations would reduce noise below that low level.

Central Training Area

Similar to the NTA, the five Frequent use LZs modeled for noise showed slightly decreased noise levels relative to current conditions (Figure 4.1.3-6). Areas directly around LZs affected by noise levels of between 75 and 80 dB $CNEL_{mr}$ would experience the maximum $CNEL_{mr}$ of nearly 78 dB. CAL operations by MV-22 squadrons would expand the area affected for the combined LZs of Falcon/Hawk (both Frequent use) as well as LZ Dodo and Peacock. Noise contours for the adjacent LZs of Falcon/Hawk would extend outside the CTA, as would those of LZ Curlew/Starling and LZ Swallow. In all cases, the affected areas would be minimal and consist of vegetated but not inhabited lands. The other LZs in the CTA (Average and Rare use) would not experience perceptible changes in noise conditions.

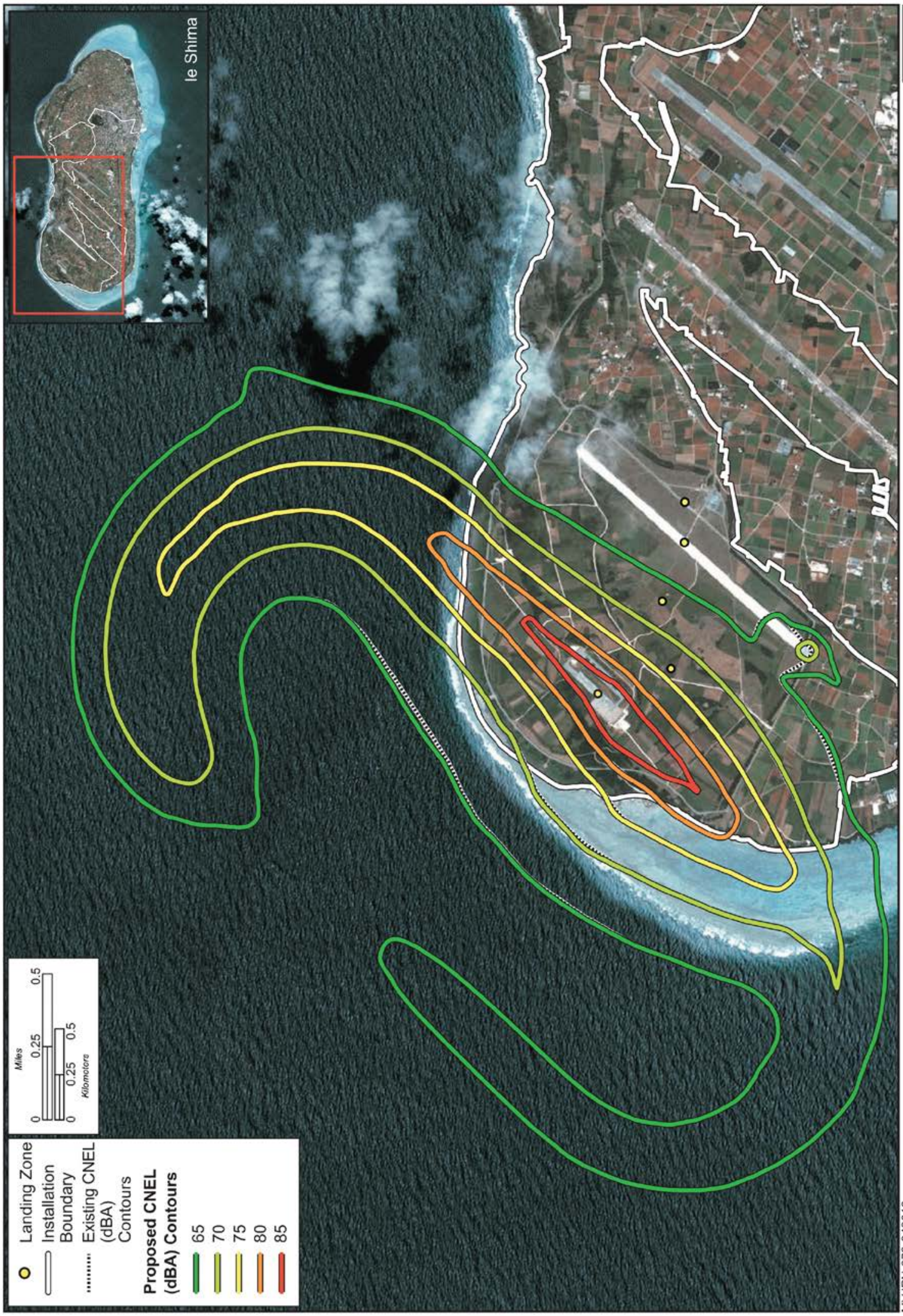


Figure 4.1.3-4. Proposed CNEL Contours at ISTF

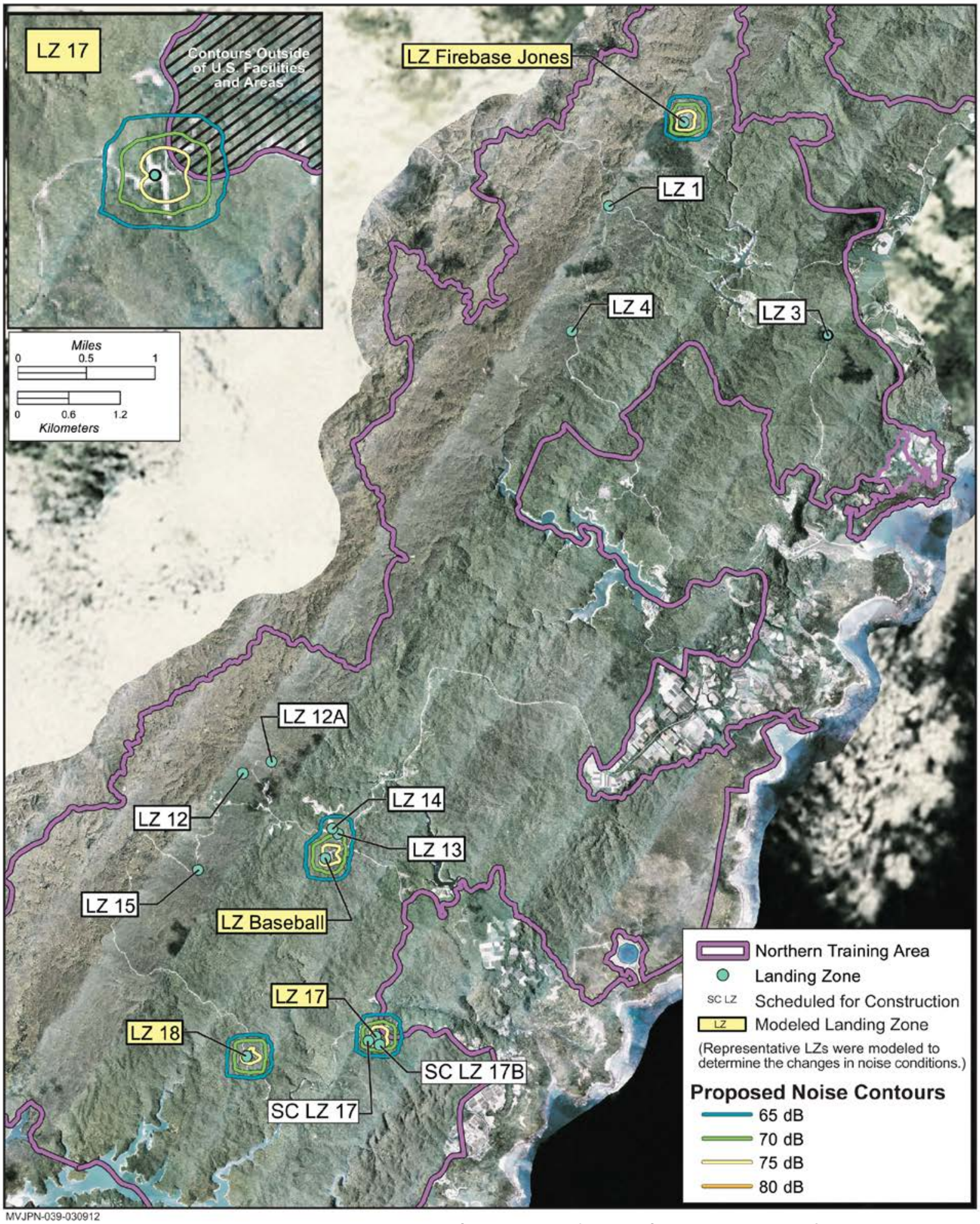


Figure 4.1.3-5. CNEL$_{mr}$ Contours for Proposed Aircraft Operations in the Northern Training Area for Representative Landing Zones

Note: U.S./GoJ designations for SC LZs: N-1A (U.S.) = N1.2 (GoJ); N-1B (U.S.) = N1.3 (GoJ); 17 (U.S.) = N4.1 (GoJ); LZ 17B (U.S.) = N4.2 (GoJ)

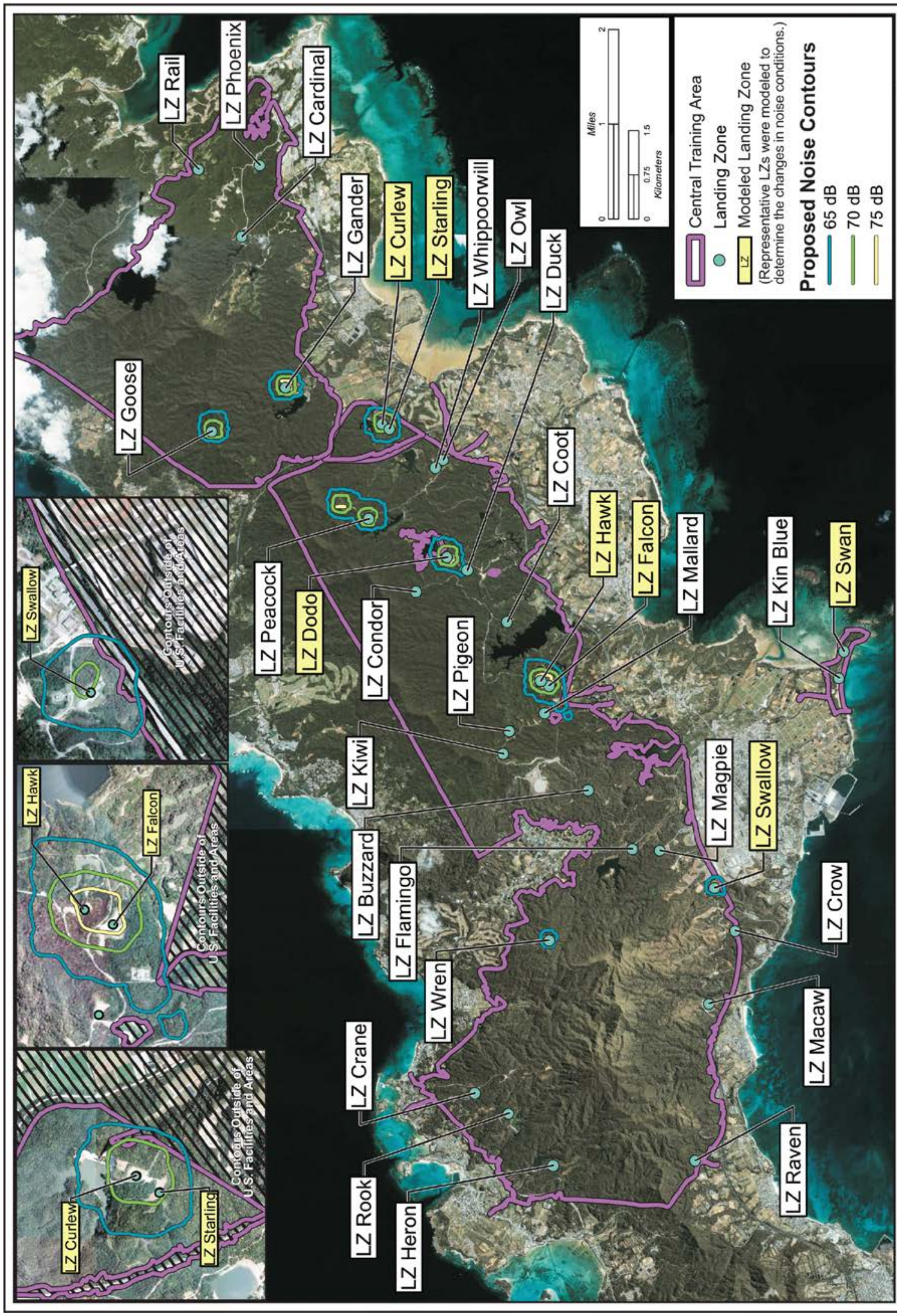


Figure 4.1.3-6. CNEL$_{mr}$ Contours for Proposed Aircraft Operations in the Central Training Area for Representative Landing Zones

Landing Zones Scheduled for Construction

Since SC LZs 17 and 17B would occur in the same basic location as the existing LZ 17, projected noise levels are roughly comparable. At existing LZ 17, Frequent use (1,260 annual operations) by MV-22 aircrews would generate noise contours similar to current conditions. Replacement by SC 17 and SC 17B would generate an estimated total of 840 annual CAL operations in the locale. With a reduction of 420 annual operations, it can be reasonably projected that both noise levels and the extent of the area affected by noise would likewise decrease.

With establishment of the other four SC LZs (G, H, N-1A, N-1B) three existing LZs in the NTA (1, 3, and Firebase Jones) would be eliminated. Noise, therefore, would decrease at these locales. In contrast, noise would increase at the SC LZs with noise levels, contours, and affected areas similar to those depicted for other Average use LZs. Noise from operations at these SC LZs is not expected to affect lands outside the NTA.

4.1.4 Land Use

Land use generally refers to human modification of the land, often for residential or economic purposes. Human land uses include residential, commercial, industrial, agricultural, or recreational uses. It also refers to use of land for preservation or protection of natural resources such as wildlife habitat, vegetation, or unique features. Characteristics of land use include land ownership and management. “Under Article II.1(a) of the Agreement Under Article VI of the Treaty of Mutual Cooperation and Security between the United States of America and Japan, Regarding Facilities and Areas and the Status of U.S. Armed Forces in Japan (SOFA), the U.S. is granted the use of facilities and areas in Japan. "Facilities and areas" include existing furnishings, equipment and fixtures necessary to the operation of such facilities and areas. Under SOFA Article II.4(a), when facilities and areas are temporarily not being used by U.S. forces, they may allow interim or joint use of such facilities and areas under a U.S. Forces Japan (USFJ) joint use agreement. According to Article II.4(a), joint use areas remain U.S. facilities and areas in Japan. In some cases, facilities and areas in Japan assigned to the U.S. are leased by the GoJ from individual Okinawan land owners, but remain U.S. facilities and areas. In addition, the U.S. can be granted temporary (limited in time) use of Japan facilities and areas under SOFA Article II.4(b). These areas are not U.S. facilities and areas and U.S. use is determined by a USFJ agreement. E.O. 12114 does not apply to these areas.

4.1.4.1 Current Environment

The 50 tactical LZs and TERF route proposed for use by MV-22 squadrons occur in three primary training areas under U.S. DoD exclusive use: ISTF, the NTA, and the CTA. These three areas are facilities and areas of Marine Corps Base (MCB) Camp Butler.

Ie Shima Training Facility

The ISTF covers about 2,000 acres on the island of Ie Shima, approximately 30 miles north of MCAS Futenma. This facility, with two runways, lies on the west coast of the island and occupies approximately one third of its entire land mass. Of the two extant runway areas, only the Coral Runway to the west is used by the USMC H-1 helicopters and by KC-130J aircraft practicing touch-and-goes. West of this runway lies LHD training area (AM-2 matting and a temporary landing support officer tower) used for FCLP training by helicopters and AV-8Bs. The central runway no longer supports aircraft operations, but serves as a north-south roadway. In terms of proposed use by MV-22 aircrews, the LZs and LHD Deck all occur within a 125-acre fenced and gated area on the western edge of the ISTF.

Tacit farms, which can be permitted on lands leased by the GoJ for U.S. military use, occur within the ISTF's boundaries. Okinawan landowners can use their properties within the ISTF boundaries provided the use does not interfere with the military mission. Some private residences are associated with the farms, but no new construction of homes is allowed, and the number of residential dwellings within the ISTF has decreased since 1972 (MCB Camp Butler 2009c). No residential dwellings lie within or adjacent to the lands encompassing the LZs.

Outside the ISTF and in the center of the island, a third runway now comprises part of a small civilian airport. The western portion of the ISTF, which contains the LZs, is bordered on the east and south primarily by agricultural lands and few residences. To the west and north, coastal areas and open water dominate. The eastern half of the island contains a mixture of residential, light industrial, and agricultural and coastal areas.

Northern Training Area

The NTA is located in the northeastern portion of Okinawa, spanning the administrative boundary of Higashi Village and Kunigami Village, approximately 40 miles north of MCAS Futenma. The NTA region is heavily vegetated, and an extensive road system connecting scattered training facilities supports the JWTC. Under DoD control, the NTA consists of a joint use area that includes portions managed by the GoJ Ministry of Agriculture, Forestry and Fisheries. A program of returning NTA land to the GoJ and original landowners has been ongoing for several years, including areas within Aha Training Area. The landowners are converting these training areas to agricultural fields and developed areas (MCB Camp Butler 2009a).

A total of 12 LZs proposed for use by the MV-22s lie within the NTA, with 8 clustered in the south and 4 dispersed in the north. The TERF route runs wholly within the restricted airspace (R-201) overlying the NTA. Although connected by a network of roads, the LZs tend to occupy remote, heavily vegetated areas away from the borders of the NTA. Three LZs, however, lie within 350 feet of a publicly accessible road. LZ 17 adjoins (within 400 feet) Highway 70, approximately 1 mile west of the village of Arakawa. Seven other LZs are located within a 5 mile radius northwest of Arakawa, in deeply forested areas near Aha Reservoir.

Population in the area surrounding the NTA centers primarily in towns and villages along the coastline. Along the eastern edge of the NTA, civilian land use is predominantly agricultural. Four large reservoirs and dams, managed by the Ministry of Agriculture, Forestry and Fisheries are located within the NTA boundaries.

Central Training Area

A total of 32 LZs proposed for use by MV-22s and currently used by CH-46Es are dispersed throughout the CTA, although fewer occur in the northern and southern extremes. Located in the central part of Okinawa, the 17,000-acre CTA consists predominantly of undeveloped, forested land with an extensive road network connecting scattered training facilities and dams. This joint use training area is part of U.S. facilities and areas in Japan, although portions are managed by resource agencies of the GoJ. Multiple tacit farms are located within the boundary of the CTA. Nine LZs lie near the southeastern border of the NTA; only five LZs are within 350 feet of a public access road.

Rural farming and fishing communities are located to the east of the CTA, while National Highway 58 and its associated linear development lie to the west of the CTA. Residential areas are located to the south, and agricultural uses occur to the southeast of the CTA.

Landing Zones Scheduled for Construction

By agreement, the U.S. Government plans to return almost 9,900 acres of the NTA to the GoJ (former Naha Defense Facilities Administrative Bureau [DFAB] 2006). As part of the agreement, the GoJ will construct six SC LZs (refer to Figure 2-11) with each covering about 1.1 acres. The six LZs scheduled for construction would replace six existing LZs currently used for training. For five of the six SC LZs, forested lands would be converted to developed lands. The sixth LZ, located near LZ 17, would be constructed in an existing cleared location.

Municipalities involved in the exchange and relocation include Kunigami Village and Higashi Village. None of the SC LZs would occupy or abut agricultural or residential lands.

4.1.4.2 Environmental Impacts

The proposed action would not involve construction at any existing LZs nor would it require changes to management or land status. No portion of the proposed action would alter the structure, size or operation of military lands, nor would the acquisition of new non-military lands be required. The proposed action would not generate changes to the status or use of training or civilian lands, nor would it affect existing plans or policies implemented for land management. Changes to operations would have no effect on land use patterns, ownership, or management plans and policies. The only aspect of the proposed MV-22 basing of concern to land use consists of noise generated by aircraft operations. Because of this, the analysis needs to consider if changes (particularly increases) in noise levels or expansion of areas affected by noise could conflict with any land uses at those sites. The Japanese Environmental Governing Standards (JEGS), however, include no standards for noise and land use so this assessment uses the basic measure of 65 dB as an indicator of community annoyance and impacts to land use. As discussed above, almost all of the LZs in the ISTF, NTA, and CTA lie well within U.S. facilities and areas in Japan. Only a few occur on the margins of the training areas where noise contours may extend outside of U.S. facilities and areas. Those few LZs are the subject of the following analysis.

Ie Shima Training Facility

Under the proposed action, noise levels of 65 dB CNEL and greater would almost remain the same as under current conditions. Total area exposed to noise levels of 65 dB CNEL would increase by 27 acres, but no new areas outside of the ISTF would be exposed to noise levels exceeding or equal to 65 dB CNEL. Although total CAL and FCLP operations would increase at the LZs, noise levels are primarily determined by the use of the LHD Deck by AV-8B aircraft, which would continue to form the dominate source of noise influencing the contours. Based on this analysis, no aspects of land use would be affected.

Northern Training Area

Only LZ 17 lies sufficiently close to the NTA boundary that noise levels of 65 dB $CNEL_{mr}$ would extend outside of U.S. facilities and areas. However, neither the extent nor level of the noise would change under the proposed action relative to existing conditions (refer to Figure 4.1.3-5). In both instances, noise levels of 65 to 70 dB $CNEL_{mr}$ would affect a small area (no more than 15 acres) of uninhabited, densely vegetated forest. Therefore, no aspects of land use would be affected.

Central Training Area

The combined area of effect for LZs Curlew and Starling lies sufficiently close to the boundary of the CTA so that noise levels of 65 dB $CNEL_{mr}$ would extend outside of U.S. facilities and areas. However, neither the extent nor level of the noise would change under the proposed action relative to noise levels currently in this area. Although LZs Raven and Crow are on the edge of U.S. facilities, noise levels under the proposed action would not extend outside U.S. facilities and areas since few operations would occur at those LZs. Nevertheless, land use in the adjacent area is uninhabited, densely vegetated forest. Noise levels at LZs Falcon and Hawk would also extend minimally outside of U.S. facilities and areas, but again, the exposed areas would be vegetated, uninhabited land. Based on this analysis, no aspects of land use would be affected.

Landing Zones Scheduled for Construction

Based on presently available information, the SC LZs would receive average use by the MV-22s (i.e., 420 CAL operations per year). In all other LZs with this few operations, the 65 dB and greater contours would adhere close to the central portion of the LZ. As such, these noise levels would be expected to remain within U.S. facilities and areas and not affect outside land uses.

4.1.5 Air Quality

As noted in Section 3.4, neither the standards defined by the GoJ and Okinawa prefecture, nor DoD regulations apply to the emissions generated by proposed MV-22 operations. The JEGS specifically exclude military aircraft (C1.3.3); off-installation deployments and operations (C1.3.3); and environmental analysis conducted under E.O. 12114 (C1.3.6). However, since potential air quality effects were determined to be an important environmental consideration for the proposed action, they were described in this ER.

This section, therefore, briefly describes the existing air quality of the project region for the LZs within their training areas and compares the basic emissions of the CH-46Es and the MV-22. The latter employs a generic operational scenario in which each aircraft flies a 1 hour sortie during which it lands at an LZ and departs. For the purposes of this comparison, the analysis uses the same criteria pollutants as identified in Section 3.5. The analysis used times in flight mode and emissions per 1,000 pounds of fuel used, derived from AESO Memorandum Report No. 9816, Revision F, January 2001, *Aircraft Emission Estimates: H-46 Landing and Take-off Cycle and In-Frame, Engine Maintenance Testing Using JP-5* and Aircraft Environmental Safety Office Memorandum Report No. 9946, Revision E, January 2001*, Aircraft Emission Estimates: V-22 Landing and Take-off Cycle and In-Frame, Engine Maintenance Testing Using JP-5.*

4.1.5.1 Current Environment

Sources of USMC air emissions at LZs consist principally of short-duration aircraft operations for the sites on Ie Shima, and in the NTA and CTA. Vehicles for training support and maintenance represent negligible contributors. Some LZs within these areas contain exposed soils which can become airborne during these ancillary activities. In the NTA, the surrounding area predominately consists of densely forested lands with small, dispersed villages and limited sources of emissions. Larger cities with large populations and associated emission sources surround the CTA and its LZs, whereas the rural character of Ie Shima includes fewer vehicles and no major industrial sources.

