CHAPTER 6. NOISE

6.1 AFFECTED ENVIRONMENT

The main sources of noise within the affected environment on Tinian addressed in this Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) are related to military operations (airfield operations, ground training, construction noise and ground vehicular traffic). Ground training encompasses many types of activities, but live-fire activities are emphasized in analyzing the noise environment because they generate more noise than other ground-based activities. Heavy equipment used during construction activities is the primary source of construction noise. Traffic noise relates to vehicle movements on roadways around the island. The following sections discuss the baseline noise environment to assess the potential effects of noise that may be generated in each geographical area of interest on Tinian should the proposed action be implemented.

6.1.1 Definition of Resource

Sound is the stimulation of auditory organs produced by sound waves transmitted through the air or other medium. Sound waves are small pressure fluctuation waves caused by vibrations. Human hearing generally covers fluctuations between frequencies of 20 and 20,000 hertz, with higher frequencies interpreted as having a higher pitch. Frequency is a measure of wave cycles per unit of time. Cycles per second is the standard unit of measurement for sound wave frequency and is expressed as hertz. Sound waves move outward in all directions from the vibration source, dissipating as the distance from the source increases (inversely proportional to the square of the distance to the source). High frequency sounds dissipate more quickly. Dissipation also occurs due to wind, ground cover, and temperature.

Loudness is the relative measure of the magnitude of a sound and is typically measured in decibels (dB). Decibels are the ratio of the intensity of the sound to a reference intensity based on atmospheric pressure. The dB is a logarithmic unit of measurement that expresses the magnitude of a physical quantity, like sound, relative to a specified or implied reference level. Since it expresses a ratio of two quantities with the same unit, it is a dimensionless unit.

Noise is unwanted or annoying sound and is not necessarily based on loudness. It comes from both natural and manmade sources. Noise can have deleterious effects on physical and psychological health, affect workplace productivity, and degrade quality of life. Military activities often involve the use of specialized equipment that cause noise, including aircraft, artillery, heavy vehicles, and ships. The degree that a sound is perceived to be noise may be influenced by the following factors:

- Frequency spectrum (300 – 4,800 hertz range has the highest potential for deleterious effects on humans)
- Intensity (loudness and frequency)
- Modulation (level of distortion)
- Time and place of occurrence
- Duration
- The individual’s background

Table 6.1-1 shows typical intensity levels for common sounds. Since sound level intensity is logarithmic, the decibel levels of multiple sources of sound are not additive. In fact, doubling a noise source would only generate a 3 dB increase. For example, a receptor under a flight path with one jet airliner 500 feet (ft)

(152 meters [m]) overhead would experience 115 dB; if two jetliners passed side-by-side, the receptor would experience 118 dB not 230 dB.

Table 6.1-1. Intensity Levels for Common Sounds

Levels	*dB*
Pain threshold	140
Discomfort threshold (pure tones)	120
Jet airliner (500 ft [152 m] overhead)	115
Loud shout (1 ft [.3 m] away)	110
Discomfort for speech threshold	100
Residential lawn mower	98
Heavy city traffic	92
Loud speech	80
Conversation	60
Window air conditioning unit	55
Faint speech (3 ft away[1 m])	40
Whisper	30
Very quiet speech	20
Hearing threshold (young adult)	0

Source: Newman and Beatty 1985.

6.1.1.1 Frequency Weighting

A number of factors affect sound as the human ear perceives it. These include the actual level of noise, the frequencies involved, the period of exposure to the noise, and changes or fluctuations in noise levels during exposure. In order to correlate the frequency characteristics from typical noise sources to the perception of human ears, several noise frequency weighting measures have been developed. The most common frequency measures include the following:

- *A-weighted Scale.* Since the human ear cannot perceive all pitches or frequencies equally well, these measures are adjusted or weighted to compensate for the human lack of sensitivity to low-pitched and high-pitched sounds. This adjusted unit is known as the A-weighted decibel, or dBA. The dBA is used to evaluate noise sources related to transportation (e.g., traffic and aircraft) and to small arms firing (up to .50-caliber).
- *C-weighted Scale.* The C-weighted scale measures more of the low-frequency components of noise than does the A-weighted scale. It is used for evaluating impulsive noise and vibrations generated by explosive charges and large-caliber weapons (such as artillery, mortars). C-weighted noise levels are indicated by dBC.

Noise levels from one scale cannot be added or converted mathematically to levels in another weighting scale.

6.1.1.2 Noise Metrics

Because of continuous versus impulsive types of noise, variations in frequency and period of noise exposure, and the fact that the human ear cannot perceive all pitches and frequencies equally well, noise from military operations is measured using noise metrics that reflect different noise characteristics. Common metrics used in this EIS/OEIS noise analysis are as follows:

- Day-night Sound Level (DNL). This metric cannot be measured directly; rather, it is calculated as the average sound level in decibels with a 10 dB penalty added to the nighttime levels (10 p.m. to 7 a.m.). This penalty accounts for the fact that noises at night sound louder because there are usually fewer noises occurring at night so generally nighttime noises are more noticeable. The DNL noise metric may be further defined, as appropriate, with a specific, designated time period (e.g., annual average DNL, average busy month DNL). This metric is recommended by USEPA, used by most federal agencies when defining their noise environment, and applied as a land-use planning tool for predicting areas potentially impacted by noise exposure.

