2.0 DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

Two alternatives are assessed in this EA—the Proposed Action and the No Action Alternative. Section 2.1 provides a description of the MM III system, including missile system components and the operational MM Wings. Section 2.2 provides a description of the No Action Alternative. Section 2.3 gives a detailed description of the Proposed Action by phase and activity. Alternatives to the Proposed Action that were considered and eliminated from further study are discussed in Section 2.4. A summary comparison of the environmental impacts associated with the Proposed Action and the No Action Alternative is presented in Section 2.5. Lastly, Section 2.6 identifies the USAF's preferred alternative.

2.1 MINUTEMAN III SYSTEM DESCRIPTION

2.1.1 Minuteman III Missile

The MM III ICBM consists of five major missile sections: the three-stage solid-propellant booster, the propulsion system rocket engine (PSRE), the missile guidance set, the Model or MOD 7 instrumentation wafer (flight test configuration only), and the RS. The latter four sections make up what is generally referred to as the post-boost vehicle. The missile is approximately 59.9 feet (ft) [18.3 meters (m)] long, with a maximum diameter of 5.5 ft (1.7 m), and weighs approximately 79,400 pounds (lb) [36,000 kilograms (kg)]. Further discussions on key components of the MM III missile are provided in the paragraphs that follow. A diagram of the MM III is provided in Figure 2-1.

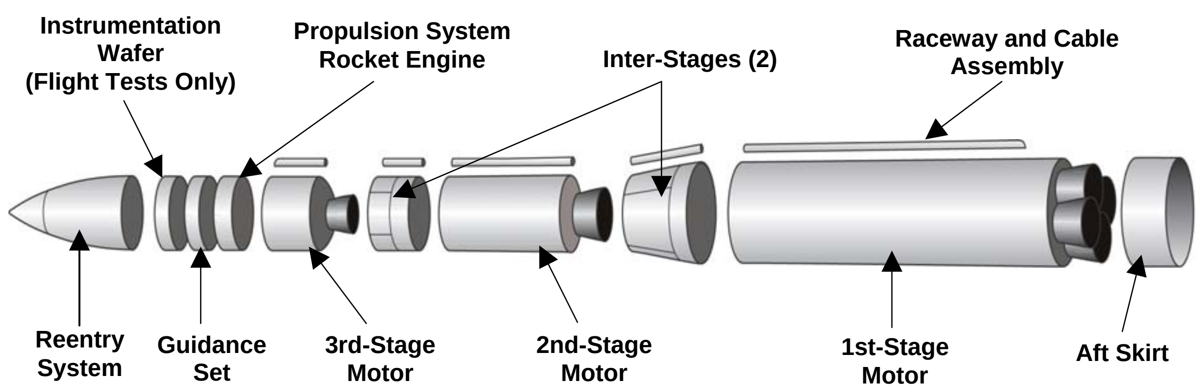

Figure 2-1. Minuteman III Missile

Solid-Propellant Booster

The solid-propellant booster is comprised of the assembled 1st, 2nd, and 3rd stage motors, along with the inter-stages and ordnance systems. Information on the dimensions of each motor—and propellant weight, main chemical components, and DOD explosive classification—is provided in Table 2-1. The DOD classification determines the method of shipping and storing of the rocket propellants and other ordnance (DOD, 1999; USAF, 2001c).

Table 2-1. Solid-Propellant Rocket Motors					
Stage	Diameter ft (m)	Length ft (m)	Propellant		
			Quantity (approx.) lb (kg)	Main Chemical Components	DOD Classification
1st	5.5 (1.7)	18.6 (5.7)	45,700 (20,730)	Ammonium Perchlorate Aluminum Polybutadiene-Acrylic Acid-Acrylonitrile	Class 1.3
2nd	4.3 (1.3)	9.1 (2.8)	13,750 (6,240)	Ammonium Perchlorate Aluminum Polybutadiene-Carboxyl Terminated	
3rd	4.3 (1.3)	5.5 (1.7)	7,300 (3,310)		

Source: Ogden ALC, 2003; USAF, 2001b

During powered flight, each rocket motor uses a different Thrust Vector Control (TVC) system (steering mechanism) for pitch and yaw control. Descriptions of each and the materials they use are as follows:

- **1st Stage.** The TVC system on the 1st-stage motor uses hydraulically actuated, moveable nozzles for altering the thrust vector. Several gallons of hydraulic fluid are contained in the system.