Based on the LZ operations scenario described above, Table 4.1.5-1 presents the emissions for the CH-46E and MV-22 operations. The older CH-46Es generate high rates of carbon monoxide (CO) and hydrocarbons (HC) as volatile organic compounds (VOCs).

Table 4.1.5-1. Comparison of Air Emissions (pounds) from a Sortie by a CH-46E and MV-22

Flight Operation	CO	NO_x	HC as VOC	SO_2	PM_{10}	CO_2e
CH-46E						
Take-off	0.81	0.30	0.09	0.03	0.12	208.67
Cruise	22.11	4.41	3.84	0.45	1.99	3,557
Land	0.84	0.12	0.17	0.01	0.07	105.57
Total	**23.76**	**4.83**	**4.10**	**0.49**	**2.18**	**3,871.24**
MV-22						
Take-off	0.14	3.13	0.00	0.09	0.37	758.62
Cruise	2.42	35.62	0.03	1.22	4.83	9,829
Land	0.19	1.60	0.00	0.07	0.26	529.36
Total	**2.75**	**40.35**	**0.03**	**1.38**	**5.46**	**11,116.98**
Change	***-21.01***	***35.52***	***-4.06***	***0.90***	***3.28***	***7,245.74***

Notes: SO_2= sulfur dioxide; PM_{10}= particulate matter less than or equal to 10 microns in diameter; CO_2e= equivalent carbon dioxide

4.1.5.2 Environmental Impacts

Sources of emissions from the proposed action at the LZs and overlying airspace would consist of aircraft operations. Maintenance and vehicle support would remain unaffected, as would the operations by the AH-1, UH-1, and CH-53 helicopters out of MCAS Futenma. Comparison of the two aircraft reveals that the MV-22 would generate substantially less CO and HC as VOCs per average sortie. The remaining criteria pollutants would increase by almost 36 pounds per sortie of nitrous oxides (NO_x) and lesser increases for HCs and particulate matter less than or equal to 10 microns in diameter (PM_{10}). However, as defined in Chapter 2 (refer to Figure 2-5), the MV-22 would conduct fewer CAL operations (a decrease of 12 percent), thereby reducing the emissions of CO and HC from training activities. While the per hour emissions of NO_x, SO_2, and PM_{10} would increase with the MV-22s, the reduction in operations and associated time in the airspace would offset these increased rates. Therefore, no noticeable effects on the air quality of the training areas would result from these LZ and associated operations. Emissions associated with training at the landing sites scheduled for construction in the NTA would be minimal and as total operations would be about the same as under current conditions, no change would occur to air quality under the proposed action.

4.1.6 Safety

With regard to operations on the LZs and along the TERF route, the potential safety issues include rotorwash effects on people and vehicles, fire potential, aircraft mishaps, and Bird-Aircraft Strike Hazard (BASH). Section 3.6 provides detailed information on the background for potential mishaps and BASH, so this section will summarize the conditions and impacts. Since these topics apply to all training areas, this section does not present separate discussions so as to avoid repetition.

Operations at the ISTF, and in the CTA and NTA and their associated LZs are governed by U.S. Forces Japan (USFJ) Instruction 13-201, *Joint Airspace/Range Scheduling* (USFJ 2009). This document establishes scheduling procedures and requirements to assure safe operation of all the MCB Camp Butler ranges and related airspace. In addition, the training areas each have their own set of regulations that deal with safety issues in further detail.

4.1.6.1 Current Environment

Rotorwash

Background

A hovering aircraft can produce large gusts of wind as air is drawn through its rotors. The air that is directed downward is known as "downwash," which becomes "outwash" when it hits the ground and travels outward. Collectively, this high-velocity air is known as "rotorwash." Both helicopters and tiltrotor aircraft produce rotorwash, and safety concerns include the effects on people, vehicles, and structures.

The velocity of rotorwash depends on three sets of factors: configuration of the rotors and blades, altitude of the aircraft above the ground, and the distance and angle (the azimuth, measured clockwise with 0 degrees at the nose of the aircraft) from the center of the aircraft. The following discusses these factors for the current conditions and proposed action, comparing the MV-22 to two helicopters that operate at the LZs currently: the CH-53E—the largest helicopter in the U.S. military— and the CH-46E—the medium-lift helicopter that the MV-22 would replace. The primary information relied on in this discussion is a study by the Naval Air Warfare Center Aircraft Division (NAWCAD) that addressed rotorwash from a hovering 45,000-pound MV-22 and compared these results to rotorwash from a CH-53E. Additionally, examination of rotorwash wind velocities for the CH-46E in 1968 and subsequent assessments of effects of rotorwash on personnel in 2008 provide supportive and comparative data (Appendix B-2).

Rotor Configuration. Each of these aircraft has a different rotor configuration (Figure 4.1.6-1) that affects their rotorwash profiles. With two sets of rotors aligned along the fuselage, the CH-46 produces a symmetrical rotorwash profile with nodes encircling the tandem counter-directional rotors. As the airflow from each rotor travels away (perpendicular) to the long axis of the fuselage, they interact and join with one another. This flow quickly (beyond 50 feet) becomes disorganized, incoherent, and loses velocity; at this distance from the helicopter, rotorwash velocities become uniform in all directions. On the CH-53E, the single seven-bladed rotor generates a relatively uniform airflow that extends outward and produces peak windspeeds at about 50 feet from the aircraft. These windspeeds diminish with distance from the helicopter, but remain strong (approximately 57 miles per hour [mph]) as far as 150 feet away. At this distance, rotorwash speeds become uniform in all directions from the aircraft.

Figure 4.1.6-1. CH-53E, CH-46E, and MV-22

In contrast to the CH-46 and CH-53, the side-by-side rotor configuration of the MV-22 produces a rotorwash profile as seen in Figure 4.1.6-2. The downwash from the two rotors meets in the middle and the air is pushed upwards, creating “fountain flow” primarily in the front of the aircraft, but also to a lesser degree in the rear. Upwash and turbulence occur most markedly near the aircraft, but stabilize beyond 80 feet. For the MV-22, the configuration of the rotorwash is asymmetrical, with lobes of higher windspeeds at 60, 0/360, and 300 degrees relative to the nose of the aircraft. The highest wind velocities extend the greatest distance from the aircraft along the 60 and 300 degrees vectors. The lowest velocities and least extent of rotorwash occur at the reciprocal angles (120 and 240 degrees) relative to the nose of the MV-22, and at the tail (180 degrees).

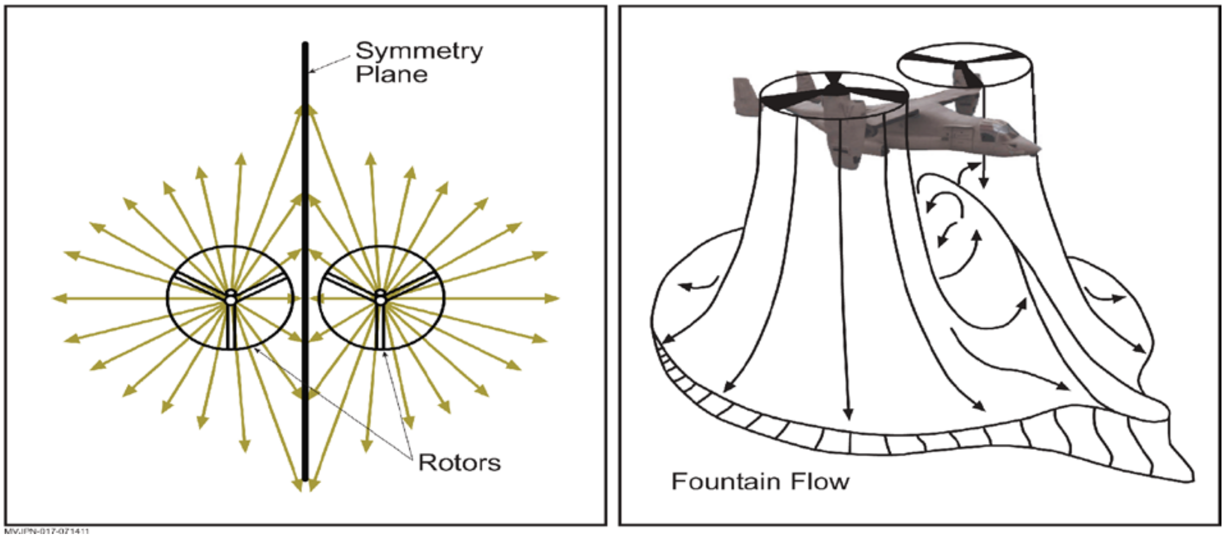


Figure 4.1.6-2. Illustration of MV-22 Rotorwash

Altitude of Aircraft. The altitude of the aircraft during landing or take off affects the strength and lateral extent of rotorwash. At differing altitudes, the amount and interaction of downwash and upwash influences the speed and direction of the rotorwash. As the aircraft reaches higher altitudes, the rotorwash interacts less with the ground until it is no longer noticeable by those on the ground. Rotorwash speeds and forces also vary with the weight of the aircraft (a heavier aircraft will produce stronger winds) and the ambient conditions (speed and direction of natural winds). A study completed in 1998 for the NAWCAD addressed rotorwash from a 45,000-pound MV-22 hovering at 20 feet AGL and compared these results to rotorwash from a 70,000 pound CH-53E. At this altitude, the MV-22 windspeeds and extent of the rotorwash exceeded those of the CH-53E and substantially exceeded the CH-46 depending on distance and angle. At higher altitudes approaching 80 feet AGL, the CH-53E, generated greater rotorwash windspeeds than the MV-22. The CH-46 generates lesser windspeeds at all ascent and descent altitudes than the MV-22 and CH-53.

Distance and Angle from the Aircraft. Based on the above-referenced studies and comparisons, rotorwash windspeeds vary with distance and angle from the specific aircraft. Figure 4.1.6-3 compares the wind velocities from rotorwash of the CH-46Es and MV-22s at distances up to 156 feet, the maximum distance tested. For the CH-46, maximum windspeeds of about 37 mph occur at 50 feet from each side of the aircraft (90 and 270 degrees) Beyond about 70 feet, the windspeeds diminish symmetrically at all angles from the aircraft, eventually decreasing to 16 mph at 156 feet. In comparison, MV-22 rotorwash windspeeds peak at 92 mph within 25 feet of the aircraft at 60 and 300 degrees from the nose of the aircraft (Table 4.1.6-1). Windspeeds at these angles persist as the highest for all distances from the aircraft. At 156 feet, the maximum distance tested, windspeeds diminish to about 63 mph for the MV-22. Beyond this distance, the windspeeds extrapolated from the testing data reflect consistent deceleration. At 180 degrees from the nose of the MV-22, peak windspeeds at close range are less than at the 60/300 degree angles, and they decelerate more rapidly. In sum, the MV-22 generates significantly higher rotorwash windspeeds than the CH-46 it would replace.

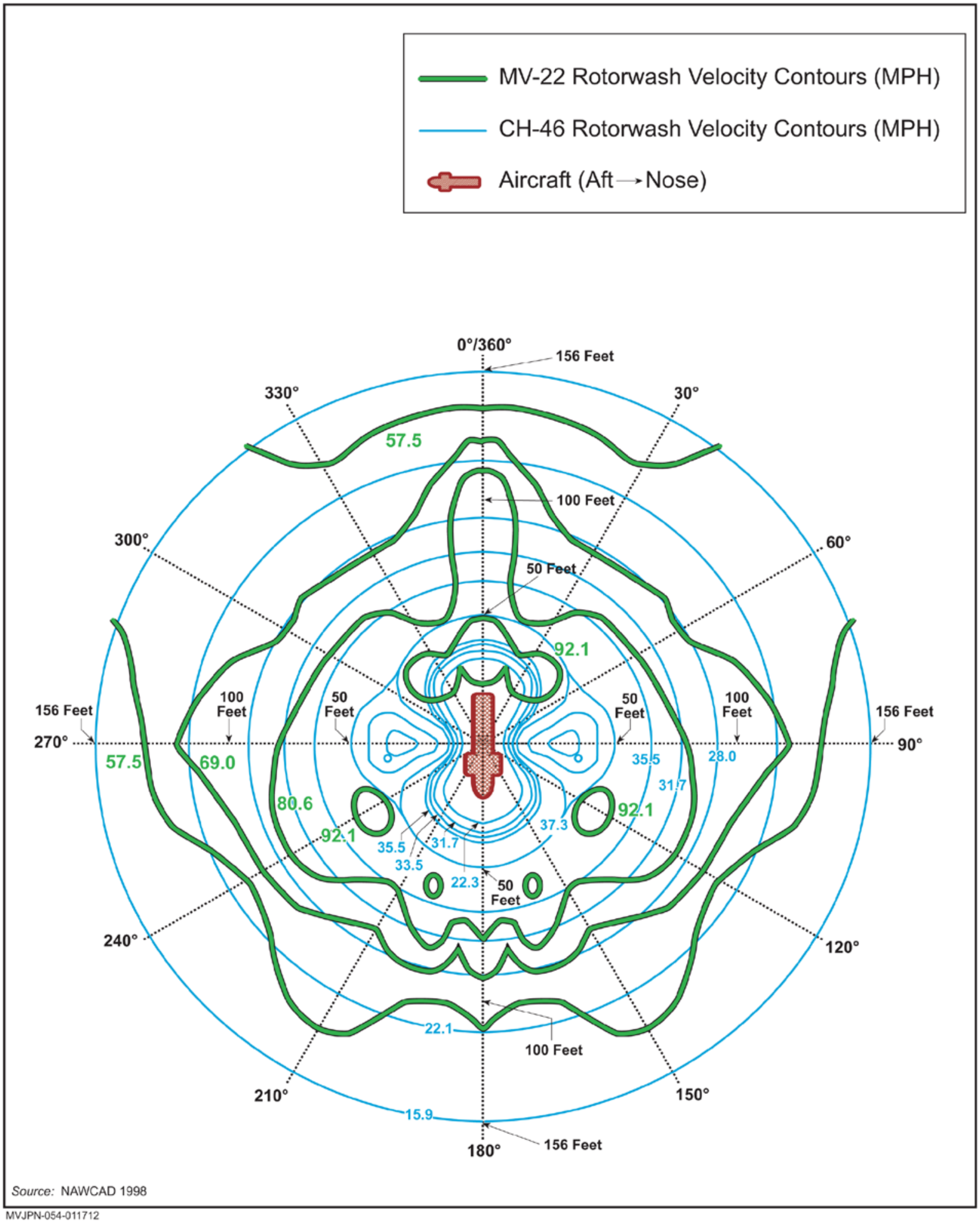


Figure 4.1.6-3. Rotorwash Velocity Contours: MV-22 and CH-46E

Table 4.1.6-1. Comparison of CH-46E and MV-22 Rotorwash Wind Speeds			
Distance (feet)	**Wind Speed (mph)**		
	CH-46E (90/270 degrees)	***MV-22 (60/300 degrees)***[2]	***MV-22 (180 degrees)***[2]
25	35	92	86
50	37	89	85
75	32	83	83
100	25	67	71
125	20	65	57
150	16	64	55
175	<16[1]	62	54
200	<16[1]	59	52
225	<16[1]	56	50
250	<16[1]	55	47
275	<16[1]	52	43
300	<16[1]	48	38
325	<16[1]	44	33
350	<16[1]	40	27
375	<16[1]	32	19
400	<16[1]	23	5

Note:
[1]No test data available for these distances.
[2] Data for distances beyond 150 feet extrapolated from test data.

Current Conditions

Use of the tactical LZs by currently-based helicopters (CH-46E and CH-53E) generates rotorwash and its related effects. The USMC reports no current issues with impacts to the public, vehicles, or structures from CH-46E or other helicopter use of the LZs. As noted above, the extent of rotorwash by the CH-46E is limited to within the LZs, and windspeeds are relatively low. Most of the tactical LZs lie well away from areas allowing public access, and occur within U.S. facilities and areas. For safety and maneuverability, structures are rare at these LZs and situated far from actual landing points.

Under certain conditions in appropriate climates, helicopters can generate dust when hovering near the ground. If sufficient dust is raised, it can envelope the aircraft and obscure visibility of the ground and its features (e.g., rocks, gullies). For the LZs at the ISTF, NTA, and CTA, such incidents have not occurred and dust does not pose a problem. First, a large proportion of the LZs consist of prepared surfaces such as asphalt, concrete, or grass, or contain extremely limited areas (<0.4 acre) of exposed soils (see Table 4.1.9-1 in Geology and Soils). Without exposed soils, no potential exists for rotorwash to generate dust and reduce visibility. Second, a relatively wet climate characterizes Okinawa, so wind erosion of soils is uncommon. For those few LZs with larger areas (1-1.3 acres), the exposed soils are not susceptible to wind erosion and the USMC reports no issues associated with dust at LZs. However, local residents of Ie Shima have lodged complaints about dust from fixed wing aircraft use of the Coral Runway at the ISTF.

Fire Potential

A brief discussion of fire in the training areas is presented in Section 4.1.7, Biological Resources. Each training area has fire prevention and control procedures in effect. On a daily basis, the fire condition in each area is determined to be green, yellow, or red (least risk to most risk), based on rainfall in the preceding 24 hours, the relative humidity, and environmental conditions (USMC 2011). While the fire condition determines the nature of ammunition use on ranges, it rarely, if ever, influences CAL operations at LZs. With restrictions on personnel, smoking, and other fire sources, these CAL operations pose a negligible risk for starting a fire since the helicopter engines and exhaust lie several feet above the ground and potential fuel (vegetation) and so engine heat would not be sufficient to ignite vegetation. Clearing and development of many LZs further reduces the already negligible risk of fire from CAL operations. If a fire begins, Range Control is notified immediately, and it sets "red" fire condition for the entire training area containing the fire and halts all training in that area. The unit training in the area where the fire started will make a reasonable attempt to put the fire out. If they are unable to, the installation/air station USMC Fire Department will be contacted. Open fires are not permitted in any training area, though controlled fires in designated portable containers are allowed with prior approval.

Mishaps

Section 3.6 details mishap rates and safety records under current conditions, and demonstrates the low rate for the CH-46Es (a Class A mishap rate of 1.14 from 2004 to 2011). This level of safety would apply also to training at the LZs and transiting the airspace over them. Although entry is restricted for the airspace over the ISTF, NTA and CTA, the USMC monitors air traffic for unauthorized entry. Because civil airways surround the CTA, unintentional intrusions into the CTA airspace occur routinely. The current procedure for avoidance of mishaps involving non-military aircraft, known as "see and avoid," has, however, been successful.

Bird Aircraft Strike Hazards

Wildlife represents a significant hazard to flight operations. Birds, in particular, are drawn to the open, grassy areas and warm pavement of the airfield. Although most bird and animal strikes do not result in crashes, they cause structural and mechanical damage to aircraft. Most collisions occur when the aircraft is at an elevation of less than 1,000 feet AGL. Due to the speed of the aircraft, collisions with wildlife can happen with considerable force.

Migratory waterfowl (e.g., ducks, geese, and pelicans) are hazardous to low-flying aircraft because of their size and their propensity for migrating in large flocks at a variety of elevations and times of day. Waterfowl vary considerably in size, from 1 to 2 pounds for ducks, 5 to 8 pounds for geese, and up to 20 pounds for most pelicans. There are two normal migratory seasons, fall and spring. Waterfowl are usually only a hazard during migratory seasons. These birds typically migrate at night and generally fly between 1,500 to 3,000 feet AGL during the fall migration and from 1,000 to 3,000 feet AGL during the spring migration. The potential for Bird/Wildlife-Aircraft Strike Hazard (BASH) strikes is greatest in areas used as migration corridors (flyways) or where birds congregate for foraging or resting (e.g., open water bodies, rivers, and wetlands).

Along with waterfowl, raptors, shorebirds, gulls, herons, and songbirds also pose a hazard. In considering severity, the results of bird aircraft strikes show that strikes involving raptors result in the majority of Class A and B mishaps, which are few in number. Raptors of greatest concern are buzzards and hawks. Peak migration periods for raptors, especially eagles, are from October to mid-December and from mid-January to the beginning of March. In general, flights above 1,500 feet AGL would be above most migrating and wintering raptors. No significant BASH issues have arisen in the training areas or at any LZs.

4.1.6.2 Environmental Impacts

The proposed action would not noticeably affect safety at the ISTF, in the CTA or NTA, or at any SC LZs. The tactical LZs at the ISTF, NTA, and CTA represent existing sites located in training areas with a history of supporting similar training activities. Replacement of the CH-46E operations with those by the MV-22 would represent a negligible change in the overall training and safety environment within these areas. In addition, the total number of operations at the NTA and CTA under the proposed action would decrease relative to current conditions, thereby reducing the overall potential for mishaps, bird-aircraft strikes, inadvertent fires, and incidents with rotorwash. Although the use of the ISTF would increase substantially, the complex would remain separated and restricted from public access, and most aircraft activity would occur over the water.

Rotorwash

Given the increased strength and extent of the MV-22 rotorwash (refer to Figure 4.1.6-3 and Table 4.1.6-1), the potential impacts that warrant evaluation include dust effects on flight safety and public safety. Like the current squadrons, the MV-22 squadrons would adhere to all operational and safety procedures applicable for the airspace and training areas. Additionally, existing restrictions on access onto the U.S. facilities and areas which contain the LZs would remain in force, thereby protecting the public and military personnel. Military personnel and civilian workers in the training areas would be familiar with the sites and recognize the need for awareness during operations.

Dust Effects on Flight Safety

Like under current conditions, all but a few of the existing LZs projected for use by the MV-22s would include either prepared surfaces lacking exposed soils or small areas of exposed soils. The few (see Geology and Soils, Section 4.1.9) LZs with larger areas of exposed soils would not pose an issue since the types of soils would not be susceptible to disturbance and creation of dust clouds even with the MV-22's greater rotorwash.

Public Safety

Although the MV-22 generates powerful rotorwash winds out beyond the vicinity of the aircraft, several factors establish that rotorwash poses a minimal risk to people and some vehicles. These winds are not sustained, but represent gusts oscillating with one gust per second. All wind speed scales focus on damage to structures or the environment and generally employ sustained wind measures or gusts of 3 seconds or more. The Enhanced Fujita Scale (Table 4.1.6-2), although developed for tornados, provides a basic means of assessing effects of wind gusts over a period of 3 seconds. Okinawa is subject to typhoons and accompanying high winds every year. Sustained winds for typhoons exceed 74 mph and can reach well above 100 mph. Considered in comparison with Table 4.1.6-1, this scale shows that only within 125 feet of the MV-22 would the rotorwash windspeeds (65 mph) meet and exceed the threshold for damage (0 Rating) to structures or trees. The area within 125 feet of the aircraft would lie within the LZ in every case but LZ 3 on the NTA and LZ Wren in the CTA. No public access or publicly-accessible roads occur within a 125 foot radius of the other 48 tactical LZs. Additionally, these higher rotorwash windspeeds would occur at limited angles relative to the nose of the MV-22 (refer to Figure 4.1.6-3). Neither this scale nor any other, however, sets standards for effects on people on the ground or vehicles.

Table 4.1.6-2. Enhanced Fujita Scale for Wind Damage

Rating	3 Second Gust (mph)
0	65-85
1	86-110
2	111-135
3	136-165
4	166-200
5	Over 200

The 1998 NAWCAD study (NAWCAD 1998), which specifically addressed effects on military personnel operating near the MV-22, concluded that personnel may encounter difficulties with stability when walking, especially closer to the aircraft. Lighter individuals may continue to need to adjust walking even with greater distances from the aircraft and reduced wind speeds. However, the nature of the gusts and the different wind speeds at different azimuths relative to the MV-22 would allow individuals to adjust and adapt without danger or risk of injury. This study established that 90 percent of the population would not have difficulty walking forward with winds of 47 mph or less, and between 47 and 58 mph, walking would be difficult but without safety issues. Although these data were developed for troops operating under the aircraft, they provided the only available measure of potential impact applicable to non-military persons in the affected area. The analysis used unattenuated windspeed of 47 mph and the greatest distance from the MV-22 this windspeed could occur at 300 feet from the nose at 60 or 300 degrees. As detailed previously in Chapter 2, public access to areas near the LZs would remain limited under the proposed action, with only nine LZs within 300 feet or less from a public thoroughfare (Table 4.1.6-3). These LZs formed the focus of further analysis, whereas the remainder lay well away from public roads.