- Maximum Sound Level (L_{max}). The highest A-weighted integrated sound level measured during a single event in that the sound level changes value with time (e.g., an aircraft overflight) is called the maximum A-weighted sound level or L_{max}. L_{max} is given in units of dBA. The L_{max} is important in judging the interference caused by a noise event such as participating in 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 account for the length of time that the sound is heard.
- Sound Exposure Level (SEL). This metric is a measure of the total sound energy and is a sum of the sound intensity over the duration of exposure. The SEL provides a convenient single number that adds the total acoustic energy in a transient event and it has proven to be effective in assessing the relative annoyance of different transient sounds.
- Equivalent Sound Level (L_{eq}). Another way of describing fluctuating sound is to describe the fluctuating sound heard over specific periods as if it had been a steady, unchanging sound. For this condition, a descriptor called the L_{eq}, can be computed. L_{eq} is the constant sound level that, in a given situation and period (e.g., 1 hour, denoted by $L_{eq}(1)$, or 24 hours, denoted as $L_{eq}(24)$), conveys the same sound energy as the actual time-varying sound.
- Peak Sound Level. The metric Peak 15 is the single event peak level exceeded by 15% of event. This metric account for statistical variation in received single event peak noise level that is due to weather. It is the calculated without frequency weighting (i.e., unweighted as opposed to A- or C-weighted).

6.1.1.3 Noise Standards and Guidelines

The Marine Corps employs three programs that address adherence to the Noise Control Act of 1972 and United States (U.S.) Environmental Protection Agency (USEPA) Guidance: the Range Air Installation Compatible Use Zone (Office of the Chief of Naval Operations Instruction [OPNAVINST] 3550.1) for air-to-ground operations at training areas, and the Air Installation Compatible Use Zone (OPNAVINST 11010.36A) for airfield operations. The Range Air Installation Compatible Use Zone and Air Installation Compatible Use Zone 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 assess existing and proposed land uses on an Installation. For ground training noise, the Marine Corps adheres to a guidance memo dated June 29, 2005 (Marine Corps 2005). In addition, Army Regulation 200-1 (Environmental Protection and Enhancement), Chapter 14 (Operational Noise) provides the guidance for evaluation of ground training noise at Marine Corps installations (Army 2007). Noise zones are used in land use planning around Marine Corps installations. The following (and Table 6.1-2) describes these zones and the types of land use that are considered compatible within these zones (USCHPPM 2009 and Army 2007).

- **Zone I** – includes all areas around a noise source that DNL is less than 65 dBA or 62 dBC, or the Peak 15(met) exceeds 87 dB. This area is usually suitable for all types of land use activities (e.g., homes, schools, and hospitals). Zone I on maps are simply areas that are neither Zone II nor Zone III.

- **Zone II** – consists of an area where the DNL is between 65 and 75 dBA or 62 and 70 dBC, or the Peak 15(met) is between 87 to 104. Exposure to noise within this zone is normally considered incompatible with noise-sensitive land uses and use of the land within the zone should normally be limited to activities such as industrial, manufacturing, transportation, and resource production (e.g., industrial parks, factories, and highways).
- **Zone III** – is an area around the noise source that the DNL is greater than 75 dBA or 70 dBC, or the Peak 15(met) exceeds 104. The noise level within this zone is considered incompatible with noise-sensitive land uses such as churches, schools, parks, and playgrounds.

Table 6.1-2. Noise Zones and Compatibility Levels

Zone	*Small Arms/Aviation A-weighted DNL*	*Explosives Day Night Average C-weighted DNL*	*Small Arms PK 15 (met) Peak Unweighted*	*Compatibility with Residential/Noise-Sensitive Land Uses*
I	<65 dBA	<62 dBC	87 dB	Compatible
II	65 to 75 dBA	62 to 70 dBC	87 to 104 dB	Normally Incompatible
III	>75 dBA	>70 dBC	>104 dB	Incompatible

Sources: USCHPPM 2009, Army 2007.

Noise contours for large caliber weapons and explosives (demolition activities and hand grenades) are developed using the C-weighted scale to determine the land use zones. Another analysis used for assessing explosive noise is complaint risk using PK 15 (met) peak noise levels as shown in Table 6.1-3.

Table 6.1-3. Large Caliber and Explosives Risk of Complaints Levels

Risk of Complaints	*Large Caliber Weapons/Explosives PK15(met) dB Noise Contour*
Low	< 115
Moderate	115 - 130
High	> 130

Construction Noise

Construction noise is generated by the use of heavy equipment on job sites and is short-term in duration (i.e., the duration of the construction period). Commonly, use of heavy equipment occurs sporadically throughout daytime hours. Table 6.1-4 provides a list of representative samples of construction equipment and associated noise levels, adjusted for the percentage of time equipment would typically be operated at full power at a construction site. Construction noise varies greatly depending on the construction process, type and condition of equipment used, and layout of the construction site. Overall, construction noise levels are governed primarily by the noisiest pieces of equipment, impact devices (e.g., jackhammers, pile drivers).

Table 6.1-4. Samples of Construction Noise Equipment

Equipment Description	*Impact Device[1]*	*Acoustical Usage Factor[2] (%)*	*Actual Measured L_{max} @ 50 feet[3] (dBA, slow) (Samples Averaged)*	*Number of Actual Data Samples[4] (Count)*
All Other Equipment > 5 HP	No	50	N/A	0
Backhoe	No	40	78	372
Clam Shovel (dropping)	Yes	20	87	4
Compactor (ground)	No	20	83	57
Compressor (air)	No	40	78	18
Concrete Mixer Truck	No	40	79	40
Concrete Saw	No	20	90	55
Crane	No	16	81	405
Dozer	No	40	82	55
Dump Truck	No	40	76	31
Excavator	No	40	81	170
Front End Loader	No	40	79	96
Generator	No	50	81	19
Grader	No	40	N/A	0
Impact Pile Driver	Yes	20	101	11
Jackhammer	Yes	20	89	133
Pavement Scarifier	No	20	90	2
Paver	No	50	77	9
Roller	No	20	80	16
Scraper	No	40	84	12
Tractor	No	40	N/A	0
Vibratory Pile Driver	No	20	101	44

Legend: N/A- Not Applicable

Notes:

1. Indication whether or not the equipment is an impact device.
2. The acoustical usage factor refers to the percentage of time the equipment is running at full power on the job site and is assumed at a typical construction site for modeling purposes.
3. The measured "Actual" emission level at 50 ft for each piece of equipment based on hundreds of emission measurements performed on Central Artery/Tunnel, Boston MA work sites.
4. The number of samples that were averaged together to compute the "Actual" emission level.