- **2nd Stage.** The TVC is accomplished through the liquid injection of perfluorohexane into the rocket's gas exhaust. Approximately 200 lb (91 kg) of perfluorohexane are used.

- **3rd Stage.** The 3rd stage motor uses a liquid injection TVC system nearly identical in concept to the 2nd-stage system, except that strontium perchlorate is used. The TVC system uses approximately 50 lb (23 kg) of the liquid.

Small amounts of ordnance, in the form of linear explosive assemblies, are used to separate the stages during flight. Other ordnance carried on the three-stage booster includes motor igniter assemblies and an ordnance destruct package, used only for test launches at Vandenberg AFB.

Propulsion System Rocket Engine (PSRE)

Just above the 3rd-stage motor on the MM III is the PSRE. It is a liquid propellant rocket unit consisting of two sealed propellant storage assemblies, a helium gas storage tank for pressurizing the propellant, and several small rocket engines. The propellants used are monomethylhydrazine (CH_6N_2) as the fuel, and nitrogen tetroxide (N_2O_4) as the oxidizer, which form a hypergolic combination. The PSRE is completely assembled and fueled with 13.2 gallons (gal) [50 liters (L)] of fuel and oxidizer each at the time of manufacture. Other ordnance materials within the PSRE contain less than 1 ounce (28 grams) of additional explosives.

Missile Guidance Set and MOD 7 Instrumentation Wafer

Mounted on top of the PSRE are the electronic missile guidance set and the MOD 7 instrumentation wafer (used only for flight tests). The guidance set is an inertial guidance system that directs the flight of the MM III missile. Components within the instrumentation wafer transmit data to track the missile's flight path and evaluate performance, following launch from Vandenberg AFB.

Reentry System (RS)

The payload section on top of the MM III missile is referred to as the RS. Inside of the RS, the Support Payload Bulkhead provides a structural support base for the RVs, and carries the electronics needed to activate and deploy them in flight. A two-piece shroud covers the bulkhead and RVs, protecting them during ascent. The nose cap on top of the shroud contains a small rocket motor containing 6.8 lb (3.1 kg) of solid propellant, which is used to eject the shroud from the vehicle while in flight. Other small quantities of ordnance carried on board the RS include a shroud ejection motor initiator, gas generators, and gas generator initiators, which, when combined, contain less than 1 lb (0.45 kg) of additional explosives.

In its current configuration, the fielded MM III RS employs either the Mark 12 RV or the Mark 12A RV (see Figure 2-2).

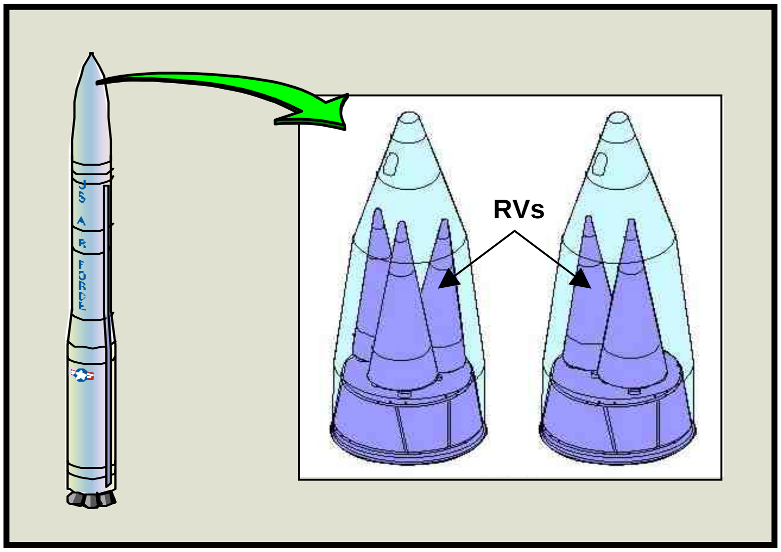

Figure 2-2. Minuteman III Reentry System (Existing)