Table 4.1.6-3. Landing Zones in Proximity (< 300 feet) to Public Roads				
LZ Name	**Training Area**	**Proposed MV-22 Use**	**Proximity to Public Road**	**Maximum Attenuated Windspeed (mph)**
LZ 1	NTA	Rare	213 feet	21
LZ 3	NTA	Rare	113 feet	45
LZ 4	NTA	Average	201 feet	59
LZ Buzzard	CTA	Rare	185 feet	43
LZ Crow	CTA	Rare	246 feet	58
LZ Flamingo	CTA	Rare	199 feet	22
LZ Mallard	CTA	Average	190 feet	23
LZ Raven	CTA	Rare	200 feet	46

Attenuation of windspeeds by natural windbreaks formed the next step of this analysis, since the forests on Okinawa tend to be dense. Forests surrounding LZs provide natural windbreaks similar or more extensive than those commonly used in agricultural areas to lessen erosion and crop damage due to wind. These natural windbreaks, where present, would attenuate the wind velocities from MV-22 rotorwash at the LZs and reduce the windspeeds experienced by pedestrians or vehicle operators on nearby public roads. The efficiency of windbreaks depends upon initial wind velocity, distance of the windbreak from the wind source, and the width, height, and density of the windbreak vegetation (USDA n.d.). With sufficient vegetation characteristics and ample distance to the wind source, wind breaks can attenuate velocities to 25 percent (or 75 percent reduction) of the initial wind source velocity (Figure 4.1.6-4). For example, a 125 foot wide band of dense forest with an average height of 25 feet would reduce a 60 mph wind velocity to a 15 mph velocity. In order to quantify the approximate wind attenuation for the LZs within 300 feet of a publicly accessible road, aerial imagery and GIS were used to measure the width of the forest windbreaks, whereas vegetation density and height (H) was estimated based on recent surveys and existing data. GIS provided the means to measure the distance from the landing point (i.e., wind source) to the start and extent of the forest windbreak. Assuming the MV-22 would land in a position to maximize the rotorwash (i.e., with the aircraft situated so angles of 60 and/or 300 degrees relative to the nose point at the road), windspeeds were calculated at the roads near the LZs accounting for attenuation by the forest. This calculation used the methods outlined in the USDA publication “Windbreak Characteristics” (USDA n.d.). Of the nine LZs near roads, attenuation would decrease the windspeeds below the threshold of 47 mph (i.e., no issues walking) for six sites (refer to Table 4.1.6-3). With such attenuation, neither persons nor vehicles along the road would experience windspeeds sufficient to cause harm or pose a safety hazard.

For the other two LZs (LZ 4 and LZ Crow), attenuation would be insufficient to prevent windspeeds from exceeding 47 mph. Figure 4.1.6-5 depicts these LZs, illustrating with aerial imagery and graphs the location and extent of the portions of the road potentially affected by rotorwash windspeeds above 47 mph. In contrast to LZ Crow only a very short segment of roadway would be exposed to higher wind velocities at LZ 4. For this reason, the probability for impacts to persons or vehicles on the road near LZ 4 would be negligible unless the MV-22 landed with the 60 or 300 angles pointed exactly at the narrow gap in the forest visible on the aerial imagery (southeast of landing point) and a person walked on that segment at the exact same time.

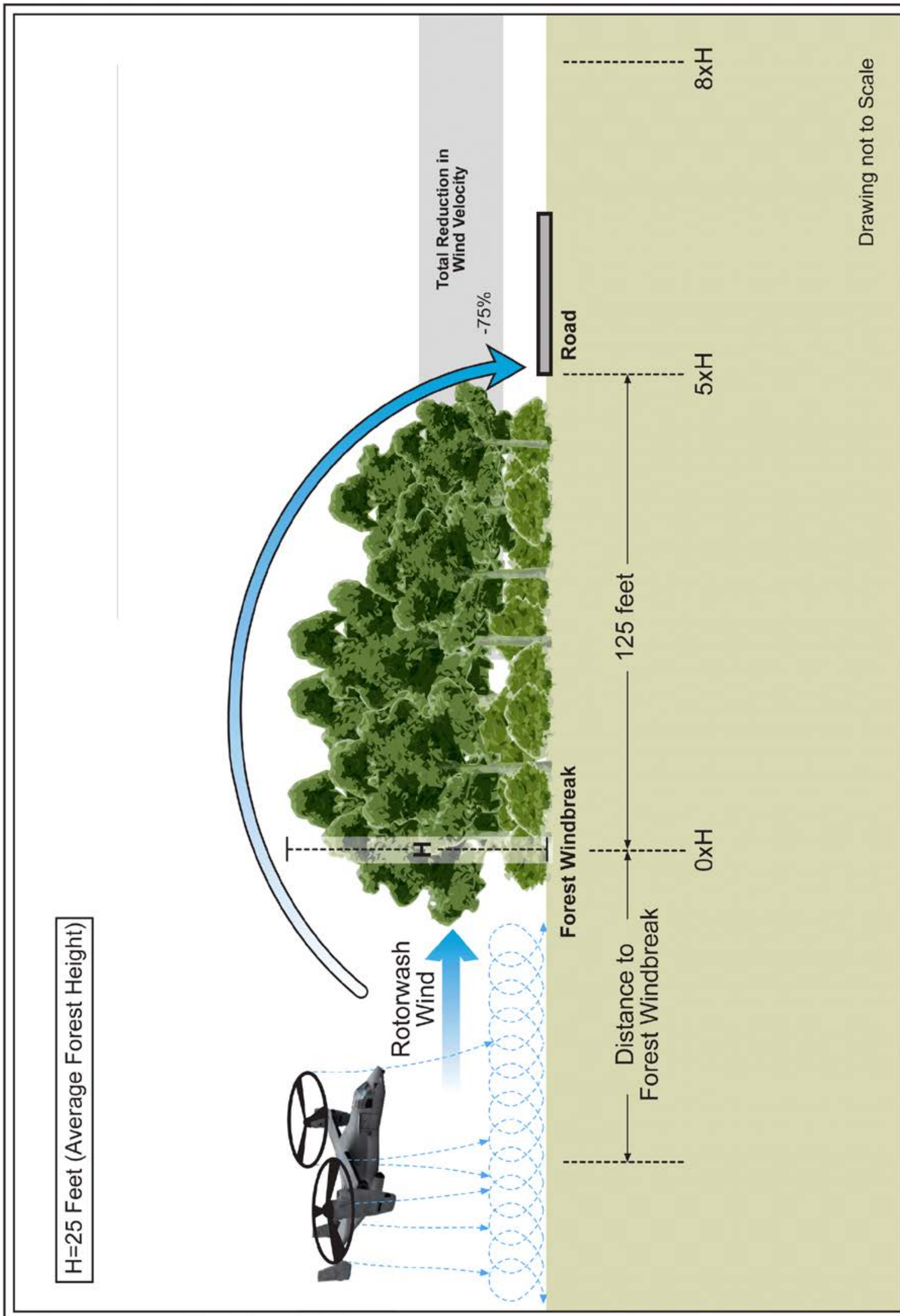


Figure 4.1.6-4. Windspeed Attenuation by Forest Vegetation

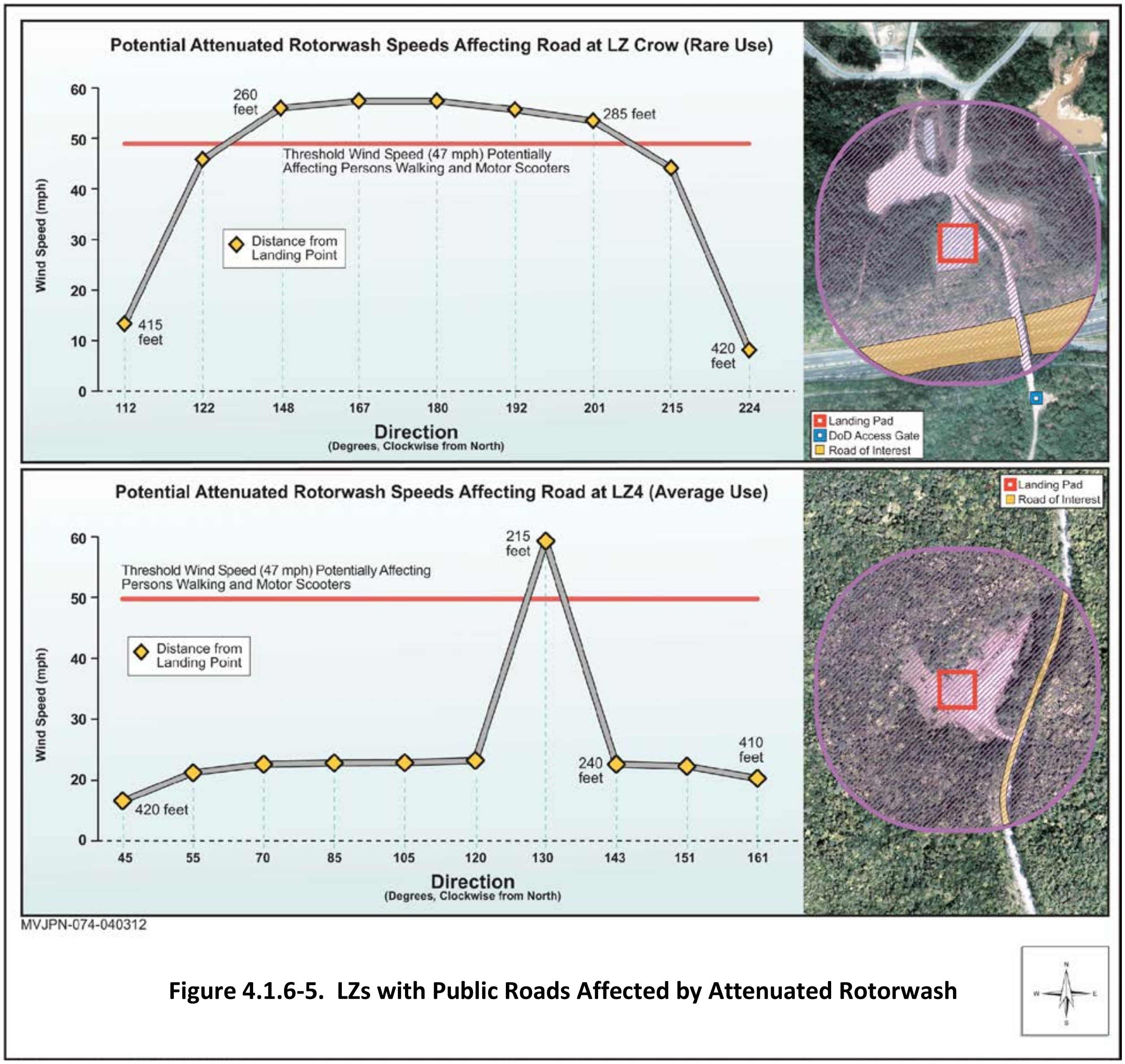


Figure 4.1.6-5. LZs with Public Roads Affected by Attenuated Rotorwash

At LZ Crow, a segment of a major highway could receive exposure to rotorwash windspeeds in excess of 50 mph but less than 59 mph. For a normal person walking, such winds would prove momentarily annoying and could affect forward movement, but they would not be harmful (NAWCAD 1998). Cars and trucks could likewise experience buffeting for the brief period they transited through the affected segment. Based on the location of the road relative to LZ Crow and expected wind speeds, these gusts should not move vehicles off a road or precipitate an accident due to the weight and stability of the vehicle. Smaller motor scooters, which weigh between 200 and 400 pounds, could also be buffeted, but not dangerously. Since this LZ would receive Rare use, the probability of an encounter between a hovering MV-22 and an unaware motor scooter would be minimal. Impacts at this LZ would not pose significant harm.

Fire Potential

The configuration of the MV-22 engines when used in the VTOL mode has led to past concerns regarding fire potential underneath the aircraft. Due to these concerns, the Program Office at Patuxent River, Maryland, recently examined numerous information sources to assess the fire risk associated with MV-22 exhaust temperatures (see Appendix B-1). Data from a Bell Boeing Test Report of the exhaust deflector system, a National Institute of Standards and Technology report on the combustion temperatures of various plant based materials, and a Naval Air Systems Command safety assessment of the risk of a grass fire from hot exhaust were all examined.

The engine exhaust of the MV-22 aircraft is directed downwards when the nacelles are in the vertical position, as for vertical take-offs and landings. In this position, exhaust exits the engines at 4 feet 4 inches above the ground at 515 degrees Fahrenheit (°F) above the ambient temperature, and decreases to 150°F above the ambient temperature at the ground. To reduce the temperatures to which the ground is exposed, an exhaust deflector system is used. This system directs exhaust outward and away from the aircraft, and is activated at low power settings when the weight of the aircraft is on its wheels, although it may be turned off by the pilot. The maximum ground temperature achieved during the Bell Boeing test with the exhaust deflectors engaged was 422°F.

The National Institute of Standards and Technology study (NIST 2007) tested the amount of time and the temperatures required for several types of plants to combust. The results showed that for the plants tested, the lowest temperature at which glowing ignition was observed was 572°F, which is significantly higher (150 to 192°F) than the temperatures that can be expected to occur at ground level with exhaust deflectors operating.

The Naval Air Systems Command assessment (NAVAIR 2007) of the risk of a grass fire caused by hot exhaust took into account all the information presented above as well as extenuating circumstances, such as rigid vegetation extending higher into the exhaust stream and leaking fuel hydraulic fluid after an extended period with the engines shut down. This safety assessment calculated the risk of a grass fire as a remote frequency, about one event per million flight hours.

Available data indicate with exhaust deflectors operating, the exhaust of the MV-22 should not heat the ground to a temperature high enough to support combustion of plant-based materials. This conclusion is also consistent with MV-22 operational experience. After 44,000 flight hours and operations to numerous unprepared landing zones at bases and ranges including sites in Alabama, Arizona, California, Florida, Maryland, Nevada, New Mexico, North Carolina, and Virginia, only one documented grass fire has been attributed to the exhaust of a V-22 (USMC as well as USAF V-22) aircraft. In 2007, a fire occurred about 10 miles southwest of Troy, Alabama, and the probable cause was determined to be an interruption in the operation of the exhaust deflector system. There have been no fires documented with the exhaust deflectors working normally and standard operating procedures being followed. If exhaust deflectors are not working, pilots will not land on unprepared surfaces.

The climate on Okinawa is generally humid, with an average temperature of 71 to 73°F, and an average annual rainfall of 60 inches. The moisture content of the ground, in addition to the exhaust deflectors, would help to reduce the chance of a fire starting. If a fire does start, fire control procedures are in place, and would continue to be practiced should the MV-22 be introduced on Okinawa, to ensure that it does not spread.

Additionally, the MV-22 is certified to deploy Bambi Buckets® for fighting fires in the ranges in accordance with the latest version of the National Timber Industry Policy. The Bambi Bucket® is a collapsible bucket suspended from a helicopter performing firefighting operations and used for lifting and dumping water or fire retardant chemicals. The MV-22 would provide an increase in fire-fighting capability as the water bucket the MV-22 would carry has more than twice the water carrying capacity as current fire-fighting accessories. This increase would benefit all USMC operations in the area.

Mishaps

Should the MV-22 be introduced to Okinawa, existing airspace management controls and procedures would continue to be a priority to military aircraft operating in the training areas. The MV-22 aircraft has demonstrated a safety record that is consistently better than USMC averages of other aircraft, including the CH-46Es, while conducting military training, humanitarian missions, and combat operations in very challenging environments. The pilots arriving with the MV-22 aircraft would be experienced in flying the aircraft. Additionally, pilots flying the MV-22 would use simulators extensively, providing training for all facets of flight operations and comprehensive emergency procedures. This in-depth training would minimize pilot error. The sophistication and fidelity of current simulators and related computer programs are commensurate with the advancements made in aircraft technology. Thus, the rate of mishaps that occur can be expected to remain similar to present.

Bird Aircraft Strike Hazard

The MV-22 would operate in the same airspace environment as the current aircraft. While it would fly at low altitudes, it would perform far less TERF operations near treetop levels, thereby reducing the potential for encounter with birds. Additionally, with fewer operations than current levels, the overall potential for bird aircraft strikes is not anticipated to increase after beddown of the MV-22.

Landing Zones Scheduled for Construction

SC LZs would have 150-foot diameter prepared surfaces at the landing points with 50-foot cleared areas surrounding it. These cleared and prepared surfaces would reduce any effects due to rotorwash or the potential for fire. Mishap potential would remain low, consistent with other LZs.

4.1.7 Biological Resources

The definitions of biological resources and international regulatory guidelines for the protection and management of species are presented in Section 3.7. Of particular importance are Protected Species designated as Natural Monuments, or *Tennen-kinenbutsu* which include plants and animals that possess a high scientific, historical, or aesthetic value. Japan's Natural Monument listing is the equivalent of historic and cultural resources listed on the U.S. *National Register*. Historic or cultural resources are defined by the JEGS as, "…artifacts, archeological resources, records, and material remains that are related to such a district, site building, structure, or object, and also includes natural resources (plants, animals, landscape features, etc.) that may be considered important as a part of a country's traditional culture and history" (USFJ 2010). Section 402 of the National Historic Preservation Act of 1966, as amended in 2000, states that "Prior to the approval of any Federal undertaking outside the U.S. which may directly and adversely affect a property which is on the World Heritage List or on the applicable country's equivalent of the National Register, the head of a Federal agency having direct or indirect jurisdiction over such undertaking shall take into account the effect of the undertaking on such property for purposes of avoiding or mitigating any adverse effects" (16 United States Code [U.S.C.] §470a-2). Through negotiation, the U.S. and GoJ have agreed upon standards for the treatment of biological resources on U.S. military facilities in Japan in the JEGS. Chapter 13 of the JEGS requires that "installations shall take reasonable steps to protect and enhance known endangered or threatened species and GoJ-Protected Species and their habitat." Mitigation measures have been included for species that could receive significant harm due to MV-22 operations.

As discussed in Chapter 3, the analysis of impacts to biological resources focuses on effects to vegetation and habitat, wildlife, and Protected Species. Protected Species include those species that are subject to protection by either the U.S. or appropriate GoJ authorities. The presence of Red List Species, which are not protected under the JEGS, was recorded during the Natural Resources surveys in 2011 and are discussed in detail for each surveyed LZ in Appendix D. As part of the analysis of impacts to biological resources from MV-22 training and readiness operations, an Okinawan contractor conducted flora and fauna surveys during the summer of 2011 at 35 LZs in order to identify any Protected Species found on and around the LZs and to update vegetation mapping of the areas. Thirty of these are tactical LZs and assessed herein. Of the 30 surveyed LZs, 6 are at the ISTF, 3 in the NTA, and 16 in the CTA (Table 4.1.7-1). The remaining five LZs consist of Administrative LZs that required no detailed analysis as discussed in Chapter 2. Appendix D presents the complete Natural Resources Report, including detailed information on survey methods and results.

Table 4.1.7-1. Natural Resource Surveys at Tactical Landing Zones

#	LZ Designation	Survey 2011 (Appendix D)	Previous Watershed/ Other Surveys[1]	Increase In Use from Current Conditions to Proposed	Presence of Protected Species
Ie Shima Training Facility					
1	Coral Runway	X		X	
2	Sling Load	X		X	
3	Sling Load Alternative	X		X	
4	VIP Helipad	X		X	
5	LHD Deck	X		X	X[2]
6	Drop Zone	X		X	
Northern Training Area					
7	LZ 1	X			X
8	LZ 3	X			X
9	LZ 4		X		X
10	LZ 12		X		X
11	LZ 12A		X		

#	LZ Designation	Survey 2011 (Appendix D)	Previous Watershed/ Other Surveys[1]	Increase In Use from Current Conditions to Proposed	Presence of Protected Species
Table 4.1.7-1. Natural Resource Surveys at Tactical Landing Zones (con't)					
Northern Training Area (con't)					
12	LZ 13		X		
13	LZ 14		X		
14	LZ 15		X		X
15	LZ 17		X		X
16	LZ 18		X		X
17	LZ Baseball		X		X
18	LZ Firebase Jones	X			X
Central Training Area					
19	LZ Buzzard	X			X
20	LZ Cardinal	X			X
21	LZ Condor		X		
22	LZ Coot		X	X	
23	LZ Crane	X			X
24	LZ Crow		X		
25	LZ Curlew		X		
26	LZ Dodo		X		
27	LZ Duck		X		
28	LZ Falcon		X	X	
29	LZ Flamingo	X			
30	LZ Gander	X			X
31	LZ Goose	X			X
32	LZ Hawk		X		
33	LZ Heron	X			
34	LZ Kin Blue	X		X	X[2]
35	LZ Kiwi		X		
36	LZ Macaw		X		
37	LZ Magpie	X			
38	LZ Mallard		X	X	
39	LZ Owl		X		
40	LZ Peacock		X		
41	LZ Phoenix	X		X	X[2]
42	LZ Pigeon		X		
43	LZ Rail	X			X
44	LZ Raven	X			X
45	LZ Rook	X			
46	LZ Starling		X		X[2]
47	LZ Swallow	X		X	
48	LZ Swan	X		X	X[2]
49	LZ Whippoorwill		X		
50	LZ Wren	X			X

[1]*Source:* MCB Camp Butler 2006a, 2006b, 2006c, 2009a, 2010a
[2]Protected species is hermit crab; LZ Phoenix also has the alligator newt

Natural resource surveys have also been conducted at the watershed level (MCB Camp Butler 2006a, 2006b, 2006c, 2009a, 2010a). Data from these studies were used to describe the biological resources at the 25 tactical LZs that were not surveyed in 2011 (refer to Table 4.1.7-1). Information on biological resources in the SC LZs was obtained from the GoJ Environmental Assessment (former Naha DFAB 2007) and previous watershed studies.

The area potentially affected by the MV-22 training operations included the 100 x 100-foot landing point and a 350-foot buffer zone as described in Chapter 2. As such, the analysis focuses on the resources within that 12.3-acre area.

4.1.7.1 Current Environment

Ie Shima Training Facility

The ISTF is comprised of approximately 1,981 acres located on the western portion of the island. A mixture of residential, industrial, and agricultural lands exists on Ie Shima, but the ISTF is primarily surrounded by agricultural areas. Due to development on Ie Shima, most natural/semi-natural vegetation is located on steep slopes and protected areas on the island (MCB Camp Butler 2009a). A total of six LZs and nearby areas on the ISTF were evaluated for biological resources. All LZs were surveyed in 2011 (refer to Table 4.1.7-1).

Vegetation

Vegetation around the ISTF LZs is divided into three types: grassland, shrub, and tree stand. The majority of the area is covered with grassland (Table 4.1.7-2), which is mowed frequently. The tree stands mainly consist of planted Australian pine or Mokuma-ou (*Allocasuarina littoralis*) and lie along the fence line; whereas, the scattered shrubs are dominated by the Wild Tamarind or *Gin-nemu* (*Leucaena leucocephala*) (MCB Camp Butler 2009c).