Source: U.S. Department of Transportation (USDOT) 2006.

The dB level of a sound decreases (or attenuates) exponentially as the distance from the source increases. For a single point source, like a construction bulldozer, the sound level decreases by approximately 6 dBs for each doubling of distance from the source. Sound that originates from a linear, or 'line' source, such as a passing aircraft, attenuates by about 3 dBs for each doubling of distance where no other features such as vegetation, topography, or walls absorb or deflect the sound. Depending upon their nature, such features ability to reduce noise levels may range from minimally to substantially.

With the exception of safety standards for construction workers, the Marine Corps does not have a formal policy for management of construction noise. Construction noise is typically confined within an installation boundary, occurs during daylight hours, and is only present during the period of construction. There are no local requirements for construction noise that would apply to the proposed construction activities.

6.1.2 Tinian

The noise environment on Tinian stems from the existing aviation and ground training that occur at the Tinian Military Lease Area (MLA). This area encompasses 15,400 acres (ac) (6,232 hectares [ha]) on the island, leased by the Department of Defense from the Commonwealth of the Northern Mariana Islands (CNMI). Training on Tinian is conducted on two parcels within the MLA: the Exclusive Military Use Area (EMUA) encompassing 7,600 ac (3,075 ha) on the northern third of Tinian, and the Leaseback Area (LBA) encompassing 7,800 ac (3,156 ha) and the middle third of Tinian. The MLA supports small unit-level through large field exercises and expeditionary warfare training.

The LBA is Department of Defense (DoD) leased land covering the central portion of the island, and makes up the middle third of Tinian. The LBA is used for ground element training including Military Operations in Urban Terrain-type training, command and control, logistics, bivouac, vehicle land navigation, convoy training, and other field activities. Tinian Airport (West Field) is located south of the southern border of the LBA.

Airfield Operations

North Field in the EMUA is an unimproved expeditionary World War II era airfield used for vertical and short-field landings. North Field is also used for expeditionary airfield training including helicopter insertion and extraction, paratroops training, Military Operations in Urban Terrain, airmobile landings, C-130 cargo drops, night vision goggle training, airfield seizure/defense, forward area refueling, bivouac, command and control, air traffic control, logistics, armament, rapid runway repair, and other airfield-related requirements. Pyrotechnics are authorized for use throughout the main North Field Area.

During World War II, aircraft originating from North Field bombed Japan and the deployed atomic bombs to Hiroshima and Nagasaki and, today, North Field is a National Historic Landmark. The surrounding area is used for force-on-force airfield defense and offensive training. While the activities at North Field and the EMUA create noise, they are located far north on Tinian. Consequently, no sensitive noise receptors are in the vicinity, thus there was no need to develop airfield noise contours to assess potential noise impacts.

The other airfield on Tinian is the Tinian Airport (West Field), the commercial airport on the southern boundary of the LBA. The runway is not instrumented; however, it is capable of landing large aircraft. Currently, Tinian Airport (West Field) averages 67 flight operations a day (62 air taxi, and five general aviation flights). There are four single engine aircraft and two multi-engine aircraft based at the airport. The airport has limited airfield services. No noise contours have been developed for this airfield since sensitive noise receptors associated with San Jose village are located well to the south and east of the airfield.

The instrument landing system approach for Saipan International Airport occurs over the north end of Tinian, resulting in periodic elevated noise levels from low-altitude jet aircraft throughout the day. With 22 aircraft based at Saipan International Airport, daily aircraft operations average 108, consisting of commuter/inter-island flights for Tinian and Rota using single engines, Shorts 360 and ATR 42 aircraft.

Firing Ranges

There are no active live-fire ranges in the EMUA or LBA. Some sniper small arms firing into bullet traps is conducted in association with training at North Field, resulting in discountable and infrequent noise.

6.2 ENVIRONMENTAL CONSEQUENCES

6.2.1 Approach to Analysis

Potential sound-generating events associated with the proposed action were identified and the potential sound levels that could result from these activities were estimated on the basis of published military sound sources information. These estimated sound levels were reviewed to determine if they would represent a significant potential increase from the current ambient sound level, subsequently resulting in an adverse impact on sensitive receptors. In addition, evaluation was conducted to ensure that potential noise would not exceed any relevant or applicable standards.

6.2.1.1 Methodology

To derive the noise level contours, widely applied noise models were used for evaluating small arms ranges, large caliber ranges, construction, and airfields.

Airfield noise was estimated using NOISEMAP, a model which is used to generate noise level contours in DNL around an airfield. The model uses the aircraft type and number; takeoffs, landings, touch and go exercises, as well as closed patterns, and time of operation to depict noise levels at an airfield (USCHPPM 2009).

For live-fire training at the five proposed small arms ranges, noise was calculated using the Small Arms Range Noise Assessment Model (SARNAM) Version 2.6.2003-06-06. For the proposed hand grenade range, noise was calculated using the BNOISE2 modeling program updated BNOISE model (BNOISE2, Version 1.3.2003-07-03).