Batteries

To provide electrical power to the MM III subsystems, several different types of batteries are carried on board the motors, the RS, and other sections of the missile. These include multiple silver-zinc batteries, a single lithium carbon monofluoride battery, and a single lithium silicon/iron disulfide (thermal) battery. Approximately 15 batteries are carried on each MM III flight test missile (depending on the RS configuration used), each weighing from 1 to 21 lb (0.5 to 9.5 kg).

2.1.2 Minuteman Wings

Of the 500 MM III ICBMs currently deployed, 200 are located within the missile Wing at Malmstrom AFB, while 150 each are at FE Warren and Minot AFBs. All of the missiles are widely dispersed in underground, hardened LF silos within the Wing area. For every grouping or "flight" of 10 LFs in the field, there is one manned LCC providing command and control interface with the LFs.

As shown in Figures 2-3 through 2-5, the individual Wings cover broad areas, ranging in size from 8,500 to 12,600 square miles [22,015 to 32,635 square kilometers (km)]. Each polygon on the figures

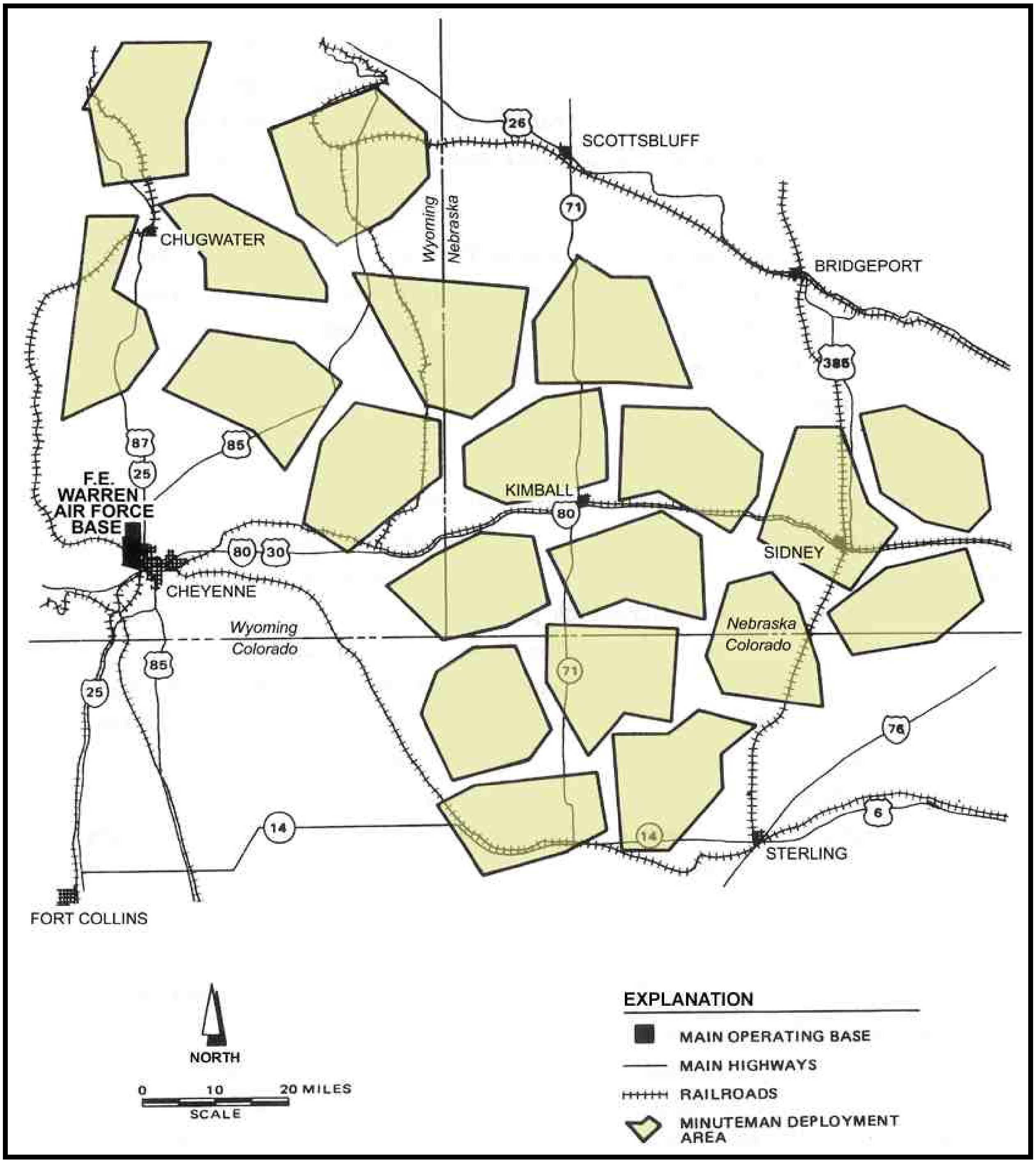

Figure 2-3. Minuteman Wing for FE Warren AFB, Wyoming

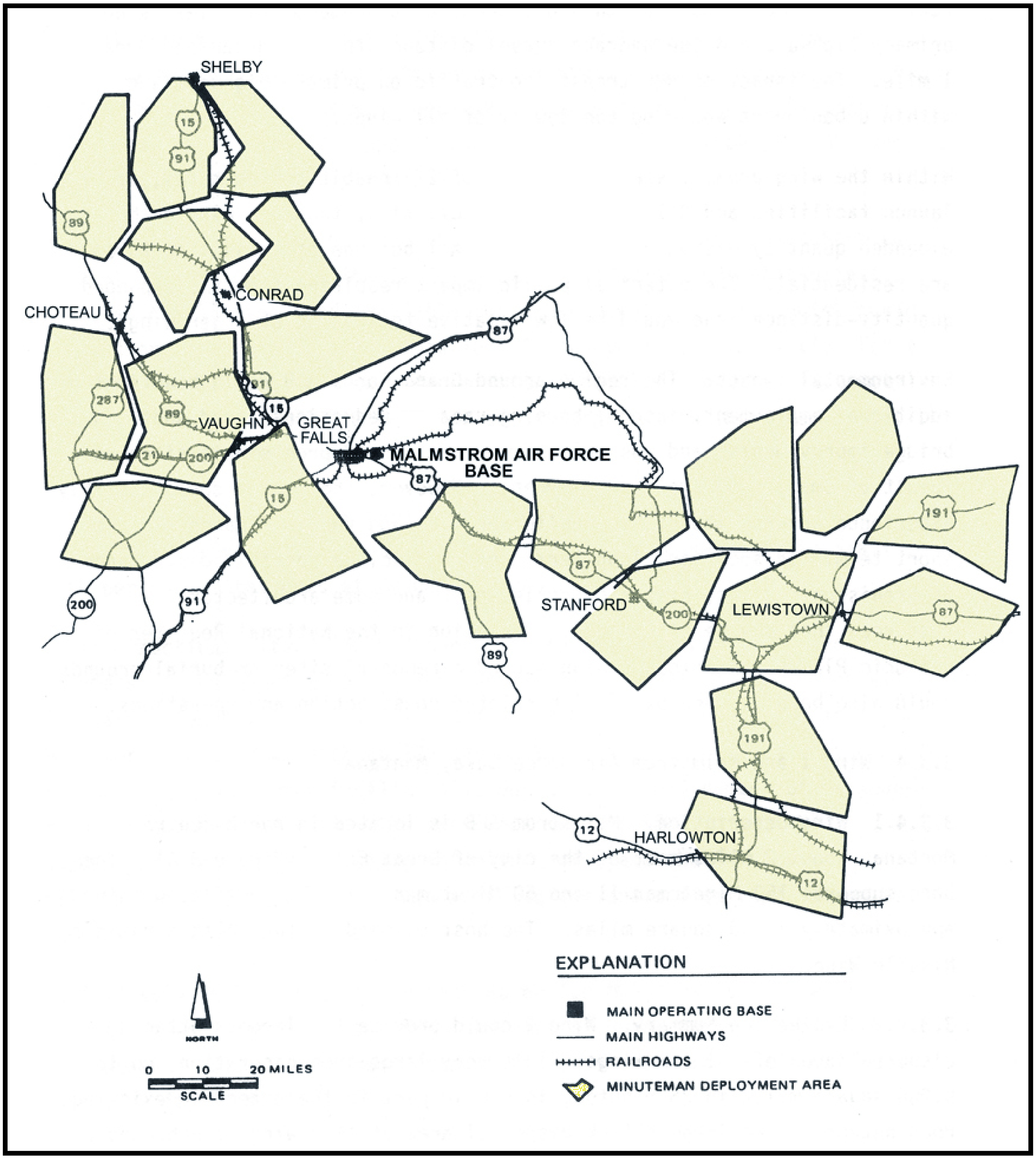

Figure 2-4. Minuteman Wing for Malmstrom AFB, Montana

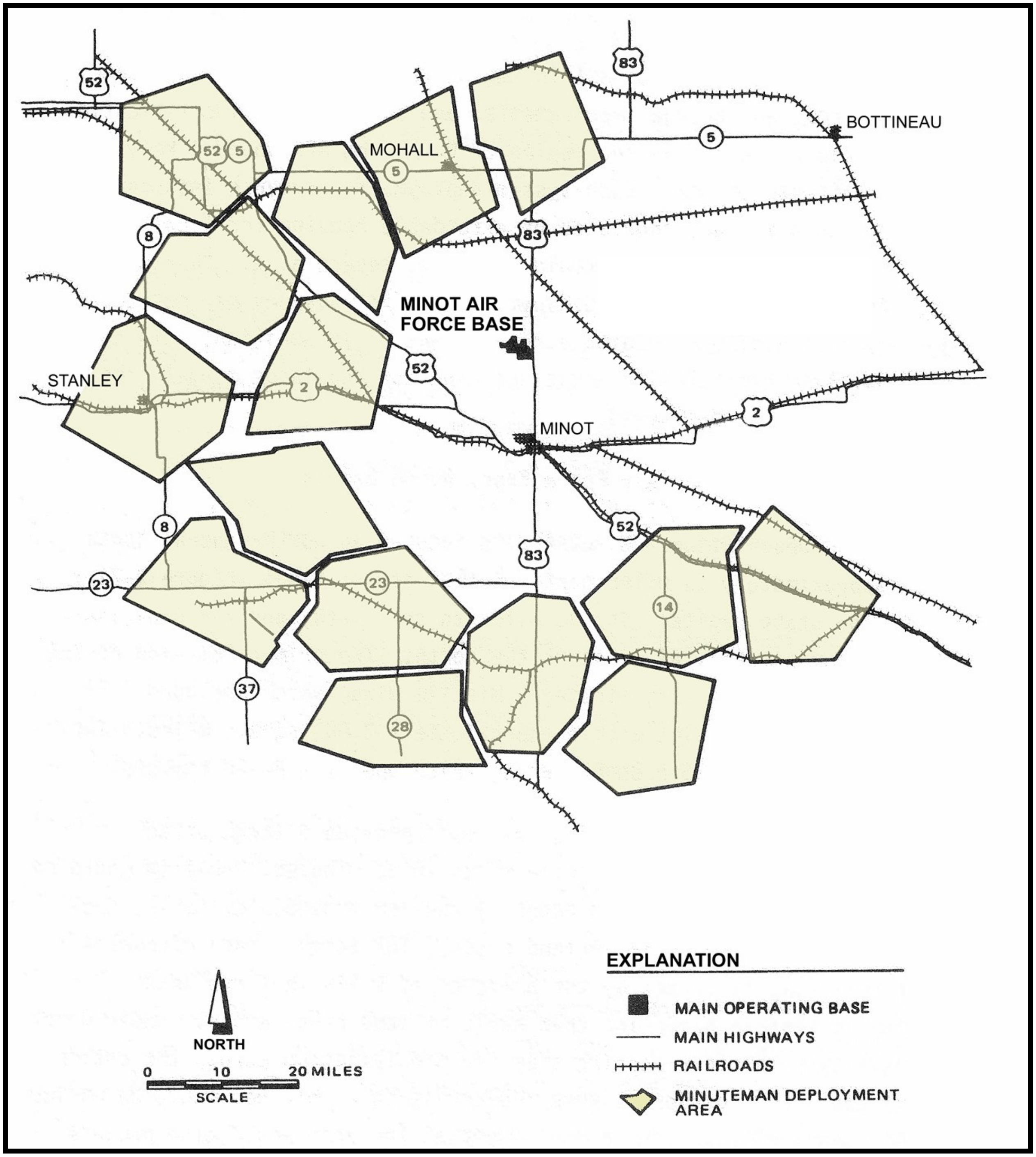

Figure 2-5. Minuteman Wing for Minot AFB, North Dakota

represents an area containing a single "flight" of 10 missile LFs and one LCC. Additional missile maintenance and training facilities are located at each Wing.

2.2 NO ACTION ALTERNATIVE

Under the No Action Alternative, the proposed MM III modification would not be implemented. The RS-related equipment would not be flight tested at Vandenberg AFB, or deployed on the fielded MM III ICBMs at each of the Wings. In addition, the MM III command and control console equipment (hardware and software) upgrades would not be deployed to the LCCs, or to other trainer and support facilities. Command and control operations would continue to use and maintain the existing console equipment, and replace failed units for as long as spares are available.