Table 4.1.7-2. Vegetation Types at Tactical Landing Zones

#	LZ Designation	Landing Point Area Characteristics[1]	% of LZ Developed[2]	Dominant Vegetation Types	Description
Ie Shima Training Facility					
1	Coral Runway	Coral Runway	100	Pasture	Grassland
2	Sling Load	Pad/Maintained Grass	70-100	Pasture	Grassland
3	Sling Load Alternative	Maintained Grass	10-40	Pasture	Grassland
4	VIP Helipad	Pad/Maintained Grass	70-100	Pasture	Grassland
5	LHD Deck	AM-2 Matting	100	Developed (cleared)	N/A
6	Drop Zone	Grass	<10	Pasture	Grassland
Northern Training Area					
7	LZ 1	Cleared/Soil/Vegetation	10-40	*Pinus luchuensis* community	Evergreen Coniferous Secondary Forest
8	LZ 3	Cleared/Soil/Vegetation	10-40	*Castanopsis sieboldii-Tarenna gracilipes* association	Subtropical Evergreen Broad-Leaved Secondary Forest
9	LZ 4	Cleared/Soil/Vegetation	10-40	*Castanopsis sieboldii-Illicium anisatum* association	Subtropical Evergreen Broad-Leaved Forest
10	LZ 12	Pad/Vegetation	10-40	*Castanopsis sieboldii-Tarenna gracilipes* association	Subtropical Evergreen Broad-Leaved Secondary Forest
11	LZ 12A	Cleared/Soil/Vegetation	10-40	*Castanopsis sieboldii-Illicium anisatum* association	Subtropical Evergreen Broad-Leaved Forest
12	LZ 13	Pad/Maintained Grass	70-100	*Castanopsis sieboldii-Illicium anisatum* association	Subtropical Evergreen Broad-Leaved Forest
13	LZ 14	Maintained Grass	70-100	*Castanopsis sieboldii-Illicium anisatum* association	Subtropical Evergreen Broad-Leaved Forest
14	LZ 15	Pad/Gravel/Vegetation	10-40	*Castanopsis sieboldii-Tarenna gracilipes* association	Subtropical Evergreen Broad-Leaved Secondary Forest
15	LZ 17	Cleared/Soil/Vegetation	10-40	*Castanopsis sieboldii-Illicium anisatum* association	Subtropical Evergreen Broad-Leaved Forest
16	LZ 18	Cleared/Soil/Vegetation	10-40	*Castanopsis sieboldii-Illicium anisatum* association	Subtropical Evergreen Broad-Leaved Forest
17	LZ Baseball	Maintained Grass	10-40	*Castanopsis sieboldii-Illicium anisatum* association	Subtropical Evergreen Broad-Leaved Forest
18	LZ Firebase Jones	Cleared/Soil/Vegetation	10-40	*Castanopsis sieboldii-Tarenna gracilipes* association	Subtropical Evergreen Broad-Leaved Secondary Forest

Table 4.1.7-2. Vegetation Types at Tactical Landing Zones (con't)					
#	**LZ Designation**	**Landing Point Area Characteristics[1]**	**% of LZ Developed[2]**	**Dominant Vegetation Types**	**Description**
Central Training Area					
19	LZ Buzzard	Maintained Grass/Vegetation	40-70	*Castanopsis sieboldii – Tarenna gracilipes* association	Subtropical Evergreen Broad-Leaved Secondary Forest
20	LZ Cardinal	Cleared/Soil/Vegetation	40-70	*Castanopsis sieboldii – Tarenna gracilipes* association	Subtropical Evergreen Broad-Leaved Secondary Forest
21	LZ Condor	Maintained Grass/Road Surface/Vegetation	10-40	*Castanopsis sieboldii – Tarenna gracilipes* association	Subtropical Evergreen Broad-Leaved Secondary Forest
22	LZ Coot	Cleared/Soil/Vegetation	10-40	*Pinus luchuensis* community	Evergreen Coniferous Secondary Forest
23	LZ Crane	Pad/Maintained Grass	10-40	*Pinus luchuensis* community	Evergreen Coniferous Secondary Forest
24	LZ Crow	Pad/Gravel	40-70	*Pinus luchuensis* community	Evergreen Coniferous Secondary Forest
25	LZ Curlew	Maintained Grass/Road Surface	40-70	*Pinus luchuensis* community	Evergreen Coniferous Secondary Forest
26	LZ Dodo	Maintained Grass/Road Surface	40-70	*Leucaena leucocephala* community	Non-Native Shrubland
27	LZ Duck	Cleared/Soil/Vegetation	10-40	*Castanopsis sieboldii – Tarenna gracilipes* association	Subtropical Evergreen Broad-Leaved Secondary Forest
28	LZ Falcon	Maintained Grass/Road Surface/Vegetation	40-70	Developed land (cleared)	N/A
29	LZ Flamingo	Pad/Vegetation	10-40	*Panicum repens* community	Grassland
30	LZ Gander	Cleared/Soil/Vegetation	70-100	*Castanopsis sieboldii – Tarenna gracilipes* association	Subtropical Evergreen Broad-Leaved Secondary Forest
31	LZ Goose	Maintained Grass/Road Surface/Vegetation	10-40	*Castanopsis sieboldii – Tarenna gracilipes* association	Subtropical Evergreen Broad-Leaved Secondary Forest
32	LZ Hawk	Maintained Grass/Soil/Vegetation	40-70	*Pinus luchuensis* community	Evergreen Coniferous Secondary Forest
33	LZ Heron	Pad/Vegetation	10-40	*Pinus luchuensis* community	Evergreen Coniferous Secondary Forest
34	LZ Kin Blue	Cleared/Gravel/Soil	40-70	*Leucaena leucocephala* community	Grassland
35	LZ Kiwi	Maintained Grass/Vegetation	10-40	*Castanopsis sieboldii – Tarenna gracilipes* association	Subtropical Evergreen Broad-Leaved Secondary Forest
36	LZ Macaw	Pad/Maintained Grass	70-100	*Pinus luchuensis* community	Evergreen Coniferous Secondary Forest
37	LZ Magpie	Pad/Maintained Grass	10-40	*Psychotria rubra – Schima wallidhii* ssp. *liukiuensis* community	Subtropical Evergreen Broad-Leaved Secondary Forest
38	LZ Mallard	Maintained Grass/Vegetation	10-40	*Castanopsis sieboldii – Tarenna gracilipes* association	Subtropical Evergreen Broad-Leaved Secondary Forest
39	LZ Owl	Cleared/Vegetation	10-40	*Pinus luchuensis* community	Evergreen Coniferous Secondary Forest
40	LZ Peacock	Cleared/Vegetation	10-40	*Pinus luchuensis* community	Evergreen Coniferous Secondary Forest
41	LZ Phoenix	Maintained Grass/Soil/Vegetation	10-40	*Psychotria rubra – Schima wallidhii* ssp. *liukiuensis* community	Subtropical Evergreen Broad-Leaved Secondary Forest
42	LZ Pigeon	Cleared/Soil/Vegetation	10-40	*Castanopsis sieboldii – Tarenna gracilipes* association	Subtropical Evergreen Broad-Leaved Secondary Forest
43	LZ Rail	Cleared/Vegetation	10-40	*Quercus miyagii* community	Subtropical Evergreen Broad-Leaved Forest
44	LZ Raven	Pad/Gravel/Vegetation	10-40	*Psychotria rubra – Schima wallidhii* ssp. *liukiuensis* community	Subtropical Evergreen Broad-Leaved Secondary Forest
45	LZ Rook	Pad/Gravel/Vegetation	10-40	*Pinus luchuensis* community	Evergreen Coniferous Secondary Forest
46	LZ Starling	Cleared/Vegetation	10-40	*Sporabolus fertilis-Paspalum notatum* community	Grassland

Table 4.1.7-2. Vegetation Types at Tactical Landing Zones (con't)					
#	LZ Designation	Landing Point Area Characteristics[1]	% of LZ Developed[2]	Dominant Vegetation Types	Description
Central Training Area (con't)					
47	LZ Swallow	Pad/Maintained Grass/Vegetation	40-70	*Castanopsis sieboldii – Tarenna gracilipes* association	Subtropical Evergreen Broad-Leaved Secondary Forest
48	LZ Swan	Pad/Maintained Grass/Vegetation	40-70	Pasture Land	Grassland
49	LZ Whippoorwill	Cleared/Vegetation	10-40	*Pinus luchuensis-miscanthus sinensis* community	Subtropical Evergreen Broad-Leaved Secondary Forest
50	LZ Wren	Pad/Gravel/Vegetation	10-40	*Psychotria rubra – Schima wallidhii* ssp. *liukiuensis* community	Subtropical Evergreen Broad-Leaved Secondary Forest

Notes:
[1] Applies to the central 100-foot x 100-foot area and immediate surroundings for each LZ. As per Bell Boeing report (The Boeing Company 2010), the MV-22 needs a minimum area of 100-foot by 100 feet to operate safely (see 2.2.2.2 Landing Zones).
[2] Derived from inspection of aerial photography and applies to the entire 12.3-acre area analyzed for each LZ.

Wildlife

Wildlife species richness on Ie Shima in general is poor due to the cultivation of crops and the development of most areas on the island (MCB Camp Butler 2009a). However since Okinawa, including Ie Shima, is situated along migratory bird routes, avian species richness on the island is high, with 69 species of birds being observed at the ISTF in 2007 and 2008. In addition, 28 species listed in the U.S.-Japan Migratory Bird Treaty were observed at the training facility (MCB Camp Butler 2009a).

Protected Species

The only terrestrial Protected Species observed at ISTF was the GoJ Natural Monument hermit crab (*Coenobita cavipes*). Although hermit crabs are abundant in Okinawa, the species was designated as a Natural Monument by the GoJ in 1972 when Okinawa became Okinawa Prefecture. The GoJ Natural Monument peregrine falcon (*Falco peregrinus*) was observed during studies in 2007 and 2008 (MCB Camp Butler 2009a). No protected floral species were observed during the 2011 surveys.

Northern Training Area

The NTA is located at the northeast end of Okinawa Prefecture and is comprised of approximately 19,356 acres, the majority of which is located within National Forest owned by the GoJ and private individuals. For operational purposes tree removal within National Forest areas is allowed by the GoJ and USMC; however, for any tree over 4 centimeters (1.57 inches) diameter at breast height, reimbursement to the landowner is required. Currently, seven of the eight watersheds within the NTA have been surveyed for flora, fauna, and vegetation including: Aha, Arakawa, Furujima, Haramata, Oodomari, Sannumata, and Uka. In addition, vegetation and faunal surveys were conducted at three LZs in 2011 (refer to Table 4.1.7-1).

Vegetation

On average, over 400 vascular plant species were previously recorded in each of the seven watersheds located within the NTA. Common floral species found include *Castanopsis sieboldii*, *Pinus luchuensis,* and *Illicium anisatum* (MCB Camp Butler 2006a, 2006b, 2006c, 2009a). Where vegetation exists, all LZs in the NTA, with the exception of LZ 1, are dominated by either the *Castanopsis sieboldii-Illicium anisatum* association or the *Castanopsis sieboldii-Tarenna gracilipes* association (Table 4.1.7-2). LZ 1 is dominated by a *Pinus luchuensis* community. All 12 LZs contain disturbed areas around the landing point and, with the exception of LZ Firebase Jones, also contain cleared, developed land for access roads. Four LZs (LZ 4, 17, 18, and Baseball) in the southern portion of the NTA are in areas that have experienced higher levels of disturbance and contain secondary vegetation associations and communities in addition to the dominant associations mentioned above.

Wildlife

Wildlife found within the NTA is abundant and diverse due to the amount of largely undeveloped woodland areas covered by mature *Castanopsis sieboldii*-dominated forest and available water resources. An average of over 500 fauna species were previously recorded in each watershed associated with this area. Common fauna found throughout the NTA include wild boar (*Sus scrofa riukiuanus*), bush warbler (*Cettia diphone*), Hokou gecko (*Gekko hokouensis*), Ryukyu brown frog (*Rana okinavana*), and gobies in aquatic habitats (*Rhinogobius* spp.).

The northern forests of Okinawa (known as the Yanbaru area) have at least 21 resident forest birds (MCB Camp Butler 2009a). A flora and fauna study of the NTA and the CTA documented 35 native birds, of which five species are endemic to Yanbaru or the Okinawa Islands, and another 10 species are endemic to the Ryukyu Islands (Kaneshiro and Iwahashi 2000). In addition to native birds, Okinawa Island is considered to be an important site for migratory species. Summer migrants to Yanbaru include the ruddy kingfisher (*Halcyon coromanda*), black paradise flycatcher (*Terpsiphone atrocaudata ilex*) or *Sankocho*, and the little cuckoo (*Cuculus poliocephalus*) (MCB Camp Butler 2009a). Winter visitors include the gray and white wagtails (*Motacilla* sp.), tufted duck (*Aythya fuligula*), and peregrine falcon (*Falco peregrinus*).

Protected Species

Protected Species have been observed at nine existing LZs that would be used by the MV-22 – LZs 1, 3, 4, Firebase Jones, Baseball, 12, 15, 17, and 18 (Table 4.1.7-3). Only one protected flora species was observed, the orchid, *Dendrobium okinawense*, which is an endangered species under LCES at LZ Firebase Jones. This orchid may be found in other LZs within the NTA that were not recently surveyed since old growth, undisturbed forest is the primary habitat of the species.

Table 4.1.7-3. Protected Species Observed at Existing Landing Zones during Natural Resource Surveys

	Scientific Name	Japanese Name	English Name	LZ Name	Breeding Season	Protected Species		
						National Endangered Species	***Natural Monument Species***	***Okinawa Prefecture Monument Species***
Vascular Plants	*Dendrobium okinawense*	*Okinawa-sekkoku*	Orchid	LZ Firebase Jones	-	✓	-	-
Birds	*Galirallus okinawae*	*Yanbaru-kuina*	Okinawa Rail	LZ 1[2], LZ 3[2],LZ Firebase Jones	March - June	✓	✓	-
	Sapheopipo noguchii	*Noguchi-gera*	Pryer's Woodpecker	LZ 1, LZ 3, LZ 17[1], LZ Firebase Jones	April - June	✓	✓	-
	Erithacus komadori namiyei	*Hontou-akahige*	Stejneger's Ryukyu Robin	LZ 4[1], LZ 12[1], LZ 15[1], LZ 17[1], LZ 1, LZ 3, LZ Firebase Jones, LZ 18[1], LZ Baseball[1]	April - June	✓	✓	
	Scolopax mira	*Amami-yama-shigi*	Amami Woodcock	LZ 18[1]	March - May	✓		✓
	Columba janthina	*Karasu-bato*	Japanese Wood Pigeon	LZ 12[1]	September - December	✓		
Reptiles	*Geoemyda japonica*	*Ryukyu-yama-game*	Ryukyu Black-Breasted Leaf Turtle	LZ 1, LZ 12[1], LZ Baseball[1], LZ Firebase Jones	April - June	-	✓	-
	Goniurosaurus kuroiwae kuroiwae	*Kuroiwa- tokage-modoki*	Kuroiwa's Ground Gecko	LZ 1, LZ 3	April - July	-	-	✓
Amphibians	*Echinotriton andersoni*	*Ibo-imori*	Anderson's Alligator Newt	LZ 1, LZ 3, LZ 18[1], LZ Baseball[1], LZ Buzzard, LZ Cardinal, LZ Crane, LZ Gander, LZ Goose, LZ Phoenix, LZ Rail, LZ Raven, LZ Wren	November - May	-	-	✓
	Limnonectes namiyei	*Namie-gaeru*	Namie's Frog	LZ 3, LZ 12[1]	June - August	-	-	✓
	Odorrana ishikawae	*Ishikawa-gaeru*	Ishikawa's Frog	LZ 3	January - February	-	-	✓
	Babina holsti	*Horusuto-gaeru*	Holst's Frog	LZ 3, LZ 12[1], LZ 15[1], LZ Firebase Jones	July - September	-	-	✓
Insects	*Kallima inachus eucerca*	*Konoha-cho*	Leaf Butterfly	LZ 1, LZ Firebase Jones	All Year	-	-	✓
	Polyura eudamippus weismanni	*Futao-cho*	Great Nawab Butterfly	LZ Goose	April - October	-	-	✓
Crustaceans	*Coenobita* sp.	*Oka-yadokari*	Hermit Crab	LZ 3, LHD Deck, LZ Gander, LZ Kin Blue, LZ Phoenix, LZ Starling[1], LZ Swan	May - August	-	✓	-

Sources: MCB Camp Butler 2010a, Appendix D
Notes: [1] Species observed during prior national resource surveys; [2] Species observed during 2011 and prior natural resource surveys.

Two Endangered and GoJ Natural Monument species were found at LZ 1 – the Okinawa rail and Pryer's woodpecker. One Protected Species, Stejneger's Ryukyu robin, was observed at LZ 1. One GoJ Natural Monument listed species, Ryukyu black-breasted leaf turtle and three Okinawa Prefecture Government (OPG) Natural Monument species, Kuroiwa's ground gecko, Anderson's alligator newt, and leaf butterfly, were also observed in the LZ 1 survey area.

The largest diversity of protected fauna species of the LZs recently surveyed was LZ 3. Two dually-listed Endangered and GoJ Natural Monument species were found including the Okinawa rail and Pryer's woodpecker. One projected species, Stejneger's Ryukyu robin, was observed at LZ 3. One GoJ Natural Monument listed species, the hermit crab, and five OPG Natural Monuments – Kuroiwa's ground gecko, Anderson's alligator newt, Namie's frog, Ishikawa's frog, and Holst's frog – were observed in the LZ 3 survey area.

At LZ 4, the Stejneger's Ryukyu robin was the only Protected Species found. At LZ 12, five Protected Species were observed including; Holst's frog, Namie's frog, Stejneger's Ryukyu robin, Japanese wood pigeon, and Ryukyu black-breasted leaf turtle. Two Protected Species, Holst's frog and the Stejneger's Ryukyu robin, were observed around LZ 15. Two Protected Species were observed around LZ 17, Stejneger's Ryukyu robin and Pryer's woodpecker. Stejneger's Ryukyu robin, Amami woodpecker, and Anderson's alligator newt were observed around LZ 18.

At Firebase Jones, six protected fauna species were recorded. Three dually-listed Endangered and GoJ Natural Monument species were found including the Okinawa rail, Stejneger's Ryukyu robin, and Pryer's woodpecker. One GoJ Natural Monument listed species, Ryukyu black-breasted leaf turtle, and two OPG Natural Monuments – Holst's frog and leaf butterfly – were also observed in the LZ Firebase Jones survey area.

Three Protected Species were observed around LZ Baseball – the Ryukyu black-breasted leaf turtle, Anderson's alligator newt, and Stejneger's Ryukyu robin. There were no Protected Species reported within 350 feet of the landings points at LZs 12A, 13, and 14 during the watershed surveys (MCB Camp Butler 2006a, 2006b, 2006c, 2009a, 2010a).

Central Training Area

The CTA consists of approximately 17,000 acres and is made up of 26 different watersheds. Since 2004, watershed studies have been conducted in order to map vegetation and record flora and fauna species at the Kan, Mitoku, and Ginoza Watersheds (MCB Camp Butler 2009a). In addition, vegetation and faunal surveys were conducted at 15 LZs in 2011 (refer to Table 4.1.7-1).

Vegetation

Common floral species in the CTA include *Pleioblastus linearis*, *Rhododendron scabrum,* and *Castanopsis sieboldii* (MCB Camp Butler 2008, 2009a). The vegetation surrounding most LZs in the CTA is heavily forested much like the LZs in the southern NTA. Similar to the LZs in the NTA, all LZs in the CTA were around the landing point area. Additional disturbance varied from 10 percent to 100 percent of the total 12.3 acres.

The CTA contains more diversity in vegetation communities than the NTA, most likely due to additional vegetation communities resulting from disturbance (refer to Table 4.1.7-2). The *Castanopsis sieboldii-Tarenna gracilipes* association dominated 10 of the 32 LZs including: LZs Buzzard, Cardinal, Condor, Duck, Gander, Goose, Kiwi, Mallard, Pigeon, and Swallow. The *Pinus luchuensis* community dominated 10 LZs including: LZs Coot, Crane, Crow, Curlew, Hawk, Heron, Macaw, Owl, Peacock, and Rook. The *Psychotria rubra-Schima wallidhii* ssp. *Liukiuensis* community was dominant in 3 LZs – Magpie, Raven, and Wren. The *Leucaena leucocephala* community was the dominant vegetation at LZs Dodo and Kin Blue. Seven other vegetation communities dominated single LZs each.

Wildlife

Wildlife found within the CTA is abundant in remote areas where dominated by large tracts of relatively undisturbed, mature forest and with abundant undisturbed water resources such as streams. An average of over 400 fauna species were previously recorded in the three watersheds surveyed. Common fauna found throughout the CTA include wild boar (*Sus scrofa riukiuanus*), Japanese tit (*Parus major okinawae*), Hokou gecko (*Gekko hokouensis*), and cricket frog (*Rana limnocharis*) (MCB Camp Butler 2008, 2009a).

Twenty migratory bird species are recorded from the Kin Town and CTA area (MCB Camp Butler 2006d). These birds include the sandpiper (*Actitis hypoleucos*), gray wagtail (*Motacilla cinerea*), egrets (*Egratta* sp.), herons (*Ardea* sp.), and peregrine falcon (*Falco peregrinus*).

Protected Species

Protected fauna species were observed at 12 LZs – Buzzard, Cardinal, Crane, Gander, Goose, Kin Blue, Phoenix, Rail, Raven, Starling, Swan, and Wren. No protected flora species were observed within the LZ survey areas during the 2011 surveys or any of the previous watershed surveys (refer to Table 4.1.7-3).

Anderson's alligator newt, an OPG Natural Monument species, was observed at nine LZs (Buzzard, Cardinal, Crane, Gander, Goose, Phoenix, Rail, Raven, and Wren) and the hermit crab, a GoJ Natural Monument listed species, was observed at five LZs (Gander, Kin Blue, Phoenix, Starling, and Swan). The OPG Natural Monument Great Nawab butterfly was only observed at LZ Goose (refer to Table 4.1.7-3).

Landing Zones Scheduled for Construction

The dominant vegetation type at all SC LZ locations is the *Castanopsis sieboldii-Illicium anisatum* association, which makes up the vast majority of vegetation located within the NTA. The *Castanopsis sieboldii-Illicium anisatum* association, which is characterized by mature forest with large trees, provides habitat to many wildlife species in the NTA including: the wild boar (*Sus scrofa riukiuanus*), Japanese white eye (*Zosterops japonica)*, Scops owl (*Otus* elegans), and the Okinawa green tree frog (*Rhacophorus viridis viridis*) (MCB Camp Butler 2009a).

In order to determine the presence or potential presence of Protected Species inhabiting areas within or near the SC LZ locations using previous watershed survey data, the same 12.3 acre buffer area that was applied to all existing LZ locations was applied to the SC LZ locations. Protected Species observed within the buffer area from previous watershed studies and from surveys conducted by the former DFAB were then identified. Protected Species were observed at all six SC LZ locations during surveys conducted by the former DFAB (former Naha DFAB 2007). Protected Species found during these surveys include two floral species and 14 fauna species. A summary of Protected Species observed at each SC LZ location using all previous survey data is provided in Table 4.1.7-4.

4.1.7.2 Environmental Impacts

Training and readiness operations associated with the proposed action involve the use of 50 existing tactical LZs by MV-22 squadrons within three areas of Okinawa; the ISTF, NTA, and CTA. Biological resources located within the landing point and a 350-feet buffer area at each LZ were evaluated for potential impacts stemming from various sources related to the proposed action including: possible vegetation removal to accommodate use by the MV-22, noise levels and rotorwash created by the MV-22, and wildfires due to MV-22 activity. Currently, all LZs evaluated for impacts due to the proposed action are used by the CH-46E aircraft. They all have cleared areas for landing and are regularly cleared and maintained (refer to Table 2-6). Based on the analysis described below, impacts to vegetation, wildlife, and most Protected Species would be minimal. If nesting or roosting (sleeping at night in trees) protected bird species occur in forest edge areas near the landing point, significant impacts could occur due to an increase in rotorwash from the MV-22 aircraft. These potential impacts would be confined to a limited area at four LZs in the NTA where two protected bird species (Okinawa rail and Japanese wood pigeon) have been found in the past. In order to ensure that no significant harm occurs to these species, the USMC would conduct additional surveys and institute mitigation measures, if appropriate, to reduce potential impacts to less than significant levels and therefore, meet the U.S. requirements under JEGS (2010)-- “To protect and enhance known endangered or threatened species and GoJ-Protected Species and their habitat.”