The SARNAM model analyzed various inputs for range configuration options. These inputs included the location and configuration of each range (including number of lanes, distance between firing point and target), approximate number of days the range is utilized annually, weapons to be fired at each of the ranges, percent of night firing, and information on range physical features (e.g., absorption material, backstop height, and distance parameters for barriers, baffles, etc.). In addition, land and water data were entered into the model to account for greater sound reflection as sound propagates over water versus over land.

BNOISE2 model inputs for the two options regarding the hand grenade range included information on the location and configuration of the proposed grenade ranges, number of firing points, number of pits, and estimated use rates.

The Federal Highway Administration Construction Noise Handbook and the Roadway Construction Noise Model (USDOT 2008) was used for predicting potential construction noise impacts. This model applies known noise levels for most common construction activities at a reference distance of 50 ft (15 m) and calculates the noise levels at user designated distances.

6.2.1.2 Determination of Significance

Noise impacts result from perceptible changes in the overall noise environment that increases annoyance or affects human health. Annoyance is a subjective impression of noise that may involve both physical and emotional variables. Human health effects such as hearing loss and noise-related awakenings can result from noise. For this EIS/OEIS, noise is evaluated for both construction and operational activities. It is not anticipated that maintenance activities would noticeably contribute to the noise environment due to their intermittent nature and short duration. The threshold level of significant impacts for noise is:

- The increase of any incompatible sensitive noise receptors (residences, hospitals, libraries, etc.) under noise contours where the effects are immitigable. This threshold is intended to capture areas where there would be “high annoyance” effects from operational noise, alongside health effects and complaints.
- Construction noise resulting in an hourly equivalent sound level of 75 dBA (based on USEPA data for construction noise) at a sensitive receptor (such noise exposure would be equivalent to noise Zone III) or *consistent* exposure to noise levels at 85 dBA, over an 8-hour period, the National Institute for Occupational Safety and Health recommended exposure limit (NIOSH 1998).

6.2.1.3 Issues Identified During Public Scoping Process

One comment received during the scoping process from the public, including regulatory stakeholders, expressed concern over noise-induced stress from fixed-wing aircraft and helicopters.

6.2.2 Alternative 1 (Preferred Alternative)

6.2.2.1 Tinian

<u>Construction</u>

Construction activities for the above listed projects would require the use of heavy equipment for site preparation and development (e.g., vegetation removal, grading, back fill, etc.) and could potentially generate noise above average ambient noise levels. The construction-related noise levels would be typical of standard construction activities (i.e., 85-100 dBA), and would be scheduled to occur only during normal working hours (i.e., between 7:00 a.m. and 5:00 p.m., Monday through Friday). Temporary increases in truck traffic used to transport materials on- and off-site would also produce greater noise disturbances within and near the construction corridors. These noise disturbances would diminish the farther sensitive noise receptors are from the construction site. The town of San Jose lies about 2 miles (mi) (3 kilometers [km]) south of the Tinian airport and the nearest residence is a least 1 mi (1.5 km) from the proposed construction areas in the LBA north of the airport. Construction noise could be as high as 100 dBA at the site, but would attenuate to about 60 dB L_{max} at the nearest receptor. This is well below threshold for sensitive receptors or continuous exposure and would produce an impact that is less than significant.

<u>Operation</u>

Airfield Operations

Airfield operations associated with the proposed action on Tinian focus on the Tinian Airport where airlifts would be required for transporting troops to and from Guam. The transport of 200-400 Marines to Tinian from Guam for the proposed one week per month company-level training exercises would be via air transport. The estimated sorties associated with the notional airlift requirements are provided in Table 6.2-1. The table summarizes key data such as the number of sorties for the aircraft to transport 200 and 400 Marines respectively and the percentage of operations it would represent at the Tinian Airport if all sorties were to be conducted from the Tinian Airport. The rotary-wing sorties would be between Andersen Air Force Base North Field on Guam to either the bivouac area or Tinian Airport (West Field) on Tinian. The fixed-winged sorties (C-130 and C-17s) would not go between the bivouac areas on Tinian; only the Tinian Airport (West Field) has a runway sufficient to support traffic from these aircraft. No aircraft would be permanently based at Tinian North Field. As a result, noise contours would not be required for the proposed action at Tinian because all of the flights would be transient. Furthermore, North Field is located on the opposite side of the installation from off-base land users such that noise contours, if developed, would remain well inside the boundaries of the military area.

Table 6.2-1. Guam to Tinian Notional Airlift Requirements

Aircraft Type	*Capacity (Marines Transported) per Sortie*	*Sorties for Airlift of 200 Marines*	*Sorties for Airlift of 400 Marines*	*Percentage of operations if all went to Tinian Airport*
CH-53D	37	6	11	5%
CH-53E	55	4	8	3.4%
MV-22	20	10	20	8.5%
C-130	76	3	6	2.6%
C-17	102	2	4	1.7%

Notes: Assumes two operations per sortie and 469 existing flights at Tinian per week.
Sources: Marine Corps 1999, Navy 2004, Air Force 2008.

The bivouac area proposed for the airlift operations is located well within the LBA, and noise generated at the site would emanate off installation boundaries. Airlift operations to Tinian Airport would likely be the C-130 or C-17 operations. The number of operations would be concentrated on Mondays and Saturdays when the Marines are dropped off and picked up from Tinian. The current number of operations at Tinian Airport is 67 operations per day or about 469 operations per week. Table 6.2-1 also shows the percentage of the new military airlift operations compared to the existing operations at Tinian Airport. The largest contributor would be the MV-22 at 8.5%. However, this percentage would represent a small change to the noise environment at Tinian Airport. Under this airlift operations scenario, rather than experiencing an average noise level metric such as DNL, the noise receptors would experience a series of SELs concentrated on the 2 days of the week when Marines are transported to Tinian.