Through ICBM follow-on test and evaluation programs, ongoing system monitoring and testing of MM III components would continue to ensure weapon system safety, accuracy, and reliability for the remaining life of the MM III system. All of the installations and facilities that would have supported the proposed MM III modification would continue their current operations in support of maintaining the MM III ICBM weapon system. The ICBM follow-on test and evaluation activities for these locations are described in the following sections.

Though not specifically described herein as part of the No Action Alternative, other ongoing and future life-extension programs for the MM III weapon system would continue as planned.

2.2.1 FE Warren, Malmstrom, and Minot Air Force Bases

As part of ongoing operations at the three MM Wings, MM III missiles and/or certain missile components are periodically removed from the remote LFs and transported back to the Wing support base for maintenance, system checks, parts replacement, and occasional system upgrades. If the three-stage solid-propellant booster requires maintenance or motor change-out, or is to be used for flight tests at Vandenberg AFB, then a Transporter Erector (TE) vehicle (Figure 2-6) is brought in to remove the booster from the LF and transport it back to the support base.

At the support base, the intact booster is transferred from the TE to a Missile Transporter (MT) trailer (Figure 2-7) and readied for transport to either Hill AFB or Vandenberg AFB, depending on the actions required. When necessary, the RS and PSRE are transported separately back to the support base. The design of the PSRE is such that its handling and storage does not require the transfer of liquid propellants. If such actions or other maintenance procedures are required, the PSRE is shipped to the depot maintenance facility at Hill AFB. Any maintenance or other work done on the RS is conducted at the Wing support base.