Table 4.1.7-4. Protected Species Observed at Landing Zones Scheduled for Construction

	Scientific Name	Japanese Name	English Name	SC LZ Name[2]	Breeding Season	Protected Species: *National Endangered Species*	Protected Species: *Natural Monument Species*	Protected Species: *Okinawa Prefecture Monument Species*
Vascular Plants	*Dendrobium okinawense*	*Okinawa-sekkoku*	Orchid	LZ G	-	✓	-	-
	Platanthera sonoharae	*Kunigami-tonbo-sou*	Orchid	LZ G	-	✓	-	-
Birds	*Gallirallus okinawae*	*Yanbaru-kuina*	Okinawa Rail	LZ G, LZ H, LZ N-1A, LZ N-1B, LZ 17, LZ 17B	March - June	✓	✓	-
	Sapheopipo noguchii	*Noguchi-gera*	Pryer's Woodpecker	LZ G, LZ H[1], LZ N-1A, LZ N-1B, LZ 17, LZ 17B[1]	April - June	✓	✓	-
	Erithacus komadori komadori	*Akahige*	Ryukyu Robin	-	April - June	✓	✓	-
	Erithacus komadori namiyei	*Hontou-akahige*	Stejneger's Ryukyu Robin	LZ G[1], LZ H[1], LZ N-1A[1], LZ N-1B[1], LZ 17, LZ 17B[1]	April - June	✓	✓	-
	Scolopax mira	*Amami-yama-shigi*	Amami Woodcock	LZ G	March - May	✓	-	✓
	Columba janthina	*Karasu-bato*	Japanese Wood Pigeon	LZ G, LZ H, LZ N-1A, LZ N-1B, LZ 17, LZ 17B	September - December	✓	✓	-
Reptiles	*Geoemyda japonica*	*Ryukyu-yama-game*	Ryukyu Black-Breasted Leaf Turtle	LZ G[1], LZ H[1], LZ N-1A, LZ N-1B, LZ 17, LZ 17B[1]	April - June	-	✓	-
	Goniurosaurus kuroiwae kuroiwae	*Kuroiwa- tokage-modoki*	Kuroiwa's Ground Gecko	LZ G, LZ H, LZ N-1A, LZ N-1B, LZ 17, LZ 17B	April - July	-	-	✓
Amphibians	*Echinotriton andersoni*	*Ibo-imori*	Anderson's Alligator Newt	LZ G[1], LZ H, LZ N-1A, LZ N-1B, LZ 17, LZ 17B[1]	November - May	-	-	✓
	Limnonectes namiyei	*Namie-gaeru*	Namie's Frog	LZ G, LZ H, LZ N-1A, LZ N-1B, LZ 17, LZ 17B[1]	June - August	-	-	✓
	Odorrana ishikawae	*Ishikawa-gaeru*	Ishikawa's Frog	LZ G, LZ H, LZ N-1A, LZ N-1B, LZ 17, LZ 17B	January - February	-	-	✓
	Babina holsti	*Horusuto-gaeru*	Holst's Frog	LZ G, LZ H[1], LZ N-1A, LZ N-1B, LZ 17, LZ 17B	July - September	-	-	✓
Insects	*Kallima inachus eucerca*	*Konoha-cho*	Leaf Butterfly	LZ G, LZ H, LZ 17, LZ 17B	All Year	-	-	✓
	Polyura eudamippus weismanni	*Futao-cho*	Great Nawab Butterfly	LZ 17, LZ 17B	April - October	-	-	✓
Crustaceans	*Coenobita* sp.	*Oka-yadokari*	Hermit Crab	-	May - August	-	✓	-

Sources: Former Naha DFAB 2006 and MCB Camp Butler 2010a
Notes: [1]Species was recorded during surveys conducted by the former DFAB and recorded during previous watershed level surveys.
[2]U.S./GoJ designations for SC LZs: N-1A (U.S.) = N1.2 (GoJ); N-1B (U.S.) = N1.3 (GoJ); 17 (U.S.) = N4.1 (GoJ); LZ 17B (U.S.) = N4.2 (GoJ)

Vegetation

No change to vegetation would occur at the ISTF due to MV-22 operations. Maintenance of grasses, as is done currently would continue and use of the LZs is not expected to require removal of vegetation due to the lack of nearby tree lines that could inhibit MV-22 operations. Additionally, the probability of fire from MV-22 operations is negligible (see Section 4.1.6, Safety and Appendix B-1). Operation of the MV-22, itself, has been identified as the cause one wildfire during its entire operational history. A recent DoN review (DoN 2008) concluded that under normal operations with engine exhaust deflectors operating, the exhaust of the MV-22 should not heat the ground to a temperature high enough to support combustion of plant-based materials such as dry grasses. Current MV-22 operating procedures require operable deflectors for landing zones with unimproved surfaces. If deflectors are not working properly, pilots would not land on unimproved LZs. Lastly, disturbance to vegetation from rotorwash would be minimal as the area is primarily covered with grasses or is developed.

Minimal change to vegetation would occur in the NTA and CTA due to the proposed action. Some LZs in the NTA and CTA would require modifications to vegetation around landing points to accommodate MV-22 operations. Trees and shrubs occur within 75 feet of the landing points at 9 LZs in the NTA and 21 LZs in the CTA, and some vegetation removal may be necessary to adequately accommodate the MV-22 operations. Of these 30 LZs, however, only 2 LZs in the NTA (17 and Firebase Jones) and three LZs in the CTA (Dodo, Falcon, and Hawk) would be used frequently by the MV-22s, while six would have average use. If vegetation removal is needed, MCB Camp Butler has standard operating procedures for the removal of vegetation (personal communication, Sugiyama 2011) that includes:

1. Submitting a work request for any vegetation clearing that is reviewed for potential affects to natural resources;
2. Conducting a natural resources survey if cleared areas are near the habitat of a Protected Species; and
3. Coordination with the Okinawa Defense Bureau which is responsible for reimbursement to local land owners for trees larger than 4 cm in diameter.

As discussed above, the probability of fires from MV-22 operations is negligible. Fires in the CTA at ranges are primarily caused from the use of tracers, range clearance operations, and documented EOD training (MCB Camp Butler 2011). There is no history of wildfire at the NTA associated with training operations. Risk of fire is further reduced in forested areas due to the climatic conditions of Okinawa, which includes high volumes of rain and high humidity. In addition, each of the training areas operates under procedures for fire prevention and suppression. MCB Camp Butler has an existing maintenance program at all LZs to clear the landing point and reduce the height of grasses to prevent fires. Because of the negligible likelihood of fire related to use of the MV-22 aircraft and the existing fire procedures, use of the LZs is not likely to increase the frequency and extent of wildfires. Therefore, no significant change to vegetation would occur due to the proposed action.

Wildlife

With the implementation of mitigation measures for Protected Species, no significant harm would occur to wildlife due to the proposed action from changes in vegetation, noise, or rotorwash at the ISTF, the NTA, or the CTA. In general, the vegetation that is present in the areas immediately around the landing points is highly disturbed and overall, offers minimal habitat for most common wildlife. Although limited removal of vegetation could lead to temporary impacts on vegetation compositions directly surrounding the LZs, common wildlife would be likely to utilize adjacent habitats following any vegetation removal and would only be temporarily affected.

Under the proposed action, average noise levels would be similar to the current noise levels or less. With the change from CH-46E to MV-22 training, there would be a substantial decrease (12 percent) in overall CAL operation levels with the training areas. The frequency of operations at 82 percent of the LZs would either decrease or remain the same. Numbers of operations would increase at the LZs in the ISTF and six LZs in the CTA. However, all of these LZs are currently being used for CH-46E training.

Short-term startle effects due to noise created by MV-22 operations and visual sightings of the aircraft could cause temporary displacement of individuals inhabiting areas surrounding the LZs. However, wildlife, including migratory birds, in the vicinity of all LZs are currently exposed to noise from military aircraft and are not expected to permanently react or modify behavior as a result of minimal noise increases due to the proposed action. Studies of subsonic noise from aircraft on ungulates (e.g., pronghorn, bighorn sheep, elk, and mule deer), in both laboratory and field conditions, have shown that effects are transient and of short duration, and suggest that the animals habituate to the sounds (Workman *et al.* 1992, Bowles 1995, Weisenberger *et al.* 1996). Similarly, the impacts to raptors and other birds from aircraft low-altitude flights were found to be brief and insignificant and not detrimental to reproductive success (Smith *et al.* 1988, Lamp 1989, Ellis *et al.* 1991, Grubb and Bowerman 1997). Noise levels at tactical LZs in the NTA and CTA would remain unchanged or would decrease as a result of the proposed action (see Section 4.1.3, Noise). Therefore, effects to wildlife from training operations would not be significant.

As discussed in Section 4.1.6, the wind velocities of rotorwash created by MV-22 operations are dependent upon the altitude of the aircraft, distance from aircraft center, angle around the aircraft, and the height above ground. Depending on each of these variables, the velocities of rotorwash from a MV-22 are approximately three times that of the rotorwash velocities generated by the existing CH-46E, although near the landing point, wind gusts are similar to those produced by the CH-53s. At greater distances (200 feet from the center of the landing point), wind gusts generated by the MV-22 could be as much as 57 mph if not attenuated by vegetation.

Wildlife would be expected to leave areas near the landing point when noise of an approaching or exiting MV-22 aircraft occurred. This reaction would serve to limit exposure of the individual to rotorwash created by the MV-22. It is expected that wildlife inhabiting areas surrounding the existing LZs have habituated to existing noise and wind levels caused by CH-46E and CH-53 operations; however, breeding sites of these individuals could be damaged or destroyed as a result of the increase in rotorwash velocities. Given the size of the populations, mortality of a few individuals and/or breeding sites of common wildlife, including migratory birds, would not be expected to have long term effects on overall population numbers. Displaced individuals would be expected to inhabit adjacent habitat areas as a result of this increase in rotorwash. Therefore, there would be no significant harm to wildlife from MV-22 training operations at the LZs.

Protected Species

The potential impact analysis process for Protected Species at the LZs is illustrated in Figure 4.1.7-1. Out of a total of 50 tactical LZs, Protected Species have been found at 22 LZs (1 LZ at the ISTF, 9 LZs in the NTA, and 12 LZs in the CTA; refer to Table 4.1.7-3). However, significant impacts to these species would not occur due to changes in vegetation at the LZs, the frequency of training operations, or aircraft noise for the following reasons:

1. As discussed under the preceding section, minimal to no change to vegetation would occur in the ISTF, NTA, and CTA due to the proposed action. The probability of fire at these LZs is low and only limited initial vegetation clearing could be required at a small number of LZs. None of these actions would change vegetation coverage in the immediate area.
2. Training operations at 18 of the LZs with Protected Species would either decrease or would not change from the number of CH-46E operations currently (refer to Table 4.1.7-1). Increases would only occur at LZs Swan, Kin Blue, and the LHD Deck. LZs Swan and Kin Blue in the CTA and the LHD Deck in the ISTF only contained hermit crabs. Aircraft landings and takeoffs at these LZs would be focused in areas devoid of vegetation or in prepared surfaces or grasslands, thus avoiding direct impacts to this species.
3. Noise levels at the ISTF would remain the same as current noise levels, and noise levels at most LZs in the NTA and CTA would decrease or be the same as current noise levels. Noise levels at LZs Kin Blue and Swan would increase slightly, but increases would be focused around the cleared landing point where species are not likely to occur. Therefore, effects to Protected Species from noise would not be significant.

Therefore, no significant harm would occur to protected birds, reptiles, amphibians, or crustaceans due to the proposed action from changes in vegetation, operations, and noise at the ISTF, the NTA, or the CTA. Adverse impacts to protected bird species could occur due to increases in wind velocity from MV-22 rotorwash at certain LZs. These adverse effects may occur under the following conditions:

1. Where individual Protected Species are nesting and would be unlikely to abandon their active nests, and
2. Where wind velocities associated with MV-22 rotorwash exceed wind gusts normally occurring in the area from existing CH-46E and CH-53 operations.

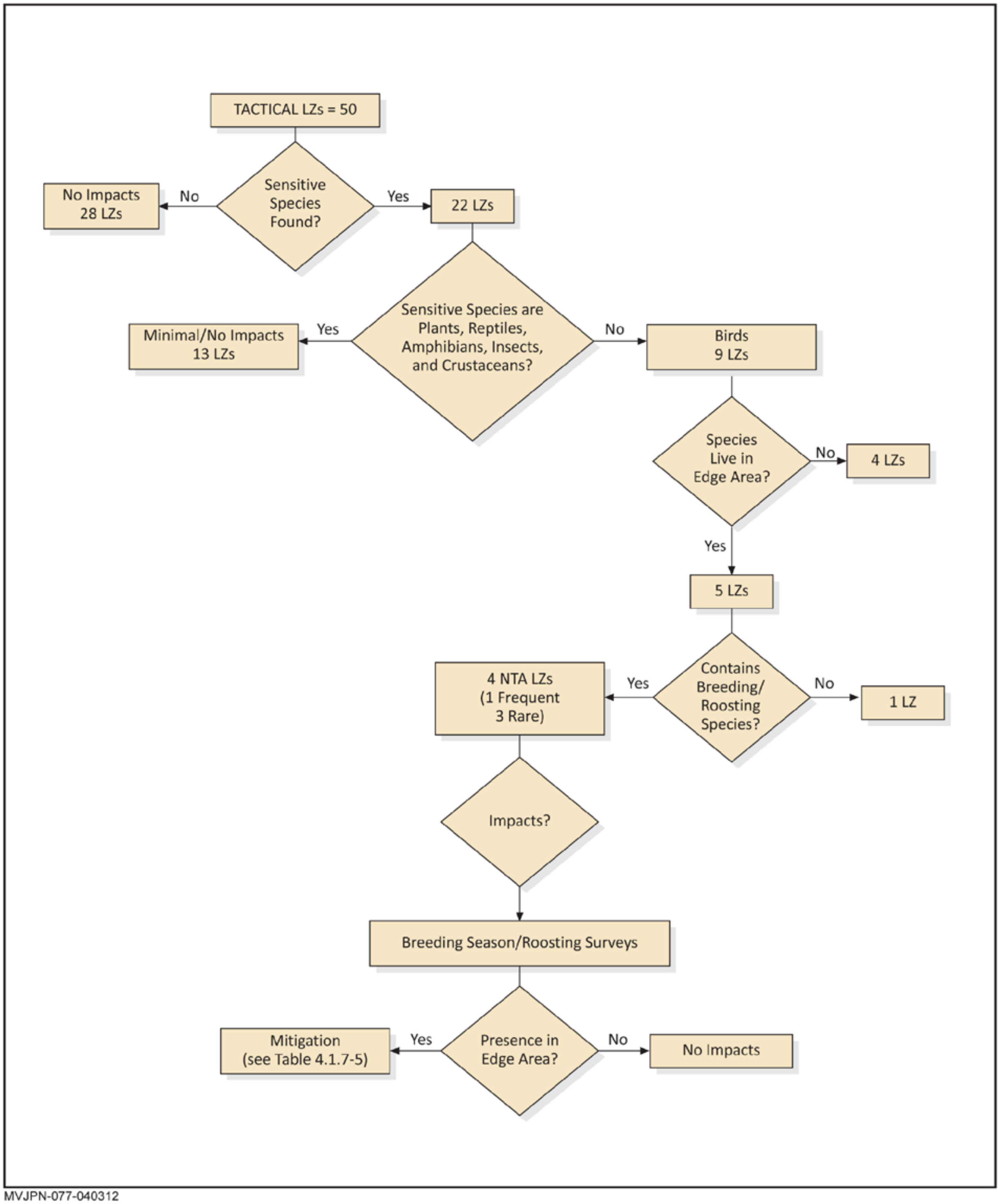


Figure 4.1.7-1. Potential Impact Analysis Process for Protected Species

The loss of individuals or nests of a protected bird species caused by increased rotorwash is possible at locations no more than 300 feet from the landing point if void of vegetation, or within forest edges if located less than 300 feet from the landing point. In these locations, vegetation would not greatly attenuate rotorwash velocities, and nesting or breeding individuals would be less likely to disperse upon increased wind gusts due to MV-22 operations in order to protect their young and/or breeding sites. If the forest edge occurs beyond 300 feet of the landing area, rotorwash velocities would be around 47 mph and would not be expected to cause harm to individual nests or roosting sites since natural wind gusts of this velocity are common.

In addition to attenuation due to distance from the landing point, dense vegetation surrounding the landing points would also act as windbreaks and attenuate rotorwash velocities to less than 47 mph. At a distance of 100 feet from the forest edge, vegetation would attenuate wind velocities to a maximum of approximately 16 mph, far less than wind velocities that occur naturally. Fifty feet of vegetation would provide densities consistent with windbreaks used in agricultural settings (3 to 5 rows of tall trees). Thus, rotorwash velocities in areas further than 50 feet from the forest edge are expected to attenuate wind speeds enough to have no significant impact upon breeding individuals or nests. Therefore, only breeding or roosting individuals or nests within 50 feet of the forest edge or within 300 feet of the landing point in cleared areas would likely be affected by rotorwash (Figure 4.1.7-2). Five protected bird species were previously found at nine LZs in the NTA (LZs 1, 3, 4, 12, 15, 17, 18, Baseball, and Firebase Jones). These species include the Ryukyu robin, Okinawa rail, Amami woodcock, Pryer's woodpecker, and the Japanese wood pigeon. The following discussion outlines overall characteristics of these species and the likelihood of impacts to nesting or roosting individuals in the area most likely to be affected by rotorwash.

Ryukyu Robin

The Ryukyu robin, *Erithacus komadori*, is the most abundant of the endemic birds restricted to the Nansei Shoto archipelago, Japan. Three subspecies are currently recognized, but only *namiyei* and *komadori* inhabit Okinawa Prefecture. Population totals for the Ryukyu robin are considered to be around 80,000-90,000 individuals. It remains common in the northern part of Okinawa, but steep declines have been reported from other islands (BirdLife International 2011). There have been 430 sightings from watershed studies and other studies, with individuals scattered throughout the NTA (MCB Camp Butler 2010a). This species was recorded at LZs 1, 3, and Firebase Jones in 2011 (see Appendix D).

The species inhabits dense undergrowth in damp areas within riparian broad-leaved evergreen forest (BirdLife International 2011), but also inhabits secondary forests, bamboo groves, and forests with low vegetation (MCB Camp Butler 2006e). It nests in crevices or among the roots of trees from May to August (BirdLife International 2011). In the Arakawa watershed flora and fauna survey (MCB Camp Butler 2006e), nests were found in an area approximately 60 feet from both sides of rivers. Since it nests in dense vegetation on the forest floor or in crevices and riparian areas, its nesting area is not likely to be disturbed by rotorwash. Although disruption during the robin's breeding season could occur due to MV-22 rotorwash, population numbers of the species are relatively large and no significant harm to the

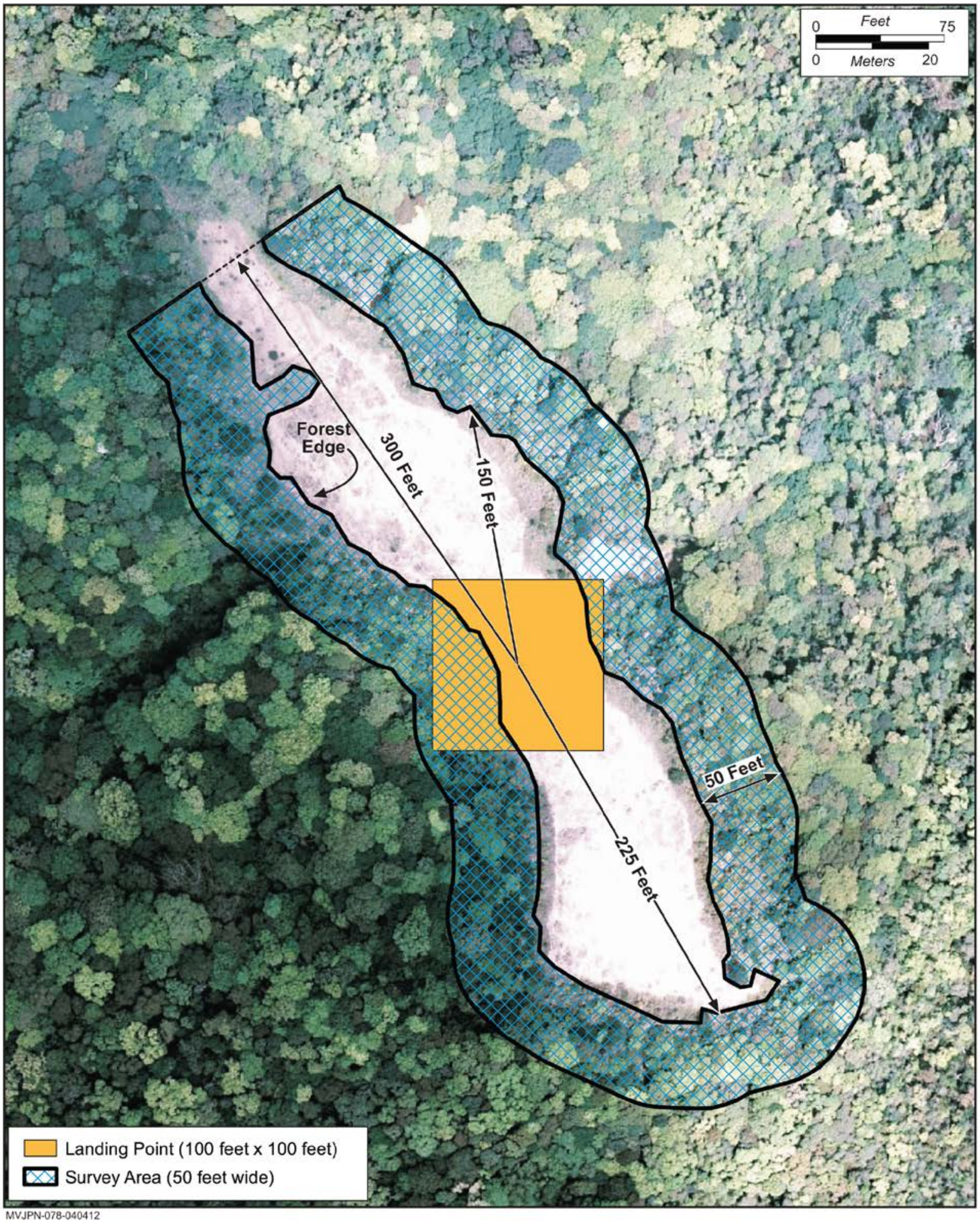


Figure 4.1.7-2. Representative Area of Potential Effect/Survey Area for Breeding/Roosting Protected Bird Species in the NTA

species population would occur (Bird Life International 2011). Therefore, impacts to nesting Ryukyu robins would be minimal due to MV-22 training operations.

Okinawa Rail

Surveys conducted between 1996 and 2004 estimated 717 total individuals, with no further decrease in population size in a 2006 survey (Bird Life International 2011). In an extensive USMC survey conducted in 2009 (MCB Camp Butler 2010c), the rail habitat was shown to be expanding to the north, which was attributed to joint U.S. and GoJ trapping of alien carnivorous species such as the Indian mongoose and roof rat (MCB Camp Butler 2010c). USMC surveys in the last five years suggest that Okinawa rail populations in the NTA are increasing. Based on the watershed studies and other studies, the occurrences of rails are widely scattered throughout the NTA area and further north (MCB Camp Butler 2010a), including within the buffer areas for LZs 1 and 3. Rails were observed at LZs 1, 3, and Firebase Jones during the 2011 surveys (see Appendix D).

Birdlife International (2011) describes its habitat as variable, including “primary and secondary, evergreen and broadleaf subtropical forest, often with a dense undergrowth of ferns, near to streams, pools or reservoirs and cultivated areas close to forest.” It is usually found in dense cover but comes into the open to bathe in standing water. The rail is nearly flightless, feeding on the forest floor, and sometimes in shallow water. Nests are constructed on the ground with the breeding season occurring from March through June (personal communication, MCB Camp Butler 2012). The time period of nesting averages 21 to 30 days. At night it roosts in trees, using a site repeatedly (Bird Life International 2001). Since the Okinawa rail nests on the forest floor, typically in dense undergrowth, its nesting area and nest are not likely to be destroyed by rotorwash. However, potential nest abandonment due to helicopter rotorwash disturbance could occur. In addition, since the rails roosts in trees overnight, any roosting area could also potentially be disrupted. Roosting is likely an adaptation to reduce predation by snakes, and would now also serve to reduce predation by mongoose and feral cats. If roosts were disturbed in the evening by helicopter rotorwash, animals may not be able to re-roost for that evening and possibly longer, putting them in greater danger of predation. If Okinawa rails are roosting or nesting within cleared areas or along the forest edge near landing points, rotorwash from MV-22 operations could have a significant effect on this species. However, although they have been recorded at three LZs in the NTA, it is not known if they reside near the landing points.