For example, if C-17s are used for transportation of 400 Marines, then ground receptor(s) would hear four sorties arriving and four leaving on Monday and not hear anymore C-17s until Saturday when they would hear the same number of planes come back to pick up the Marines at the end of the week. Since the exposure would be brief, with no residences under the flight path, the impacts would be negligible and less than significant.

Table 6.2-2 shows the SEL levels for potential airlift operations. Noise levels around airports are expressed in terms of DNLs because this measurement provides a good average noise level from aircraft travelling to and from a single location, the runways. On the other hand, training operations do not always have centralized destinations. In this case, a better measurement of noise analyses is to use SELs for aircraft traveling overhead or laterally from an observer. Table 6.2-2 lists the aircraft proposed for this action and the associated SELs for cruising speeds at various altitudes. Operations applicable for using this noise metric are those where the aircraft is moving along a route or traversing through airspace such as flying in formation, terrain flights, ground threat reaction, and defensive maneuvers.

While the information is Table 6.2-2 is useful for assessing noise effects of aircraft passing by, these data do not accurately reflect noise associated with training exercises such as hovering activities at landing zones (LZs). A better representation is provided in Table 6.2-3 for low-speed flights. However, these noise levels are modeled at the slowest speeds the models are capable of calculating. It is expected that noise levels in the hovering mode would be higher (Czech 2009).

Table 6.2-2. Sound Levels (SEL and L_{max} [dBA]) for Proposed Aircraft Associated

Altitude (ft AGL)	*MV-22*		*CH-53*		*AH-1*		*UH-1*	
	SEL	L_{max}	*SEL*	L_{max}	*SEL*	L_{max}	*SEL*	L_{max}
100	108	104	106	106	98	97	106	97
250	96	96	101	98	94	89	100	89
500	92	89	98	91	91	83	96	83
1,000	88	82	94	85	87	76	91	76
KIAS	220		120		100		80	
Power Setting	Cruise		68% Q-BPA		LFO Lite 100 knots		100% RPM	

Legend: KIAS = Knot indicated air speed; LFO = Level flight operation; RPM = Revolutions per minute.
Notes: Environmental conditions were assumed to be 80% humidity and 80^{o} F. N/A indicates data not available.
Sources: Air Force 2002, Navy 2009.

Table 6.2-3. Single Event Maximum Noise Levels (L_{max}, dBA) for Low-speed Flights

Altitude (ft AGL)	*MV-22*[1]	*CH-53E*[1]	*AH-1W*[1]	*UH-1N*[2]
	64 KIAS	*65 KIAS*	*65 KIAS*	*65 KIAS*
30	117	112	110	n/a
60	110	106	103	103
100	106	101	99	97
150	102	97	95	94

Notes: [1.] RNM Single Track Mode used for L_{max} calculation
Receiver directly below flyover and at 5 ft AGL
Time spacing equal to 0.1 seconds
Modeled utilizing the appropriate slowest speed sound sphere available for each aircraft
[2.] Modeled with MRNMAP single track flyover using L_{max} metric mode
n/a -- MRNMAP altitude limitations do not allow calculation down to 30 ft AGL

Live-Fire Training

The operation of the four proposed ranges on Tinian: would result in the introduction and long-term presence of a noise source associated with small arms fire. At the Automated Combat Pistol/Multipurpose Firearms Qualification Course, 9 millimeter small arms would be authorized for use. At the other three ranges, 5.56 millimeter rifles would be authorized for use. Noise that would be generated by the proposed small arms firing is characterized as impulsive noise that is associated with a higher level of annoyance as compared to more continuous noise sources (e.g., traffic noise). Impulsive sound is of short duration (typically less than one second) and high intensity. It has abrupt onset, rapid decay, and often a rapidly changing spectral composition. Other sources of impulse sound include explosions, impacts, and the passage of supersonic aircraft (sonic booms).

There are two major noise sources generated from small arms munitions firing. The first is the muzzle blast from the firing of a bullet. The second is the noise from the bow shock wave (also known as ballistic wave) generated by the super-sonic bullet. The bow shock wave propagates out from the path of the bullet. The bullet from an M16 has an exit velocity of approximately 3,100 ft (945 m) per second, but decelerates quickly. After approximately 3,937 ft (1,200 m), it is no longer flying at supersonic speeds and the shock wave would likely end within 6,562 ft (2,000 m).

Firing noise from single shots merged in bursts, machine gun bursts, and concurrent firing of multiple weapons as would occur at the proposed ranges, would result in short periods of intense firing followed by longer periods of silence. There may be an increased annoyance associated with this type of noise exposure pattern. Under these conditions, the number of shots becomes less important than the dB level of the typical (average) shot. It has been found that small arms fire is usually not a concern unless the linear peak sound pressure level of individual shots is above 85 dB PK 15(met) The results of the modeling of the noise impacts from Range Complex Alternative 1are provided in Figure 6.2-1. The contours would be entirely within the DoD-controlled land except for a small portion extending on the northern edge of the Tinian Airport property. In this case, no noise-sensitive receptors would be impacted, resulting in no noise impacts associated with this alternative.

Noise from other elements of the proposed action on Tinian, such as from bivouac activity and transport of the 200-400 Marines would be discountable and would not affect sensitive noise receptors. Since neither live-fire noise nor the other activities associated with Tinian would reach sensitive receptors, operational impacts due to airfield operations and live-fire training would result in no noise impacts.

6.2.2.2 Summary of Alternative 1 Impacts

Airfield operations at Tinian Airport would be due to weekly airlifting Marines to and from Guam on Mondays and Saturdays. The number of operations would be at most 8.5% if MV-22s are used, and noise impacts would be less than significant. Aviation and live-fire training would be located well with the military area and noise associated with these activities would not likely be heard from off-base receptors. Table 6.2-4 summarizes Alternative 1 impacts.