Once the missile maintenance, upgrades, or other parts replacement actions are completed, the MM III components are transported from the support base back to the missile LF, and reinstalled in the reverse order from when they were first pulled.

To safeguard the RS, PSRE, booster, and other ordnance from fire or other mishap, all transportation, handling, and storage of these components would be accomplished in accordance with DOD, USAF, and US Department of Transportation (DOT) policies and regulations. Personnel supporting the ICBM program are regularly trained on missile handling and maintenance procedures using existing trainer facilities.

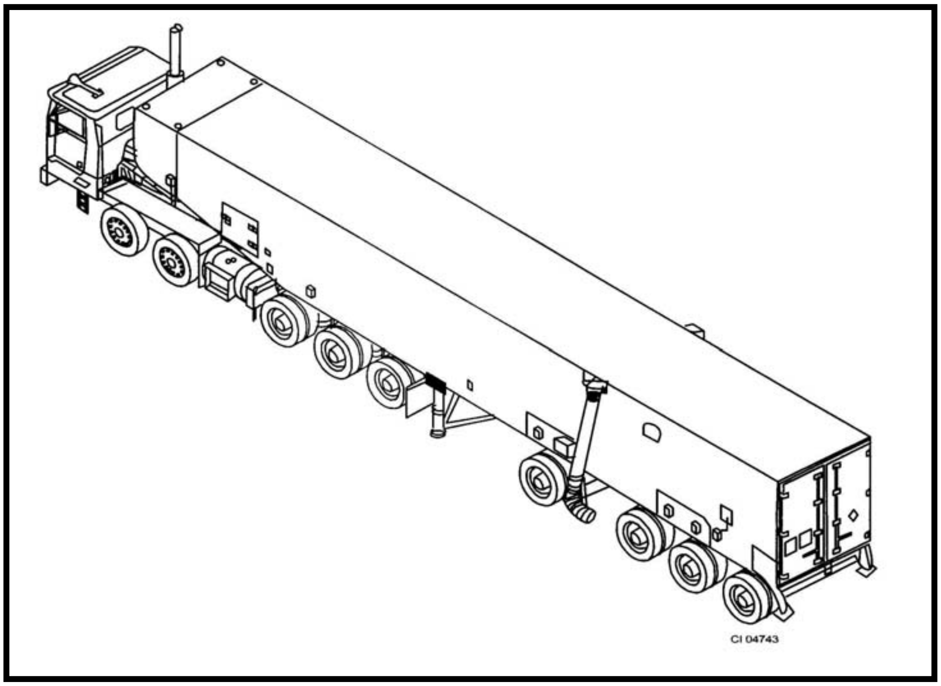

Figure 2-6. Transporter Erector

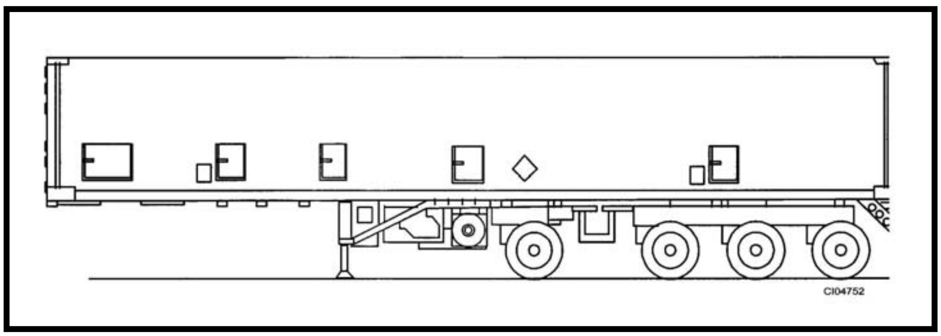

Figure 2-7. Missile Transporter Trailer

At each of the LCCs in the Wing areas, command and control operations, and missile monitoring, continue around the clock, 7 days a week. The console equipment at each LCC, which includes an HDA, VDUs, and an EMAD, is critical to the command and control operations, and interfaces with the silo-based missiles within each “flight.” Similar consoles used for training and maintenance purposes are located on each of the Wing support bases and at other MM III system support locations. Because of aging equipment problems, computer and other electronic console equipment will sometimes fail. Replacement of entire failed units is often the only option, since replacement parts are usually no longer available for equipment repairs. Failed HDA and VDU units that cannot be repaired are declassified and sent to the local or regional Defense Reutilization and Marketing Office (DRMO) for resale, material recycling, and/or disposal as solid or hazardous waste. FE Warren AFB is the only Wing support base without an on-site DRMO. In this case, the failed equipment is turned over to the base supply organization, which then ships it to Fort Carson’s DRMO in Colorado Springs, Colorado.

2.2.2 Hill Air Force Base

Located just south of Ogden, Utah, Hill AFB regularly provides logistics management and repair support for the nation's land-based ICBMs. As part of this effort, MM boosters are disassembled and reassembled at the base to allow for rocket motor inspections and testing for flight worthiness, motor refurbishment, and for motor change-outs and upgrades when required. This includes the annual replacement of three to four MM boosters pulled from the Wing LFs for flight tests at Vandenberg AFB, and the supply of other missile components needed for the tests. These actions are considered routine at Hill AFB and are dictated by standard operating procedures.