Amami Woodcock

Scolopax mira is endemic to the Nansei Shoto Islands in southern Japan, where it is recorded from the islands of Amami-ooshima, Kakeroma-jima, Toku-no-shima, Okinawa and Tokashiki-jima. On Okinawa, its population is small (<10,000 individuals) and confined to the northern part of the island. The population has declined since 2002, but following conservation efforts, it has begun to increase. There are only three records of this species in the NTA watershed (MCB Camp Butler 2010a), including a sighting at LZ 18.

This bird is a ground-dwelling species, which feeds and nests on the ground. It prefers shady broadleaf evergreen forest. It will feed in open areas such as near roads, and in winter it has been found near villages and in sugarcane fields. Given the potential to occur in all habitats, the species could be present at any location; however, there have been no reliable breeding reports on Okinawa recently and most sightings on Okinawa have occurred during the non-breeding winter season (Kotake 2010). As the Amami woodcock breed and nest elsewhere, rotorwash from MV-22 operations would have minimal effects on this Protected Species.

Pryer's Woodpecker

Sapheopipo noguchii is endemic to Okinawa Island, Japan, where it is confined to Kunigami-gun (Yambaru forest) with the main breeding areas along the mountain ridges between Mt Nishime-take and Mt Iyu-take. It also occurs in coastal areas. It was considered close to extinction in the 1930s. In the early 1990s, the breeding population was estimated to be approximately 75 birds and the total population between 146 to 584 birds. A density of 12.1 birds per km^2 has been estimated in the NTA (Birdlife International 2011). Surveys in 2011 recorded this species at LZs 1, 3, and Firebase Jones.

This species prefers evergreen broadleaved forest at least 30 years old and with trees more than 8 inches in diameter. It typically nests in a tree cavity, usually a large dead or dying *Castanopsis*. Since this species prefers older forests for feeding and nesting, it is less likely to occur near the landing points and, as they nest in tree cavities, they are not likely to be physically affected by rotorwash. Therefore, impacts to nesting Pryer's woodpecker would be minimal due to MV-22 training operations.

Japanese Wood Pigeon

Columba janthina is an uncommon and local resident in Japan whose population was thought to have declined on Okinawa during the 1980s because of forestry activities. The global population size has not been quantified, but the species is described as uncommon (Birdlife International 2011). The species has been recorded in the NTA primarily within the Arakawa and watershed east of Arakawa, but also in the Sunnumata watershed (MCB Camp Butler 2010a).

This species inhabits coastal shrub forests, evergreen, broad-leaved forests, and secondary forests having a mixture of Ryukyu pine and broad-leaved trees (MCB Camp Butler 2006e). However, the species is "heavily dependent on mature forest" (Birdlife International 2011). The nests of this species are made from twigs and placed on a tree or inside a tree hole (MCB Camp Butler 2006e). Given the potential to occur in most habitat types, the species could be present at any location within the NTA.

Nests would likely be located in forested areas that offered suitable cover; however, there is potential for nests to be located along forest edges where they could be affected by rotorwash velocities. Although not documented in 2011 surveys, it has been documented within the buffer zone of LZ 12 in previous studies. If Japanese wood pigeons are nesting within cleared areas or along the forest edge near landing points, rotorwash from MV-22 operations could have a significant effect on this species. However, although they have been recorded at LZ 12 in the past, it is not known if they currently reside near the landing point.

Mitigation Measures

MV-22 operations associated with the proposed action have the potential to cause significant harm to two nesting or roosting protected bird species if they nest or roost in the forest edge areas immediately surrounding the landing points of four tactical LZs in the NTA. Under JEGS, "installations that have land and water areas shall take reasonable steps to protect and enhance known endangered or threatened species and GoJ-Protected Species and their habitat." In order to ensure that no significant harm occurs to these species, the USMC would conduct additional surveys and institute mitigation measures, if appropriate, to reduce potential impacts to less than significant levels (Table 4.1.7-5).

1. Surveys would be conducted at LZs 1, 3, 12, and Firebase Jones to identify nesting and roosting birds in the area of potential effect prior to the initial use of the LZs by MV-22 aircraft.
2. ***Okinawa Rail:*** At LZs 1, 3, and Firebase Jones, initial surveys for rail roosting and nesting sites would occur at the beginning of breeding season. The timing for the survey is anticipated to be in March, but the survey would be initiated at the discretion of the MCB Camp Butler Natural Resources Manager. A qualified biologist would conduct nesting and roosting site surveys in all areas within 50 feet of forest edges (see Figure 4.1.7-2) that contained sufficient nesting and breeding habitat. Since all individual rails do not nest during the beginning of the breeding season (March), nesting site surveys would also be conducted in mid breeding season (approximately mid-April) at these LZs. If nests were found within the area of potential effect during either survey, MV-22 operations would be suspended at that LZ for a 30-day period to ensure that all young had left the nest. If a rail roosting site is identified, MV-22 daytime operations could continue, but night operations (after sunset) would be suspended until additional biological surveys indicate that roosting areas are no longer being used.
3. ***Japanese Wood Pigeon:*** At LZ 12, initial surveys for nesting sites would occur at the beginning of breeding season. The timing for the survey is anticipated to be in September, but the survey would be initiated at the discretion of the MCB Camp Butler Natural Resources Manager. A qualified biologist would conduct nesting site surveys in all areas within 50 feet of forest edges that contained sufficient nesting and breeding habitat. If nests are found within the area of potential effect, MV-22 operations would be suspended at that LZ until follow up surveys showed all young had left the nest.

Table 4.1.7-5. Protected Species Breeding Periods and Mitigation Schedule for Existing Tactical LZs in Okinawa					
#	**LZ Designation**	**Protected Species Breeding Periods**		**Mitigation Survey Period**	**Potential Operational Limitations**
		Okinawa Rail	***Japanese Wood Pigeon***		
1	LZ 1	March-June	-	• Beginning of March (Okinawa rail) • Mid-April (Okinawa rail)	• No MV-22 operations: ▪ Until initial biological surveys are conducted in 2012. • March – April: ▪ no operations during annual surveys ▪ 1 week in early March and 1 week survey in late April • 30-day period: ▪ If nesting sites present, no MV-22 operations for 30 day period after nest is found. • Night operations (after sunset): ▪ If roosting (sleeping) sites present, no MV-22 night operations (after sunset) until surveys indicate that roosting areas are no longer being used.
2	LZ 3	March-June	-	• Beginning of March (Okinawa rail) • Mid-April (Okinawa rail)	• No MV-22 operations: ▪ Until initial biological surveys are conducted in 2012. • March – April: ▪ no operations during annual surveys ▪ 1 week in early March and 1 week survey in late April • 30-day period: ▪ If nesting sites present, no MV-22 operations for 30 day period after nest is found. • Night operations (after sunset): ▪ If roosting (sleeping) sites present, no MV-22 night operations (after sunset) until surveys indicate that roosting areas are no longer being used.
3	LZ 12	-	September - December	• Beginning of September (Japanese wood pigeon)	• September: ▪ No operations during annual surveys ▪ 1 week period • Until all young have fledged: ▪ If nesting sites are present, no MV-22 operations until biological surveys indicate that all young have left the nest
4	Firebase Jones	March-June	-	• Beginning of March (Okinawa rail) • Mid-April (Okinawa rail)	• No MV-22 operations: ▪ Until initial biological surveys are conducted in 2012. • March – April: ▪ no operations during annual surveys ▪ 1 week in early March and 1 week survey in late April • 30-day period: ▪ If nesting sites present, no MV-22 operations for 30 day period after nest is found. • Night operations (after sunset): ▪ If roosting (sleeping) sites present, no MV-22 night operations (after sunset) until surveys indicate that roosting areas are no longer being used.

Landing Zones Scheduled for Construction

Potential effects to biological resources resulting from the construction of six LZs scheduled for construction by the GoJ have been previously assessed by the former Naha DFAB Report (2006, 2007) and are not part of the proposed action. Vegetation removal of approximately 1.1 acres will occur at each SC LZ location during their construction (former Naha DFAB 2006). This will provide a cleared area of approximately 250 feet in diameter for use by the MV-22. As a result of this vegetation clearing, there will be no vegetation within approximately 125 feet of the landing point and no further vegetation is expected to be removed as part of the proposed action. Although the timing of construction and availability of these LZs for use is not known, once constructed, the SC LZs could be used by MV-22 aircraft for training operations. At that time, three existing LZs in the NTA (LZs 1, 3, and Firebase Jones) would no longer be used. This ER examines potential impacts to biological resources from MV-22 training operations at the SC LZs.

Except for SC LZs 17 and 17B, noise at four of the SC LZs would increase over current conditions. The SC LZs 17 and 17B landing points would be located within approximately 160 and 320 feet, respectively, from the existing LZ 17 landing point and are expected to receive only a slight increase in noise due to operations currently being conducted at existing LZ 17. However, since no suitable habitat would be located within approximately 125 feet of each SC LZ center point, impacts to wildlife and Protected Species due to noise would be temporary and minimal. Additionally, since the areas around the landing points at all SC LZs would be covered with turf and native plants, the risk of fire would be minimal. Therefore, there would be no significant harm to vegetation, wildlife, or Protected Species from noise or wildfires due to MV-22 training operations at the SC LZs.

Since no operations are currently being conducted in these LZs, landing points at SC LZs G, H, N-IA, and N-IB would be exposed to wind gusts created by MV-22 rotorwash. Although near existing LZ 17, SC LZs 17 and 17B also would experience an increase in wind gusts over current conditions. Wildlife and Protected Species would inhabit areas outside of the 125 feet cleared area where wind gusts are much less than at the landing point, and therefore effects to wildlife and Protected Species would be less than significant. However, as discussed in the previous section, if nesting or roosting protected bird species occur in forest edge areas near the landing point, significant impacts could occur due to an increase in rotorwash from the MV-22 aircraft. These potential impacts would be confined to a limited area at all SC LZs where two protected bird species (Okinawa rail and Japanese wood pigeon) have been found in the past. In order to ensure that no significant harm occurs to these species, the USMC would conduct additional surveys and institute mitigation measures, if appropriate, to reduce potential impacts to less than significant levels (Table 4.1.7-6).

1. Surveys would be conducted at SC LZs G, H, N-1A, N-1B, 17, and 17B to identify nesting and roosting birds in the area of potential effect prior to use of the LZs by MV-22 aircraft.
2. ***Okinawa Rail:*** At SC LZs G, H, N-1A, N-1B, 17, and 17B initial surveys for rail roosting and nesting sites would occur at the beginning of breeding season. The timing for the survey is anticipated to be in March, but the survey would be initiated at the discretion of the MCB Camp Butler Natural Resources Manager. A qualified biologist would conduct nesting and roosting

site surveys in all areas within 50 feet of the forest edge (see Figure 4.1.7-2) that contained sufficient nesting and breeding habitat. Since all individual rails do not nest during the beginning of the breeding season (March), nesting site surveys would also be conducted in mid breeding season (approximately mid-April) at these LZs. If nests were found within the area of potential effect during either survey, MV-22 operations would be suspended at that LZ for a 30-day period to ensure that all young had fledged. If a rail roosting site is identified, MV-22 daytime operations could continue, but night operations (after sunset) would be suspended until additional biological surveys indicate that roosting areas are no longer being used.,

3. ***Japanese Wood Pigeon:*** At SC LZs G, H, N-1A, N-1B, 17, and 17B, initial surveys for nesting sites would occur at the beginning of breeding season. The timing for the survey is anticipated to be in September, but the survey would be initiated at the discretion of the MCB Camp Butler Natural Resources Manager. A qualified biologist would conduct nesting site surveys in all areas within 50 feet of forest edges that contained sufficient nesting and breeding habitat. If nests were found within the area of potential effect, MV-22 operations would be suspended at that LZ until follow up surveys showed all young had left the nest.

Table 4.1.7-6. Protected Species Breeding Periods and Mitigation Schedule for SC LZs in Okinawa

#	LZ Designation[1]	Protected Species Breeding Periods		Mitigation Survey Period	Potential Operational Limitations
		Okinawa Rail	***Japanese Wood Pigeon***		
1	SC LZ G	March-June	September - December	• Beginning of March (Okinawa rail) • Mid-April (Okinawa rail) • Beginning of September (Japanese wood pigeon)	• No MV-22 operations: ▪ Until initial biological surveys are conducted. • March – April: ▪ no operations during annual surveys ▪ 1 week in early March and 1 week survey in late April • 30-day period: ▪ If nesting sites present, no MV-22 operations for 30 day period after nest is found. • Night operations (after sunset): ▪ If roosting (sleeping) sites present, no MV-22 night operations (after sunset) until surveys indicate that roosting areas are no longer being used. • September: ▪ No operations during annual surveys ▪ 1 week period • Until all young have fledged: ▪ If nesting sites are present, no MV-22 operations until biological surveys indicate that all young have left the nest

Table 4.1.7-6. Protected Species Breeding Periods and Mitigation Schedule for SC LZs in Okinawa (con't)					
#	**LZ Designation[1]**	**Protected Species Breeding Periods**		**Mitigation Survey Period**	**Potential Operational Limitations**
		Okinawa Rail	***Japanese Wood Pigeon***		
2	SC LZ H	March-June	September - December	• Beginning of March (Okinawa rail) • Mid-April (Okinawa rail) • Beginning of September (Japanese wood pigeon)	• No MV-22 operations: ▪ Until initial biological surveys are conducted. • March – April: ▪ no operations during annual surveys ▪ 1 week in early March and 1 week survey in late April • 30-day period: ▪ If nesting sites present, no MV-22 operations for 30 day period after nest is found. • Night operations (after sunset): ▪ If roosting (sleeping) sites present, no MV-22 night operations (after sunset) until surveys indicate that roosting areas are no longer being used. • September: ▪ No operations during annual surveys ▪ 1 week period • Until all young have fledged: ▪ If nesting sites are present, no MV-22 operations until biological surveys indicate that all young have left the nest
3	SC LZ N-1A	March-June	September - December	• Beginning of March (Okinawa rail) • Mid-April (Okinawa rail) • Beginning of September (Japanese wood pigeon)	• No MV-22 operations: ▪ Until initial biological surveys are conducted. • March – April: ▪ no operations during annual surveys ▪ 1 week in early March and 1 week survey in late April • 30-day period: ▪ If nesting sites present, no MV-22 operations for 30 day period after nest is found. • Night operations (after sunset): ▪ If roosting (sleeping) sites present, no MV-22 night operations (after sunset) until surveys indicate that roosting areas are no longer being used. • September: ▪ No operations during annual surveys ▪ 1 week period • Until all young have fledged: ▪ If nesting sites are present, no MV-22 operations until biological surveys indicate that all young have left the nest

Table 4.1.7-6. Protected Species Breeding Periods and Mitigation Schedule for SC LZs in Okinawa (con't)					
#	LZ Designation[1]	Protected Species Breeding Periods		Mitigation Survey Period	Potential Operational Limitations
		Okinawa Rail	*Japanese Wood Pigeon*		
4	SC LZ N-1B	March-June	September - December	• Beginning of March (Okinawa rail) • Mid-April (Okinawa rail) • Beginning of September (Japanese wood pigeon)	• No MV-22 operations: ▪ Until initial biological surveys are conducted. • March – April: ▪ no operations during annual surveys ▪ 1 week in early March and 1 week survey in late April • 30-day period: ▪ If nesting sites present, no MV-22 operations for 30 day period after nest is found. • Night operations (after sunset): ▪ If roosting (sleeping) sites present, no MV-22 night operations (after sunset) until surveys indicate that roosting areas are no longer being used. • September: ▪ No operations during annual surveys ▪ 1 week period • Until all young have fledged: ▪ If nesting sites are present, no MV-22 operations until biological surveys indicate that all young have left the nest
5	SC LZ 17	March-June	September - December	• Beginning of March (Okinawa rail) • Mid-April (Okinawa rail) • Beginning of September (Japanese wood pigeon)	• No MV-22 operations: ▪ Until initial biological surveys are conducted. • March – April: ▪ no operations during annual surveys ▪ 1 week in early March and 1 week survey in late April • 30-day period: ▪ If nesting sites present, no MV-22 operations for 30 day period after nest is found. • Night operations (after sunset): ▪ If roosting (sleeping) sites present, no MV-22 night operations (after sunset) until surveys indicate that roosting areas are no longer being used. • September: ▪ No operations during annual surveys ▪ 1 week period • Until all young have fledged: ▪ If nesting sites are present, no MV-22 operations until biological surveys indicate that all young have left the nest
6	SC LZ 17B	March-June	September - December	• Beginning of March (Okinawa rail) • Mid-April (Okinawa rail) • Beginning of September (Japanese wood pigeon)	• No MV-22 operations: ▪ Until initial biological surveys are conducted. • March – April: ▪ no operations during annual surveys ▪ 1 week in early March and 1 week survey in late April • 30-day period: ▪ If nesting sites present, no MV-22 operations for 30 day period after nest is found. • Night operations (after sunset): ▪ If roosting (sleeping) sites present, no MV-22 night operations (after sunset) until surveys indicate that roosting areas are no longer being used. • September: ▪ No operations during annual surveys ▪ 1 week period • Until all young have fledged: ▪ If nesting sites are present, no MV-22 operations until biological surveys indicate that all young have left the nest

Note: [1]U.S./GoJ designations for SC LZs: N-1A (U.S.) = N1.2 (GoJ); N-1B (U.S.) = N1.3 (GoJ); 17 (U.S.) = N4.1 (GoJ); LZ 17B (U.S.) = N4.2 (GoJ)

4.1.8 Cultural Resources

Section 3.8 provides a general discussion of cultural resource definitions and related laws and regulations, and the following addresses conditions and impacts for the LZs and training areas. The affected area for cultural resources at the LZs includes the landing point and a surrounding buffer zone measuring no more than 350 feet. As noted in Section 2.2.2.2, this buffer zone stems from consideration of potential effects from rotorwash. However, direct effects to cultural resources would occur in a much smaller area, principally within cleared areas at and adjacent to the landing point. Indirect effects due to visual intrusions to known sites would not change from current conditions since all areas are currently used for training by CH-46E squadrons.

4.1.8.1 Current Environment

An examination of cultural resource GIS information for survey and site locations around Okinawa and Ie Shima shows that the majority of the LZs have not been surveyed for culture resources. However, some general statements can be made on the likely locations of cultural assets and the potential for increased impacts to the environment. Information on cultural resources within the training areas was obtained from the MCB Camp Butler Integrated Natural Resources and Cultural Resources Management Plan (MCB Camp Butler 2009a) and the MCB Camp Butler Environmental Office Geographic Information System database (MCB Camp Butler 2010b).

Ie Shima Training Facility

Information on cultural assets in the area derives from a cultural resource inventory produced by the Ie Village (Ie-son) Board of Education in 1999 (MCB Camp Butler 2009b), which reported five archaeological sites within the boundary of the ISTF. These include the Oyatake Fossilized Deer-bone Find (Site 4), the Oyatake Reef Fossilized Deer-bone Find Site (Site 5), the Maanupana Stone Tool Find Site (Site 6), the Gohezu Cave Site (Site 11), and the Terakoshi Site (Site 32). The Gohezu Cave Site is a Prefecture Designated Property. An archaeological survey of the ISTF in 2012, recorded 28 traditional sites, primarily around the limestone cliffs (Dixon 2012). No sites were observed on the surface at the 125-acre use area which contains the LZs.

Northern Training Area

A cultural resources inventory has not been conducted for the NTA. However, expectations on the locations of cultural assets can be made based on general knowledge of resources in the region.

Prehistoric sites in the northern region are thinly distributed in comparison to the southern region of the island. Cultural sites ranging from the Early to Late Shellmound Period (circa 3,500 Before Present to circa 800 Before Present) are typically located on sand dunes, the coast and in alluvial flats along streams. The limited flat land and steep topography of the NTA, potentially explains the lack of prehistoric property distribution in the area. The cultural properties that may exist in the NTA would be those which were generated in the latter Gusuku Period. It is said that silviculture in the mountainous area was gradually facilitated in the Gusuku Period, and was systematically administrated by the Ryukyu Kingdom in the latter Kingdom Period. Lumber and charcoal were primary products of the northern region in these periods. Camphor production flourished before World War II. The properties expected to exist are: charcoal kilns, camphor production related facilities (kiln, ponds, ditch), paths, irrigation ditches, ponds, artificial flat space for inhabitation, copper mines, sacred sites and related monuments, cultivated areas, tombs, wild boar traps, bomb shelters, military strong points, stone walls and planted trees.

Central Training Area

There are no World Heritage sites or Japanese equivalent National Register properties that have been identified at the CTA, although limited surveys have been conducted there. In 1996, background research was conducted for the CTA, the Gimbaru Training Area, and Kin Blue Beach Training Area to understand the distribution of cultural resources in the region and to assess the possible distribution and types of cultural resources within the training areas. Approximately 355 acres of the CTA, Gimbaru Training Area, and Kin Blue Beach Training Area were then surveyed using pedestrian transects. In 2006, MCB Camp Butler conducted a documentary archival research and a field verification survey for archaeological and cultural resources in the Ginoza Watershed in the CTA. The survey identified 82 archaeological sites, such as a charcoal kiln, tunnel shelter, habitation terrace, stone retaining wall, agricultural field, Indigo dying complex, dam, trench and wild boar trap.

According to the results of a 1998 survey (MCB Camp Butler 2009a) and the 2007 Ginoza Watershed Survey (Welch *et al.* 2007), it has been confirmed that archaeological and cultural resources are more abundant in the coves along the streams than in other areas of the CTA. The Ginoza Watershed Survey did examine areas within and near LZs Condor, Duck, Dodo, Owl, and Peacock. No cultural assets were recorded within the buffer zones of these LZs.

Landing Zones Scheduled for Construction

All the SC LZs lie within the NTA, so characterization of that area would apply to these LZs. The former Naha DFAB Report (2006) on these SC LZs did not specifically mention cultural resources within the surrounding area. However at all SC LZs a 1.1-acre area would be cleared and paved prior to use.

4.1.8.2 Environmental Impacts

For this action, disturbance to any cultural assets if present in the area is expected to be minimal since all of the LZs proposed for use are already either constructed with impervious surfaces or cleared and have been subject to these conditions in the past. Of the LZs at the ISTF, four reflect extensive development and/or disturbance. Of the twelve LZs at the NTA, nine contain small, cleared open areas surrounded by thick vegetation. Three others are partially or largely cleared. Of the 32 LZs at the CTA, all are wholly or partially cleared.

Although rotorwash from an MV-22 aircraft during landing, take-offs, and hovering immediately above the ground may disturb artifacts (if present) lying on the surface in the immediate vicinity of the hovering aircraft, the extent of this disturbance would depend on local soil characteristics, presence of vegetation, and size/weight of artifacts. In most cases, landing points are prepared or cleared as discussed above and most areas surrounding the pads are covered with some type of vegetation, which would prevent the disturbance of individual artifacts. Rotorwash is unlikely to affect any built resources such as stone walls or tombs, which are heavier and not likely to be affected by winds.

Natural Monument species in Japan are also protected as cultural resources in accordance with Section 402 of the National Historic Preservation Act. As Natural Monument species are on Japan's equivalent to the National Register of Historic Places, Section 402 requires that the U.S. agency take into account the effect of the action for purposes of avoiding or mitigating adverse effects. Natural resources surveys in the LZs identified the presence of five Natural Monument species at 15 existing LZs. These species include the Okinawa rail, Pryer's woodpecker, the Ryukyu robin, the Ryukyu Black-Breasted leaf turtle, and the hermit crab. No harm would occur to the Black-Breasted leaf turtle or the hermit crab. As discussed in Section 4.1.7, rotorwash from MV-22 operations at four LZs in the NTA could affect nesting birds during breeding season if they are found in cleared or forest edge areas near landing points. This adverse impact could occur to the Okinawa rail and the Japanese wood pigeon, but is unlikely to affect the Pryer's woodpecker and the Ryukyu robin. Mitigations for reducing adverse impacts to the Okinawa rail and Japanese wood pigeon are discussed in Section 4.1.7. With the implementation of these mitigation measures, no significant harm would occur to these Natural Monument species.

Standard operating procedures for cultural resources include contacting the base archaeologist whenever cultural resources, suspected properties, or human remains are discovered in an area. Based on these procedures and previous studies, there would be no significant harm to World Heritage Listed, GoJ, Prefecture, or Municipality Designated Properties due to implementation of the proposed action.