Table 6.2-4. Summary of Alternative 1 Impacts

Area	*Project Activities*	*Project Specific Impacts*
Tinian	Construction	Construction noise impacts would be less than significant because noise from construction activities would not reach sensitive receptors
	Operation	Operations noise impacts would be less than significant for airfield operations and live-fire training

6.2.2.3 Alternative 1 Potential Mitigation Measures

Mitigation measures have not been identified for any of the activities or locations associated with the proposed action since noise levels above casual receptors not permanently living or working under a noisy location would be within acceptable standards.

6.2.3 Alternative 2

6.2.3.1 Tinian

<u>Construction</u>

Noise impacts during the construction phase of Alternative 2 would be identical to Alternative 1 except for the location and orientation of the firing ranges and associated notional surface danger zones (SDZs) and below the threshold for sensitive receptors or continuous exposure. Given these assessments, potential noise impacts associated with construction activities for Alternative 2 would be less than significant.

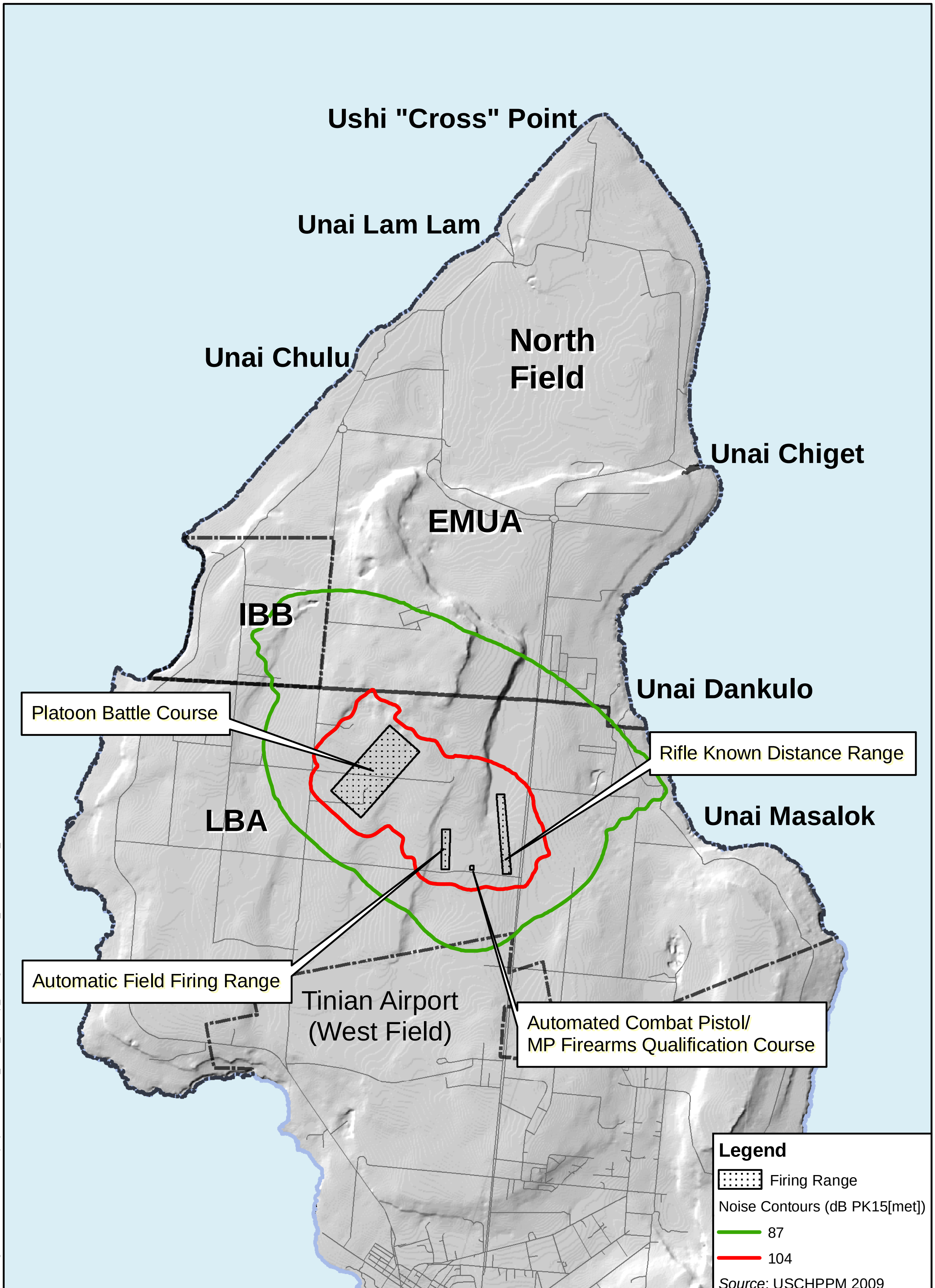

Figure 6.2-1
Projected Small Caliber Operational Noise Contours - Alternative 1

Operation

Noise impacts during the operational phase of Alternative 2 would be identical to Alternative 1 and would be considered less than significant.

The results of the modeling of the noise impacts from Range Complex Alternative 2 are provided Figure 6.2-2. With the exception of the configuration of the potential noise exposure locations, the noise impacts of Alternative 2 would be as described for Alternative 1.

6.2.3.2 Summary of Alternative 2 impacts

Table 6.2-5 summarizes Alternative 2 impacts.

Table 6.2-5. Summary of Alternative 2 Impacts

Area	*Project Activities*	*Project Specific Impacts*
Tinian	Construction	Construction noise impacts would be less than significant because noise from construction activities would not reach sensitive receptors
	Operation	Operations noise impacts would be less than significant for airfield operations and live-fire training

6.2.3.3 Alternative 2 Potential Mitigation Measures

Mitigation measures have not been identified for any of the activities or locations associated with the proposed action since noise levels above casual receptors not permanently living or working under a noisy location would be within acceptable standards.