Landing Zones Scheduled for Construction

As all SC LZs would be previously cleared and constructed, no direct or indirect impacts to cultural resources would occur due to MV-22 training activities. Previous natural resource surveys identified six Natural Monument Species; Natural Monument species occurred at all six of the SC LZs. These species included the Okinawa rail, Pryer's woodpecker, Ryukyu robin, Japanese wood pigeon, Ryukyu black-breasted leaf turtle, and the hermit crab. Rotorwash from MV-22 operations could affect roosting or nesting Okinawa rails and nesting Japanese wood pigeon if they are found in forest edge areas near landing points. Mitigation measures would reduce these affects to less than significant levels.

4.1.9 Geology and Soils

This section describes geological, topographic, and soil conditions in the project region. In particular it examines geology and soils with a focus on the potential for red soil erosion due to MV-22 training activities. Information on soils within the training areas was obtained from the MCB Camp Butler Integrated Natural Resources and Cultural Resources Management Plan (MCB Camp Butler 2009a) and the MCB Camp Butler Environmental Office Geographic Information System database (MCB Camp Butler 2010b).

4.1.9.1 Current Environment

Okinawa is comprised of three geologic zones: the Motobu Zone, the Kunigami Zone in the north and central parts of the island, and the Shimajiri Zone to the south. The island of Ie Shima lies within the

Motobu Zone and both the CTA and NTA lay within the Kunigami Zone. Okinawa has four general types of soils: *Kunigami*, *Shimajiri*, *Jahgaru*, and *Chuseki*. *Kunigami magi* soils are strongly acidic, red and yellow and are found on more than half of Okinawa (Vuai *et al.* 2001). *Shimajiri maji* is neutral to weakly acidic, dark red soils or Ryukyu limestone soil. *Jahgaru* is a gray upland soil and *Chuseki* is gray to brown, lowland, alluvial soils. Soil types in the NTA and CTA are presented in Figures 4.1.9-1a/b and 4.1.9-2a/b. Soils in the NTA and CTA are primarily *Kunigami* soils. *Kunigami* (red) soils are highly erodible, especially during periods of high rainfall.

The OPG, Department of Environment and Health, passed an ordinance to assist in preventing the impacts of red soil erosion, "Okinawa Prefecture Ordinance #36 or Ordinance" (MCB Camp Butler 2009a). The purpose of the Ordinance is "the containment of red soil erosion that accompanies development project activities, by promoting proper management of land, as well as to prevent the pollution of public water areas (including the deterioration of water quality at lower settlement levels) […] caused by red soil erosion and other measures, thus contributing to securing good environmental conditions" (OPG, Article 1, 1996).

In keeping with this policy, the USMC in Okinawa has a comprehensive erosion control program to reduce red soil erosion and prevent eroded soils from reaching the ocean. This program includes aerial hydroseeding to re-establish vegetation in exposed areas, stabilizing slopes, and low maintenance road design.

Ie Shima Training Facility

The island of Ie Shima is composed of limestone. ISTF is situated on a flat terrace in the northwest portion of the island. The soil is mostly Okinawa clay loam with pockets of acid lithosols, Chinen stony clay, and stony land near the coastline. To the east is a pinnacle of chert that reaches an elevation of 531 feet. Sandy beaches have formed along the northwest and southeast coastlines.

Northern Training Area

The NTA is located in mountainous terrain with dissected flanking terraces. The mountains are composed of layers of metamorphosed sandstones, slates, phyllites, and greenstones. Stream erosion has caused the terraces to become dissected, resulting in rough terrain. Soils in the NTA are primarily *Kunigami* soils and include acid lithosols, Chinen stony clay, and rough stony land (Figure 4.1.9-1a/b). Pockets of *Shimajiri* clay can be found near the eastern boundary of the training area. The soils here are usually less than 1.5 feet deep, covering bedrock that is typically fine-grained schist or feldspathic limestone.

Central Training Area

The terrain in the CTA is mostly steep and irregular with about 175 acres of gently sloping land where the small arms range area is situated. The elevation ranges from 33 feet to over 1,181 feet above sea level. Dissected flanking terraces comprise approximately 50 percent of the CTA, mountains take up about 25 percent, and intricately dissected terrain makes up the remainder. The land around Camp Hansen in the southeast portion of the CTA is mostly limestone, which is composed of cemented shell

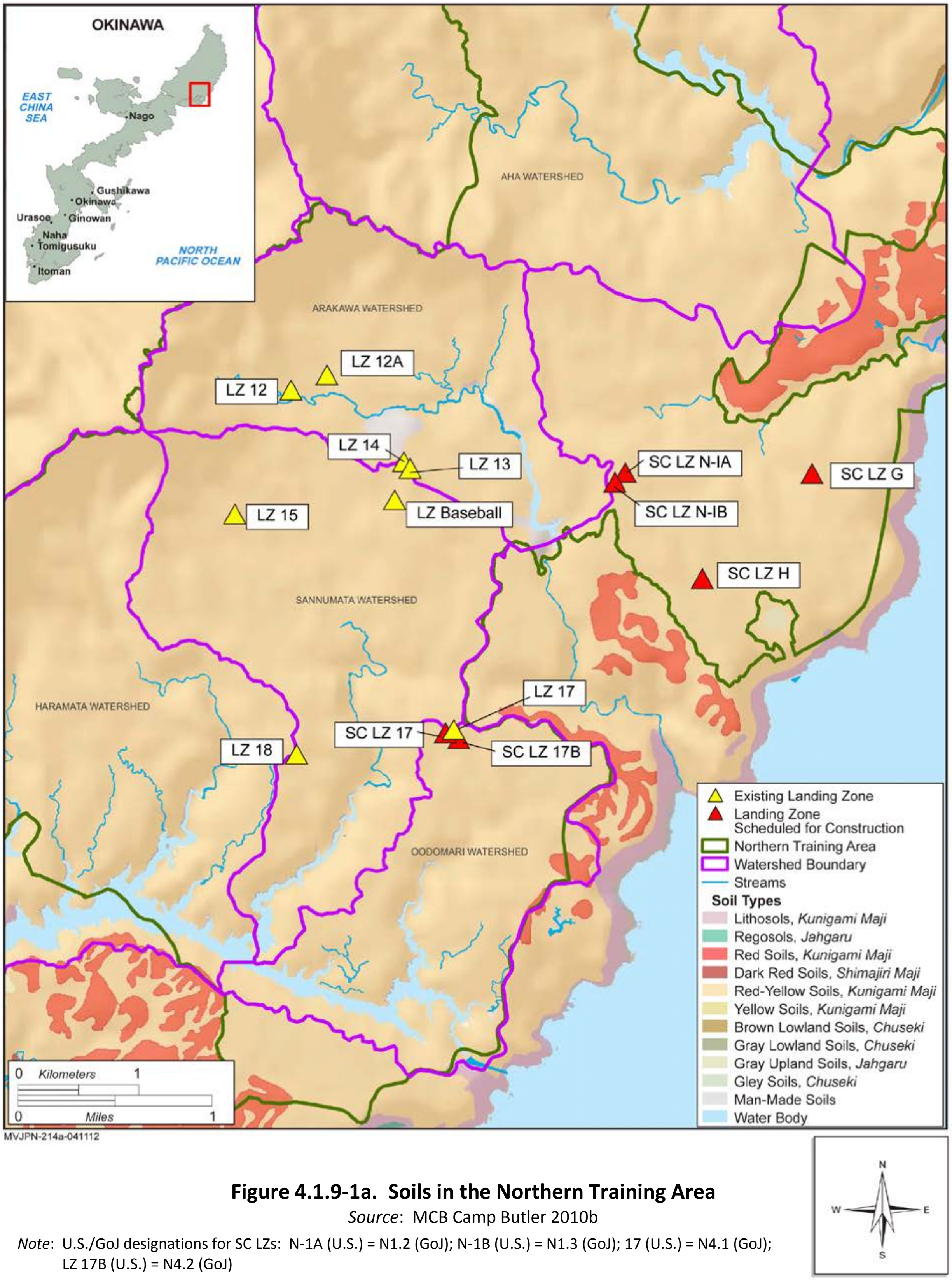


Figure 4.1.9-1a. Soils in the Northern Training Area

Source: MCB Camp Butler 2010b

Note: U.S./GoJ designations for SC LZs: N-1A (U.S.) = N1.2 (GoJ); N-1B (U.S.) = N1.3 (GoJ); 17 (U.S.) = N4.1 (GoJ); LZ 17B (U.S.) = N4.2 (GoJ)

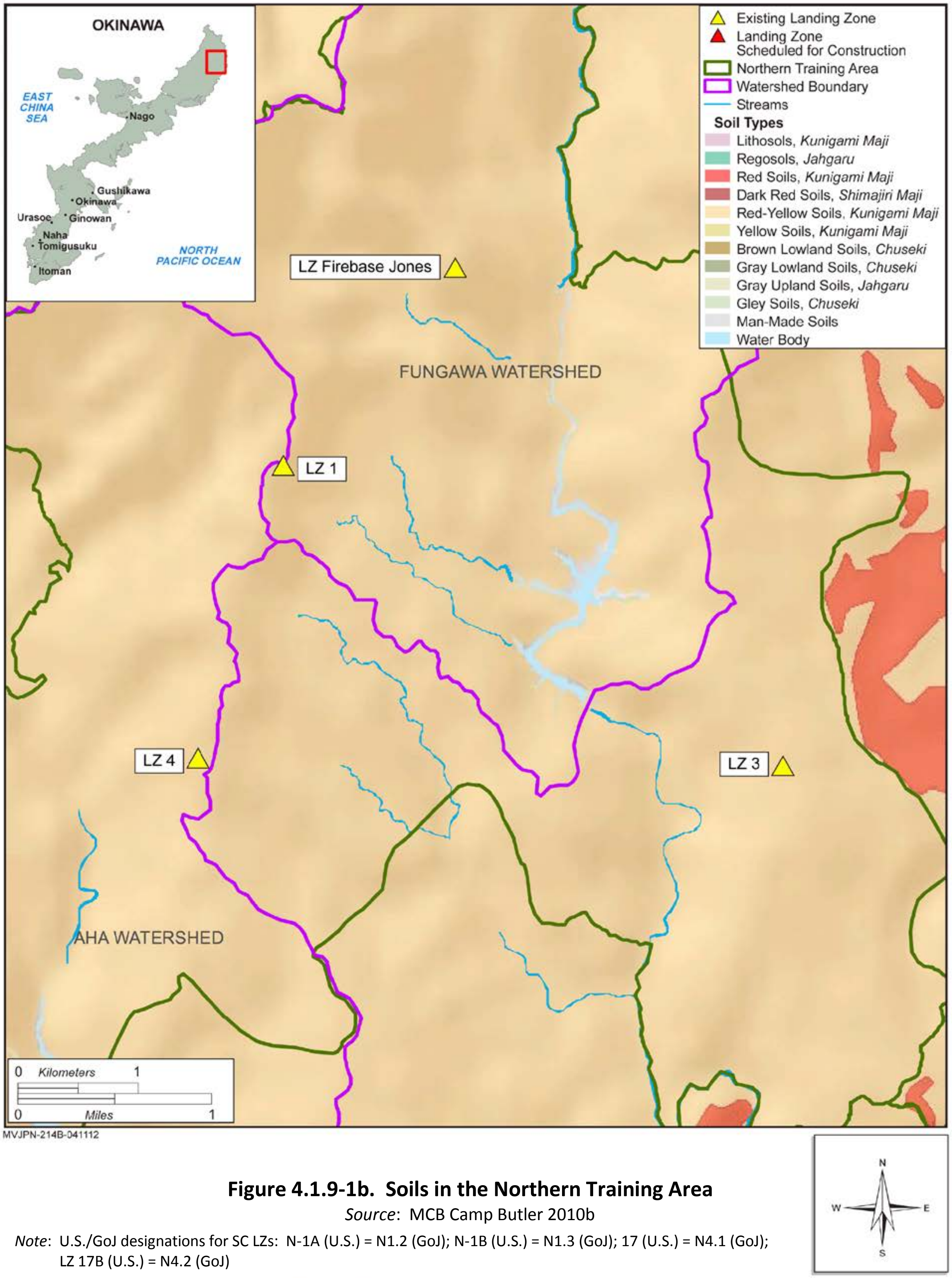


Figure 4.1.9-1b. Soils in the Northern Training Area

Source: MCB Camp Butler 2010b

Note: U.S./GoJ designations for SC LZs: N-1A (U.S.) = N1.2 (GoJ); N-1B (U.S.) = N1.3 (GoJ); 17 (U.S.) = N4.1 (GoJ); LZ 17B (U.S.) = N4.2 (GoJ)

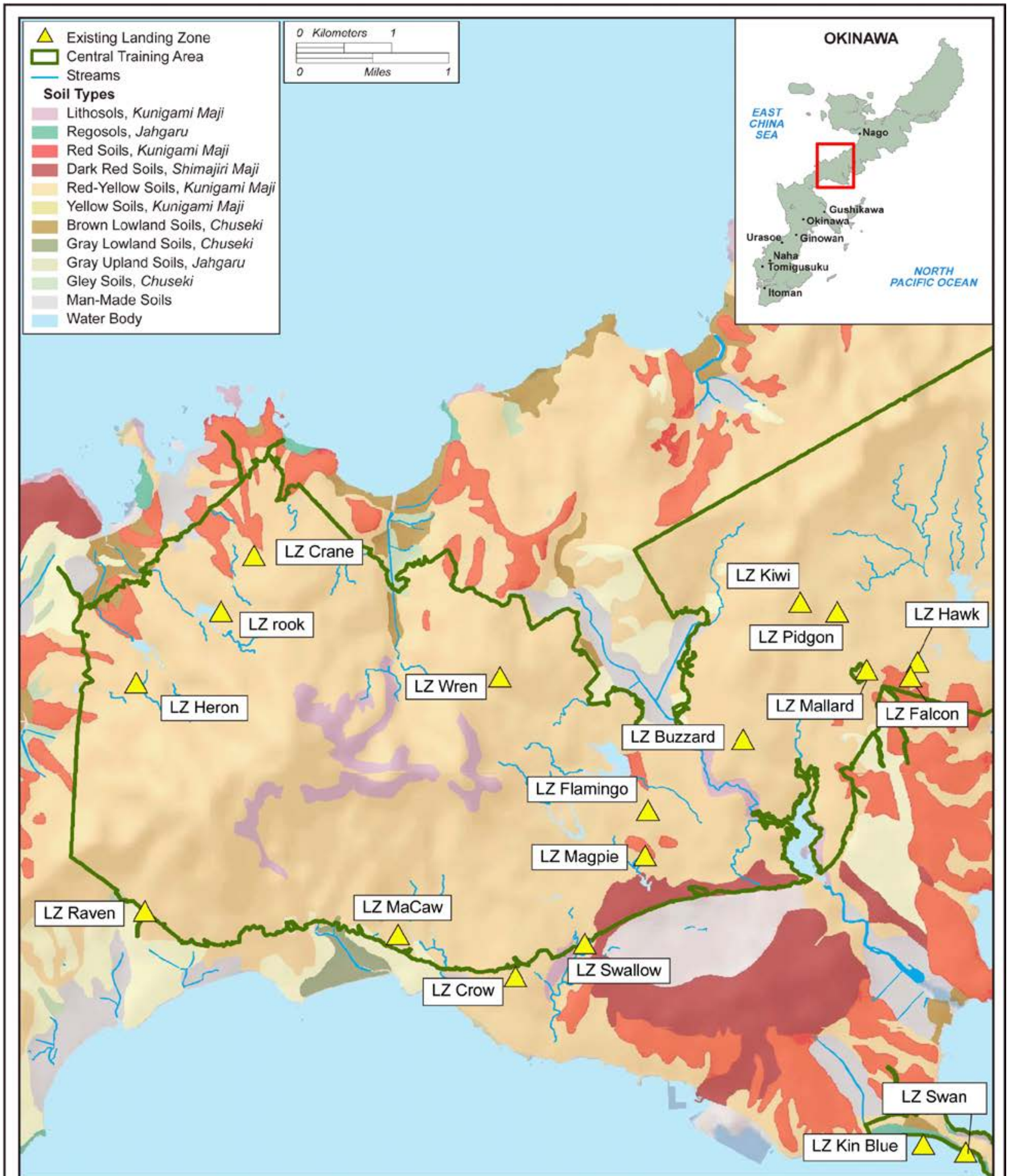


Figure 4.1.9-2a. Soils in the Central Training Area

Source: MCB Camp Butler 2010b

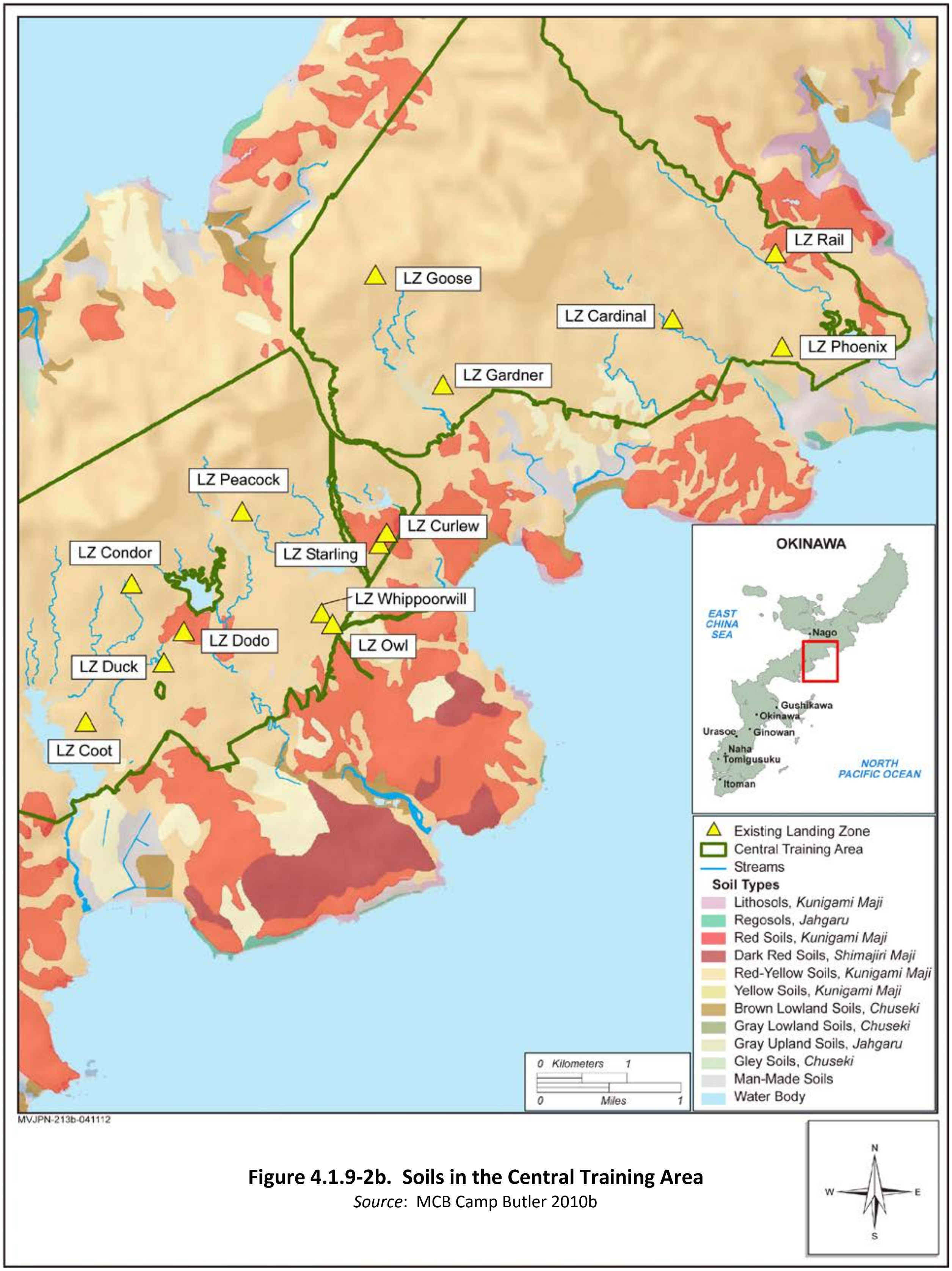


Figure 4.1.9-2b. Soils in the Central Training Area

Source: MCB Camp Butler 2010b

fragments. In contrast, Camp Schwab in the northeastern corner of the CTA is built on sedimentary deposits of gravel covering beds of sandstone. The soils in the CTA are primarily *Kunigami* soils, but change with the elevation: the mountains contain clay loam, the mid- and lower slopes are a mixture of *Shimajuri* clay and rough broken land, and alluvial soils are present in the stream drainages (refer to Figure 4.1.9-2a/b). Concrete check dams have been constructed within the CTA to control red soil erosion runoff. More recently, less intrusive alternatives including small earthen berms and improved road construction and paving have been considered as substitutes for concrete check dams, which are not very effective.

Landing Zones Scheduled for Construction

All of the SC LZs are located in the NTA on red-yellow, *Kunigami* soils. However, each site will be covered with turf grasses and other plants to prevent erosion of developed surfaces and slopes.

4.1.9.2 Environmental Impacts

The proposed action of replacing the CH-46Es currently based at MCAS Futenma with MV-22s on a one-for-one basis would have little effect on the geology or soils of the CTA, NTA, or Ie Shima LZs.

Typically, impacts to soils from operation of MV-22 aircraft could occur directly from downdraft associated with rotorwash or indirectly from the reduction of ground cover and the exposure of ground surface, which would then be affected by heavy rains and runoff leading to soil erosion. Therefore, for measurable or noticeable increases in soil erosion to occur as a result of the proposed action, the following conditions would need to apply:

1. Soils in the LZs would need to be exposed, loose, and dry;
2. MV-22 rotorwash would need to be sufficient to cause loss of vegetation, and use by the MV-22 would need to increase over current use by the CH-46Es; and
3. Topography and soil types at potentially affected LZs would need to be conducive to erosion (e.g., steep topography, highly erodible soils).

Erosion can result from high wind speeds due to rotorwash in areas where soil is exposed, loose, and dry. However, at the LZs in question, the soils generally are not exposed, loose, or dry. LZs containing landing pads made of impervious surfaces or covered completely by vegetation would have a very low potential for soil erosion due to rotorwash. The majority of all LZs analyzed in this ER without impervious landing surfaces do have varying levels of vegetation present within the landing pad area, which serves to reduce soil erosion potential. Additionally, soils are not generally dry since regional climate conditions on Okinawa include an average of at least 60 inches of rainfall annually (MCB Camp Butler 2009a). Even during dry months, rainfall averages 1 to 3 inches a month (Kadena AB 2012). Under these conditions, soils would be drier, but would not dry out completely, hence reducing the potential for soil erosion from rotorwash. Therefore, impacts to soils directly from rotorwash would be minimal.

There is a potential for indirect impacts to soils if newly exposed areas are then subject to intensive rainfall. Most rainfall occurs either during the rainy season (May and June) or typhoon season (August and September) in Okinawa, and less rainfall occurs during winter months (MCB Camp Butler 2009a). If MV-22 rotorwash were to damage vegetation and expose new ground, these areas could be subject to increased soil erosion. These conditions are most likely to occur at LZs where there is an increase in operations over current conditions, and where LZs have steep topography, highly erodible soils, and areas with sparse, patchy vegetation near the landing point.

Of the 50 tactical LZs analyzed in the ER (Table 4.1.9-1), 26 LZs have rare usage under the proposed action. For the remaining 24 LZs, 19 LZs have sufficient coverage on the surface or usage in the area would decrease or remain the same. Under these conditions, no adverse impacts to soils would occur due to the proposed action as MV-22 rotorwash is unlikely to expose soils leading to soil erosion during rainy periods. Only four LZs in the CTA where proposed usage would increase (LZs Coot, Falcon, Mallard, and Swan) have sparse ground cover and are found on red-yellow (*Kunigami maji*) soils. One LZ in the NTA (LZ Firebase Jones) has sparse ground cover and steep topography and is found on red-yellow (*Kunigami maji*) soils. Although usage at LZ Firebase Jones would remain the same, increased downdraft associated with the MV-22 combined with steep topography may increase existing erosion at the location. Therefore, there is a potential for soil erosion at five LZs (Cook, Falcon, Mallard, Swan, Firebase Jones). However, measures are already in place to mitigate erosion of red soil (CCPSOP EMP-01.2 CH2.11; MCO P5090.2A CH2). Currently, soil erosion at LZs is monitored by Range Control and Camp Coordinators and is reported to MCB Camp Butler Environmental (MCB Camp Butler 2009a). If soil erosion problems occur at these LZs, then remediation measures (for instance, hydroseeding the surface to establish vegetation on the ground and the construction of sediment dams and silt fences) in accordance with standard operating procedures at the ranges would occur. Under these procedures, no significant harm to the environment would occur to soils under the proposed action.