6.2.4 Alternative 3

6.2.4.1 Tinian

Construction

Noise impacts during the construction phase of Alternative 3 would be identical to Alternative 2 except for the location and orientation of the firing ranges and associated notional SDZs and it would be below the threshold for sensitive receptors or continuous exposure and therefore considered less than significant.

Operation

Sources of noise pollution during daily operations are common to all Alternatives and are detailed above in Alternative 1. Therefore potential operational noise impacts from this alternative would be less than significant.

The results of the modeling of the noise impacts from Range Complex Alternative 3 are provided Figure 6.2-3. The noise contours for this alternative extend farther onto non-DoD lands, but are still within the Tinian Airport property and no sensitive noise receptors would be affected. As a result, there would be no noise impacts associated with live-fire training for this alternative.

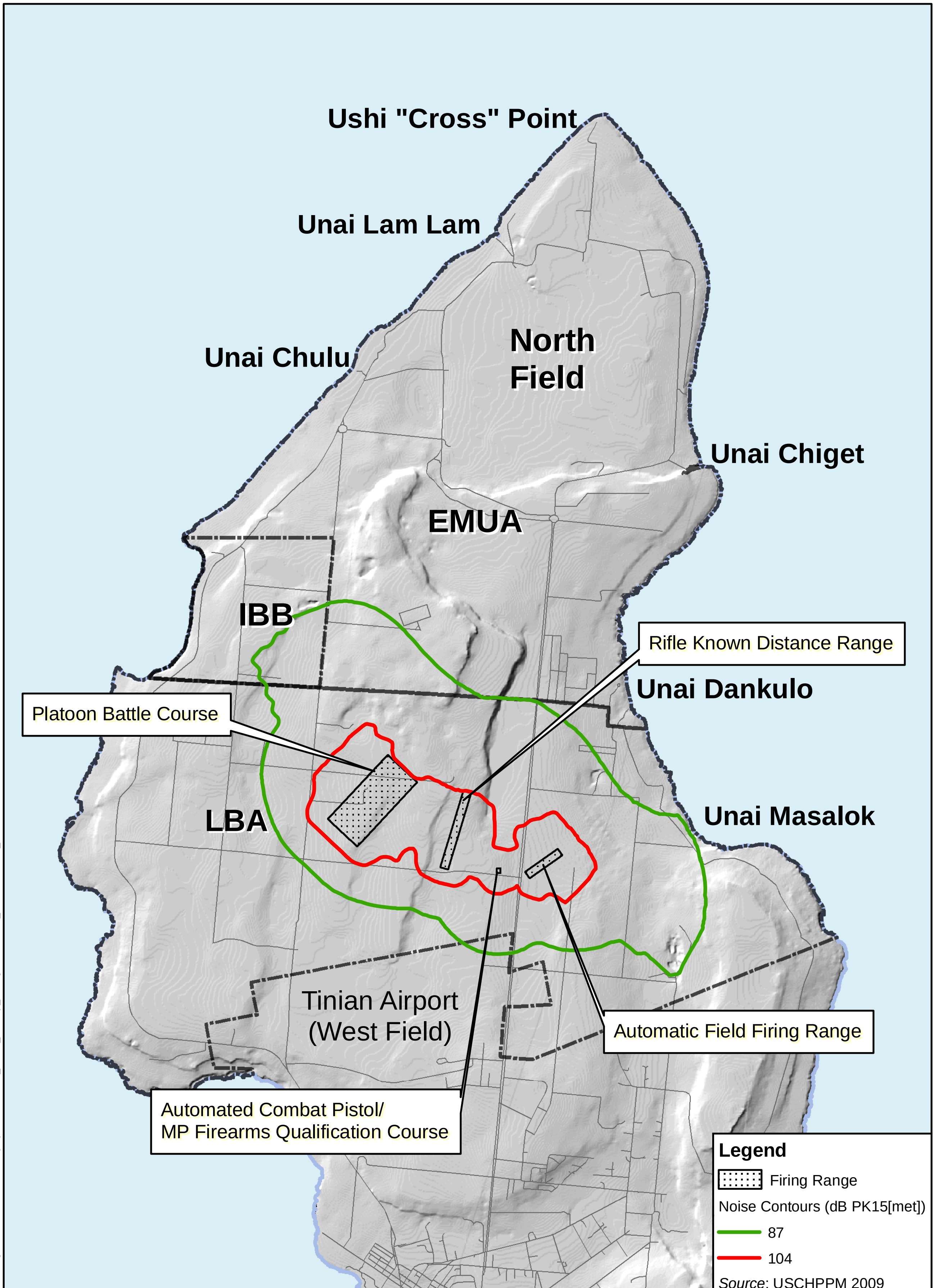

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Figure 6.2-2
Projected Small Caliber Operational Noise Contours - Alternative 2