Table 4.1.9-1. Soil Types at Existing Landing Zones

#	LZ Designation	Operational Characteristics		Site Characteristics	
		MV-22 Proposed Use[1]	*Increase in Operations from Current Conditions to Proposed*	*Soil Type*	*Approximate Exposed Area*[2]
Ie Shima Training Facility					
1	Coral Runway	5,449 operations[3]	X	Dark Red	0 acres
2	Sling Load		X	Dark Red	0 acres
3	Sling Load Alternative		X	Dark Red	0 acres
4	VIP Helipad		X	Dark Red	0 acres
5	LHD Deck		X	Dark Red	0 acres
6	Drop Zone		X	Dark Red	0 acres
Northern Training Area					
7	LZ 1	Rare		Red-Yellow	0.02 acres
8	LZ 3	Rare		Red-Yellow	0.20 acres
9	LZ 4	Average		Red-Yellow	0.65 acres
10	LZ 12	Rare		Red-Yellow	0.03 acres
11	LZ 12A	Rare		Red-Yellow	0.16 acres
12	LZ 13	Rare		Red-Yellow	0.05 acres

Table 4.1.9-1. Soil Types at Existing Landing Zones (con't)					
		Operational Characteristics		Site Characteristics	
#	*LZ Designation*	*MV-22 Proposed Use*[1]	*Increase in Operations from Current Conditions to Proposed*	*Soil Type*	*Approximate Exposed Area*[2]
Northern Training Area (con't)					
13	LZ 14	Rare		Red-Yellow	0.01 acres
14	LZ 15	Rare		Red-Yellow	0.04 acres
15	LZ 17	Frequent		Red-Yellow	1.18 acres
16	LZ 18	Average		Red-Yellow	0.24 acres
17	LZ Baseball	Average		Red-Yellow	0.02 acres
18	LZ Firebase Jones	Frequent		Red-Yellow	0.78 acres
Central Training Area					
19	LZ Buzzard	Rare		Red-Yellow	0.13 acres
20	LZ Cardinal	Rare		Red-Yellow	0.10 acres
21	LZ Condor	Rare		Red-Yellow	0.05 acres
22	LZ Coot	Average	X	Red-Yellow	0.78 acres
23	LZ Crane	Rare		Red-Yellow/Red	0.01 acres
24	LZ Crow	Rare		Red-Yellow	0 acres
25	LZ Curlew	Average		Red/Red-Yellow	0 acres
26	LZ Dodo	Frequent		Red	2.24 acres
27	LZ Duck	Rare		Red-Yellow/Red	0.01 acres
28	LZ Falcon	Frequent	X	Red-Yellow/Red	1.20 acres
29	LZ Flamingo	Rare		Red-Yellow/Red	0 acres
30	LZ Gander	Average		Red-Yellow	2.2 acres
31	LZ Goose	Average		Red-Yellow	0.04 acres
32	LZ Hawk	Frequent		Red-Yellow	0.56 acres
33	LZ Heron	Rare		Red-Yellow	0 acres
34	LZ Kin Blue	Average	X	Regosol/Brown Lowland	3.88 acres
35	LZ Kiwi	Average		Red-Yellow	0.01 acres
36	LZ Macaw	Rare		Red-Yellow	0.01 acres
37	LZ Magpie	Rare		Red/Red-Yellow	0.01 acres
38	LZ Mallard	Average	X	Red-Yellow	0.35 acres
39	LZ Owl	Rare		Red-Yellow	0 acres
40	LZ Peacock	Rare		Red-Yellow	0.07 acres
41	LZ Phoenix	Average	X	Red-Yellow	0.06 acres
42	LZ Pigeon	Rare		Red-Yellow	0.36 acres
43	LZ Rail	Rare		Red/Red-Yellow	0.05 acres
44	LZ Raven	Rare		Red-Yellow/Yellow	0.01 acres
45	LZ Rook	Rare		Red-Yellow	0.01 acres
46	LZ Starling	Rare		Red	0.01 acres
47	LZ Swallow	Frequent	X	Red-Yellow/Dark Red/ Lithosol	0.01 acres
48	LZ Swan	Frequent	X	Red-Yellow/Lithosol/ Regosol	0.5 acres
49	LZ Whippoorwill	Rare		Red-Yellow	0.11 acres
50	LZ Wren	Rare		Red-Yellow	0.35 acres

Notes:
[1]Based on input from 1st MAW and operators.
[2]Based on areas within LZs that would permit aircraft landings.
[3]The MV-22 aircrews would use the ISTF and its LZs as a single complex. Operations include 2,926 CALs and 2,523 FCLPs. No CAL operations would be conducted on the Coral Runway by MV-22s.

Landing Zones Scheduled for Construction

At the SC LZs, all of the landing areas are prepared and erosion protection measures, such as planting turf grasses, will further reduce any potential for erosion due to MV-22 operations.

4.1.10 Water Resources

Water resources include groundwater, rivers and streams, and wetlands. Okinawa's groundwater resources are the result of infiltration through the surface layers of soil and into permeable rock materials. The aquifer produces water from fractures and solution cavities in the bedrock. According to article 3 of Japan's River Law, "river" refers to a water system that is important to the public for economic or land conservation reasons, and includes the river administration facilities for those systems. River administration facilities include dams, sluices, levees, and other facilities or methods of flood mitigation or water conservation that serve to increase public benefits or decrease public losses that may be attributed to the functionality of the water systems.

According to the JEGS, wetlands are areas inundated or saturated by surface or ground water at a frequency and duration to support, and that under normal circumstances do support, a prevalence of vegetation typically adopted for life in saturated soil conditions. Currently, there is no Japanese standard for wetlands delineation.

The most recent JEGS (USFJ 2010) deals with the protection of groundwater supplies and surface water sources from contamination by appropriate land use management on U.S. facilities and areas in Japan. It also considers stormwater management, which requires the development of a stormwater pollution prevention plan for activities such as construction, vehicle maintenance, vehicle and material storage, and pesticide operations (USFJ 2010). As these specific activities would not occur at the landing zones under the proposed action, this section will focus on potential effects to groundwater and surface water resources from erosion and possible contamination at the LZs. As the GoJ LZs are located in the NTA, general discussions of the affected environment are the same.

4.1.10.1 Current Environment

Ie Shima Training Facility

Because the soil of Ie Shima is composed of porous limestone, rainwater tends to soak through the ground instead of collecting and running on the ground. There are many irrigation water impoundments located along the installation boundary at ISTF. Ie Shima Island also has a natural spring that is located on the north side of the island.

Northern Training Area

There are several dams within the NTA: the Arakawa, Fungawa, and Aha dams. The Benoki and Fukuchi dams are located just outside of the northern and southern boundaries of the NTA, respectively. All of the numerous streams and small rivers in the NTA eventually flow into the reservoirs created by these dams, which are interconnected via a series of underground tunnels, and supply water to the drier southern region of Okinawa.

Central Training Area

There are many dams located within the CTA, half of which is encompassed within the watershed area for these dams. These facilities are used for irrigation, municipal water supply, and flood control. They also supply water to the southern region of Okinawa. Wetlands also occur in parts of the CTA. They are avoided during construction activities and military vehicle maneuvers, however, infantry maneuvers are permitted (MCB Camp Butler 2009a).

Landing Zones Scheduled for Construction

All the SC LZs lie within the NTA, so characterization of that area would apply to these LZs. Measures to reduce erosion and retain sediment are part of the construction plan for the SC LZs. These include reducing slopes and providing for adequate runoff. Additionally, water could be treated on site and discharged in a manner to minimize environmental impacts to the surrounding areas.

4.1.10.2 Environmental Impacts

All LZs would be used in a manner under the proposed action similar to how they are currently used. Measures are already in place to mitigate erosion of red soil, the sediments of which collect in waterways, dirtying the public water supply and suffocating coral reefs upon reaching the ocean (ECPSOP EMP-01.2 CH2.11; MCO P5090.2A CH2; MCB Camp Butler 2009a). Best management practices in these areas include the establishment of vegetation cover on the ground (source control) and the construction of sediment dams and silt fences (run-off control). In the unlikely event of a fuel leak occurrence, the fuel would be collected to prevent washing down into the water supply, or soaking into permeable soils. There would be no increase in demand on water resources associated with operations involving the use of the LZs since there would be no construction or increase in personnel in the training areas. Based on these existing procedures, no significant harm would occur to water resources due to the proposed action.

Landing Zones Scheduled for Construction

As the SC LZs would be paved and measures to reduce erosion and retain sediment would be incorporated into the construction of the SC LZs, MV-22 training operations would not increase erosion or contamination to these LZs and no impacts to water resources are expected due to MV-22 use of the SC LZs.

4.2 MAINLAND JAPAN AND OTHER LOCATIONS

In accordance with the requirements of DoD Directive 6050.7, *Environmental Effects Abroad of Major Department of Defense Actions* (2004), an ER must evaluate important environmental issues resulting from an action. Review and evaluation of the components of proposed MV-22 basing and operations for sites on mainland Japan and at Kadena AB (refer to Chapter 2), revealed:

- MV-22 operations at these locations – Camp Fuji, MCAS Iwakuni, NAV Routes, and Kadena AB – would represent negligible to minimal additions to overall activities currently occurring there. In all cases, other aircraft operations, including those by Japanese self-defense forces (i.e., Camp Fuji), would continue to be dominant.

- The short duration and minimal use of these locations by MV-22 detachments would contribute negligibly (less than 1 dB) to overall noise conditions (Wyle 2012) and would not alter CNEL contours generated from ongoing operations by aircraft such as AV-8B Harriers or FA-18 Hornets.
- No construction or other ground disturbance would result at any of these locations as a result of the MV-22 training and readiness operations, thereby minimizing or precluding such impacts to biological resources, cultural resources, soils, and water.
- In combination, these results of the review established that no important environmental issues would arise from implementing the proposed MV-22 basing and operations.

Based on this evidence and conclusion, the following sections briefly summarize the current conditions and post-MV-22 environmental conditions for the mainland Japan locations and Kadena AB.

4.2.1 Camp Fuji

Introduction

Camp Fuji consists of a 309-acre installation with an adjacent helicopter runway and border by the extensive Fuji Maneuver Area. Helicopter and small fixed-wing operations by the Japan Ground Self-Defense Force (JGSDF) account for 94 percent of total current activity. Under the proposed action, detachments of two to six MV-22s would train out of Camp Fuji for two days each month, on average. The MV-22 would perform about 500 operations annually, accounting for a 10 percent increase in the current total.

Airfield/Airspace

Camp Fuji's airfield and overlying airspace has supported thousands of helicopter and fixed-wing aircraft (e.g., KC-130Js) for many years. No current issues regarding airspace management or use of the airfield currently apply, and air traffic is controlled by Tokyo Air Control Center. Addition of 500 (10 percent) MV-22 operations annually would not alter any of these conditions since the amount of flight activity is small and the MV-22 operates in a manner consistent with other aircraft traditionally using Camp Fuji.

Noise

The noise environment at Camp Fuji would change minimally from current conditions as a result of the proposed MV-22 operations. Military aircraft (i.e., KC-130Js, UH-60s, CH-47s, and SH-60s) form the main sources of noise in and around Camp Fuji, accounting for about 5,000 annual operations. Relative to other aircraft with greater SELs, the MV-22 detachment is expected to contribute less than 1 dB to the overall noise conditions. Such a change would not be sufficient to alter the CNEL contours or result in a perceptible change (i.e., 3 dB or greater).

Land Use

Proposed operations by the MV-22s would not alter or affect land use at Camp Fuji. Existing facilities within the 309-acre combined arms training facility would meet all requirements for deployed detachments of MV-22s. While the proposed 500 operations by the MV-22s would add to the aircraft noise, any changes would be minimal due to the low percentage of increase relative to existing operations. As noted above, a 10 percent addition of operations would not measurably expand the area affected by aircraft noise. Furthermore, the surrounding lands potentially affected by the noise consist of an existing training area designed for military activities.

Air Quality

Although within the highly populated island of Honshu, Camp Fuji lies in a rural area with no major sources of air pollution. The adjacent Fuji Training Area provides an additional buffer from industrial and urban air emissions. The available data for Japan (Japan MOE 2005) shows achievement of air quality improvement goals or trends toward those goals. Current operations dominated by the JGSDF, would continue and account for the vast majority of emissions. MV-22 emissions would not appear likely to affect achievement of air quality goals or noticeably influence concentrations since the number and duration of operations would be limited. Such emissions, however, are not subject to review under the JEGS.

Safety

Safety procedures at Camp Fuji's small airfield mirror those described for MCAS Futenma (refer to section 3.6), although on a smaller scale. The airfield includes associated aircraft safety zones, and Camp Fuji supports fire and rescue vehicles and personnel to provide emergency response in the event of an aircraft mishap. Addition of 500 annual MV-22 operations would not require any changes to existing safety plans, procedures, or equipment. Given the excellent safety record of the MV-22 (refer to Section 3.6.1) low mishap rate (1.12 per 100,000 flying hours), and the low number of operations proposed for Camp Fuji, the potential for a Class A mishap would be minimal. Similarly, bird-aircraft strikes would remain rare in this airfield environment.

Biological Resources

Most of Camp Fuji is highly developed, although an 89-acre section of woodlands and grasses is located in the southeastern section of the installation. These woodlands are divided into two areas with the first dominated by two coniferous species, Japanese cedar or *Sugi* and Japanese cypress or *Hinoki,* and the second covered by the deciduous Japanese oak or *Nara*. Based on flora surveys conducted in 1999 and 2007, overall flora richness was found to be low within and around Camp Fuji. Fauna surveys conducted at the same time revealed only common animal species. No Protected Species have been observed during recent flora and fauna surveys. Only one Protected Species, an orchid called *Atsumori-so* may occur in the woodlands on Camp Fuji; however, a 2004 survey observed no individual sitings during the blooming season (MCB Camp Butler 2009a). Without construction or ground disturbance, and given the lack of Protected Species, the proposed action would not impact biological resources at Camp Fuji.

Wildlife in the area would have habituated to aircraft noise, including helicopters. The additional MV-22 operations would not add measurably to overall noise, and individual events would generate noise levels consistent with existing aircraft using the airfield.

Cultural Resources

A full cultural resource study of all undeveloped portions of Camp Fuji was conducted in 1997 (MCB Camp Butler 2009a). This survey identified seventeen sites including concrete markers, excavated depressions, scatters of historic artifacts, terraces, a sign, and a mound. Most of these sites appear to be related to recent post-WWII activities. Evaluation of archaeological sites at Camp Fuji was completed and none were deemed significant under U.S. or Japanese law (MCB Camp Butler 2009a). Mount Fuji is listed on the GoJ list of cultural properties as a "Special Places of Scenic Beauty." "Places of Scenic Beauty" are categorized as either natural (seashores, valleys, mountains) or cultural (gardens, parks, bridges) and are places deemed indispensable to the national ascetic of Japan. The landscapes of "Places of Scenic Beauty" are considered to be national treasures. Although Mount Fuji is a natural treasure, Camp Fuji is an existing facility located approximately 7 miles away. Operations associated with MV-22 detachments would be occasional (commonly two to three days per month) and would only comprise 10 percent of total operations in the area. Based on the current use of Camp Fuji by JGSDF and the limited increase in operations by MV-22 detachments, additional operations projected for the MV-22 at the airfield would not cause significant harm to cultural resources, including GoJ cultural assets and Special Places of Scenic Beauty.

4.2.2 MCAS Iwakuni

MCAS Iwakuni is a dynamic, active installation supporting 5,000 Marines and dependents. The 1,800 acre installation supports almost 60,000 operations by 49 USMC aircraft including 36 FA-18 Hornets, 5 EA-6B Prowlers, 6 AV-8B Harriers, and 2 UC-12B Huron turboprops. The Japan Maritime Self-Defense Force operates 37 aircraft including 22 helicopters, 13 P-3 Orion patrol and reconnaissance turboprops, and 2 Learjets. Under the proposed action, detachments of two to six MV-22s would train out of MCAS Iwakuni for two to three days each month, on average. The MV-22 would perform about 500 operations annually, accounting for an 0.8 percent increase in the total.

Airfield/Airspace

MCAS Iwakuni's airfield and overlying airspace has supported more than 50,000 fighter jet, reconnaissance aircraft, and helicopter operations annually for many years. No current issues regarding airspace management or use of the airfield currently are known. Shifting of the runway in the recent past did not affect airspace management. Addition of 500 (0.8 percent) MV-22 operations annually would not alter any of these conditions since: 1) the amount of additional flight activity is miniscule; 2) a 0.8 percent change falls well within the normal annual range of variation for operations; and 3) the MV-22 operates in a manner consistent with other helicopters and short take-off/vertical landing aircraft traditionally using MCAS Iwakuni.

Noise

A recent noise study (Wyle 2010) provides the basis for defining the current noise conditions. This study established that military aircraft form the main sources of noise in and around MCAS Iwakuni. It focused on-base where most of the area exposed to noise levels of 65 dB DNL and higher would occur. Under current conditions, proposed on-station housing could be affected by noise levels of 64 to 68 dB DNL, but planned construction would attenuate these levels to 45 dB DNL or less. Addition of 500 operations by the MV-22 would comprise only a 0.8 percent increase and would contribute far less than 1 dB to the CNEL contours at MCAS Iwakuni (Wyle 2012). Rather, ongoing operations by FA-18s would continue to form the primary contributor to noise conditions.

Land Use

MCAS Iwakuni, located in the Yamaguchi Prefecture on Honshu, lies approximately 20 miles southwest of Hiroshima City. The densely populated industrial city of Iwakuni borders the base on one side while the Seto Inland Sea forms the remaining border. All land within the base is owned by the GoJ and used under the terms of the Status of Forces Agreement between the U.S. and Japan. The flight line, which dominates the eastern portion of the station, comprises the largest land use areas within MCAS Iwakuni (MCAS Iwakuni 2009). Existing facilities within the 1,800-acre facility would meet all requirements for deployed detachments of MV-22s. The 0.8 percent increase in total airfield operations resulting from the MV-22 deployments would not alter current noise conditions or expand the areas currently affected by noise. Operations by the 36 FA-18s would continue to dominate the noise environment; MV-22 noise would not be noticeable. No land use impacts would result from the proposed action.

Air Quality

MCAS Iwakuni lies on the coast of mainland Japan, bordered by the densely populated and industrialized city of Iwakuni. Major oils refineries and wood pulp producers characterize the primary sources of industrial emissions. Vehicle traffic from the city's 150,000 residents also produce emissions. For the same reasons detailed for Camp Fuji, no noticeable impacts to air quality would result from implementing the proposed action at MCAS Iwakuni.

Safety

Safety procedures at MCAS Iwakuni mirror those described for MCAS Futenma (refer to Section 3.6). The airfield includes associated aircraft safety zones and clear zones, and no obstruction problems exist. To limit the exposure of off-station inhabited areas to potential mishaps, the aircraft using the main runway (on a peninsula) plan the downwind legs of overhead break arrivals, touch-and-goes, and patterns over the ocean. Higher altitude (above 7,000 feet mean sea level) portions of these events cross over land. MCAS Iwakuni supports fire and rescue vehicles and personnel to provide emergency response in the event of an aircraft mishap. U.S. forces also operate under a BASH plan to avoid bird-aircraft strikes. Addition of 500 annual MV-22 operations would not require any changes to existing safety plans, procedures, or equipment. Given the excellent safety record of the MV-22 (refer to section

3.6.1), low mishap rate, and the low number of operations proposed for MCAS Iwakuni, the potential Class A mishap would be minimal.

Biological Resources

MCAS Iwakuni is situated on a delta formed by alluvial deposits from the Nishiki River which borders the installation to the north and southwest. Almost the entire environment of MCAS Iwakuni is artificial and only two areas, located near artificial wetland areas on the installation, are not landscaped or maintained. The trees, ground cover and shrubs on MCAS Iwakuni are typical of those found in nearby Iwakuni City and other urbanized areas in Japan (MCAS Iwakuni 2008 and 2009). Surveys (MCAS Iwakuni 2008) demonstrated that terrestrial wildlife on MCAS Iwakuni is limited to those species acclimated to a highly urbanized setting and a military airfield. No Protected Species have been identified on the station. Without construction or ground disturbance, and given the lack of Protected Species, the proposed action would not affect biological resources. The additional (0.8 percent of total) MV-22 operations would not add measurably to overall noise, and individual events would generate noise levels consistent with existing aircraft using the airfield.

Cultural Resources

A full cultural resource study of all undeveloped portions of Iwakuni has been conducted (MCB Camp Butler 2009b). No archaeological resources have been recorded on the installation and the potential for buried cultural deposits is low due to the active river delta and land reclamation activities. Four historic resources were identified during the cultural resource inventory conducted for the development of the installation Integrated Cultural Resources Management Plan (MCB Camp Butler 2009a). These four resources include: 1) the headquarters building (Building 360) built by the Japanese Imperial Navy in 1940; 2) a World War II period single Zero-type aircraft hangar; 3) a memorial to the members of the 1st Marine Aircraft Wing that lost their lives in Vietnam; and 4) Yuhi monument, located in front of the Japan Maritime Self-Defense Force headquarters. The Zero hangar and the Vietnam memorial are designated historic monuments by the USMC Historic Division (MCB Camp Butler 2009b). The proposed action would not involve any construction or ground disturbance. Activities by the deployed MV-22 detachments would be consistent with other on-going operations at the installation. As such, none of the identified resources would be directly affected and the negligible increase in operations would not generate any change in noise affecting cultural resources adversely.

4.2.3 NAV Routes

The MV-22s, when deployed as detachments to mainland Japan, propose to fly on the NAV Routes to meet low-altitude training requirements (refer to Figure 2-17). Of the six color-coded NAV Routes, five transit over mainland Japan and one extends over the ocean north of Okinawa. These routes, which extend for hundreds of miles, currently support operations by FA-18s, AV-8Bs, and KC-130Js. In comparison to the estimated 100 to 467 operations conducted on these routes annually under current conditions, the MV-22s would fly up to 55 operations on each route, or a total of 330 for all routes. Averaged over the proposed detachment deployment cycle, each route might be flown only 3 to 4 times in a month.

An average 21 percent increase across all routes, even when flown at 200 feet AGL, would not result in impacts or raise environmental issues. A previous noise study examining a subset of these routes (Wyle 2011) concluded that the MV-22 would be at least 18 dB quieter (SEL) than the FA-18s and AV-8Bs using these routes with greater frequency; and the low number of operations and substantially lower single-event noise level would result in a negligible and imperceptible change in noise levels.

Given this lack of noise effects, other resources such as Land Use, Biological Resources, and Cultural Resources would remain unaffected by the MV-22 operations. Similarly, the minimal change in use and the continuation of existing procedures would minimize the potential for impacts to airspace management and aircraft safety.

4.2.4 Kadena Air Base

The MV-22 aircraft would utilize the MWLK at Kadena AB for occasional ordnance loading at existing authorized locations (refer to Figure 2-18). Ordnance would consist of 7.62 millimeter and .50 caliber machine gun cartridges, the same as used by CH-46Es. This occasional activity would account for less than 5 percent of the average annual activity at the base. Training with the guns would continue to use authorized over water ranges. None of the proposed use would represent a new activity or pose any new risks. The CH-46Es being replaced by the MV-22s also perform ordnance loading, so no substantive change in these operations would occur. Cumulatively, these factors demonstrate that no environmental issues worthy of detailed analysis would likely arise from MV-22 use of Kadena AB.

4.2.5 Other Installations

As noted in Chapter 2, the potential exists for one or more MV-22 aircraft to fly to and operate from other installations in Japan on occasion. While not planned or scheduled as part of this basing action, such events may occur as a result of requirements to assist in the defense of Japan, for training exercise, and for humanitarian or disaster relief. The USMC anticipates that these visits would be brief in duration and involve relatively few aircraft. All procedures and restrictions appropriate to these installations would remain in force. Given all of these factors, any short-term effects on the environment would be inconsequential and conditions at the installations would not change measurably.

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