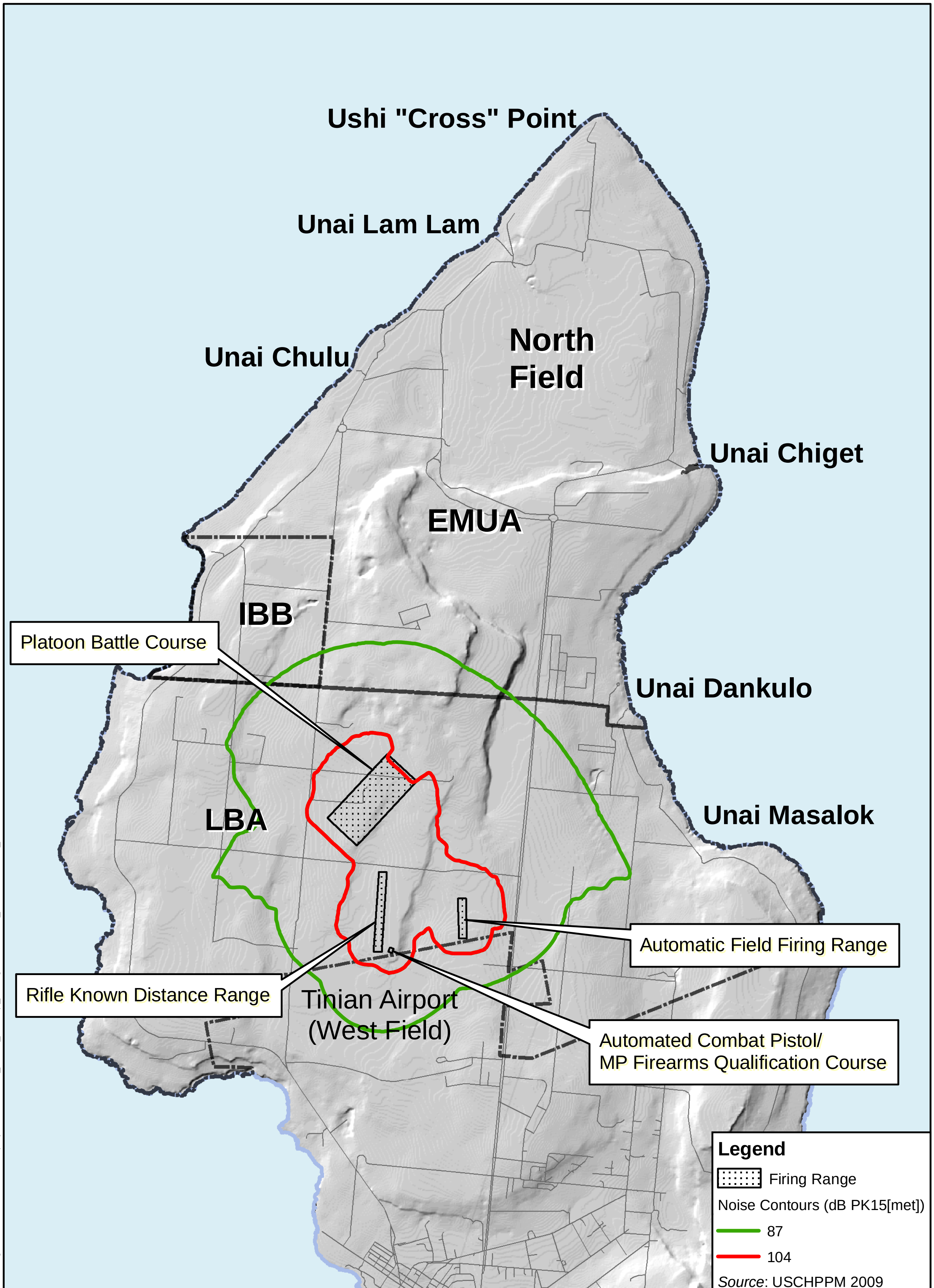

Figure 6.2-3
Projected Small Caliber Operational Noise Contours - Alternative 3

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6.2.4.2 Summary of Alternative 3 Impacts

Table 6.2-6 summarizes Alternative 3 impacts.

Table 6.2-6. Summary of Alternative 3 Impacts

Area	*Project Activities*	*Project Specific Impacts*
Tinian	Construction	Construction noise impacts would be less than significant because noise from construction activities would not reach sensitive receptors
	Operation	Operations noise impacts would be less than significant for airfield operations and live-fire training

6.2.4.3 Alternative 3 Potential Mitigation Measures

Mitigation measures have not been identified for any of the activities or locations associated with the proposed action since noise levels above casual receptors not permanently living or working under a noisy location would be within acceptable standards.

6.2.5 No-Action Alternative

Under the no-action alternative, Marine Corps units would remain in Okinawa and would not relocate to Guam. No additional training capabilities would be implemented for Tinian to support the proposed action. The purpose, needs, and treaty commitments of the DoD would not be met. There would be no new construction or new training activities on Tinian.

6.2.6 Summary of Impacts

Table 6.2-7 summarizes the potential impacts of each action alternative and the no-action alternative. A text summary is provided below.

Table 6.2-7. Summary of Impacts

Alternative 1	*Alternative 2*	*Alternative 3*	*No-Action Alternative*
LSI • Construction noise impacts would be less than significant • Operation noise impacts would be less than significant for airfield operations and live-fire training	LSI • Construction, same as Alternative 1 • Operation, same as Alternative 1	LSI • Construction, same as Alternative1 • Operation, same as Alternative 1	NI

Legend: LSI = Less than significant impact; NI = No impact.

Aircraft noise would be generated on Tinian and in Special Use Airspace at other CNMI locations, but would be concentrated well away from populated areas or at the Tinian Airport. Noise levels (if any) experienced by sensitive receptors would be low and concentrated on the days the airlift is transporting Marines to and from Tinian. Construction noise would be minimal because it would be located well within the boundary of the LBA or EMUA. Similarly, live-fire exercises would create noise, but at levels to far away from the nearest receptor(s) to be heard, consequently not creating incompatible noise zones that would extend past the boundary of military controlled lands on Tinian.

6.2.7 Summary of Potential Mitigation Measures

Table 6.2-8 summarizes the potential mitigation measures.

Table 6.2-8. Summary of Potential Mitigation Measures

Alternative 1	*Alternative 2*	*Alternative 3*
Construction		
• None	• None	• None
Operation		
• None	• None	• None

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