Most of the rocket motor operations at Hill AFB are conducted within the Missile Assembly Maintenance and Storage area, which is centrally located on base. For each building where motors are involved, Explosive Safety Quantity Distances (ESQDs) are in place to provide explosive hazard buffers between the buildings, and any non-related facilities and roadways nearby. Relatively small amounts of adhesives, sealers, and solvents are used in the booster assembly process.

Also at Hill AFB, the Strategic Missile Integration Complex (SMIC) is used for conducting a variety of tests on ICBM hardware and software components, in addition to providing training support. Just as at the Wings, failed HDA and VDU units in test consoles used at the SMIC, that cannot be repaired, are declassified and sent to the local DRMO on base for resale, material recycling, and/or disposal as solid or hazardous waste.

2.2.3 Vandenberg Air Force Base

The MM III missile is just one of a number of ballistic missiles and space-lift vehicles launched from Vandenberg AFB. As part of ongoing performance testing of the MM III system, Vandenberg AFB regularly conducts three to four MM III FDE launches every year. A comparison of the relative size of the MM III missile to some of the other launch vehicles used at Vandenberg is provided in Figure 2-8.

For each flight test, the USAF randomly selects a MM III missile from one of the three operational Wings. Using the methods previously described in Section 2.2.1, the solid-propellant booster, the PSRE, guidance set, and RS (minus the operational RVs) are shipped separately to Vandenberg AFB in preparation for a launch. An instrumentation wafer for the missile is also shipped to the base from storage at Hill AFB.

Pre-Flight Preparations

Upon arrival at the base, the booster is either placed temporarily in a missile storage bunker, or taken to the Missile Processing Facility (MPF) (Figure 2-9), depending on the launch schedule. After being unloaded at the MPF, the booster undergoes inspections and system checks, and the destruct package is added. The purpose of the destruct package is to terminate motor thrust if unsafe conditions develop during powered flight. The destruct package also contains the logic to detect a premature separation of the booster stages and initiate a thrust termination action on its own. Thrust is terminated by initiation of a linear shaped explosive charge, which splits the motor casing, releasing motor pressure. Usually, no more than four base personnel are involved during this installation process. The ESQDs from the MPF are set between 600 and 1,000 ft (183 and 305 m). These distances are expanded to 2,500 ft (762 m) during Safe and Arm Checks. The typical elapsed time from when the booster arrives at Vandenberg AFB to when the flight test is conducted is 3 to 4 months.

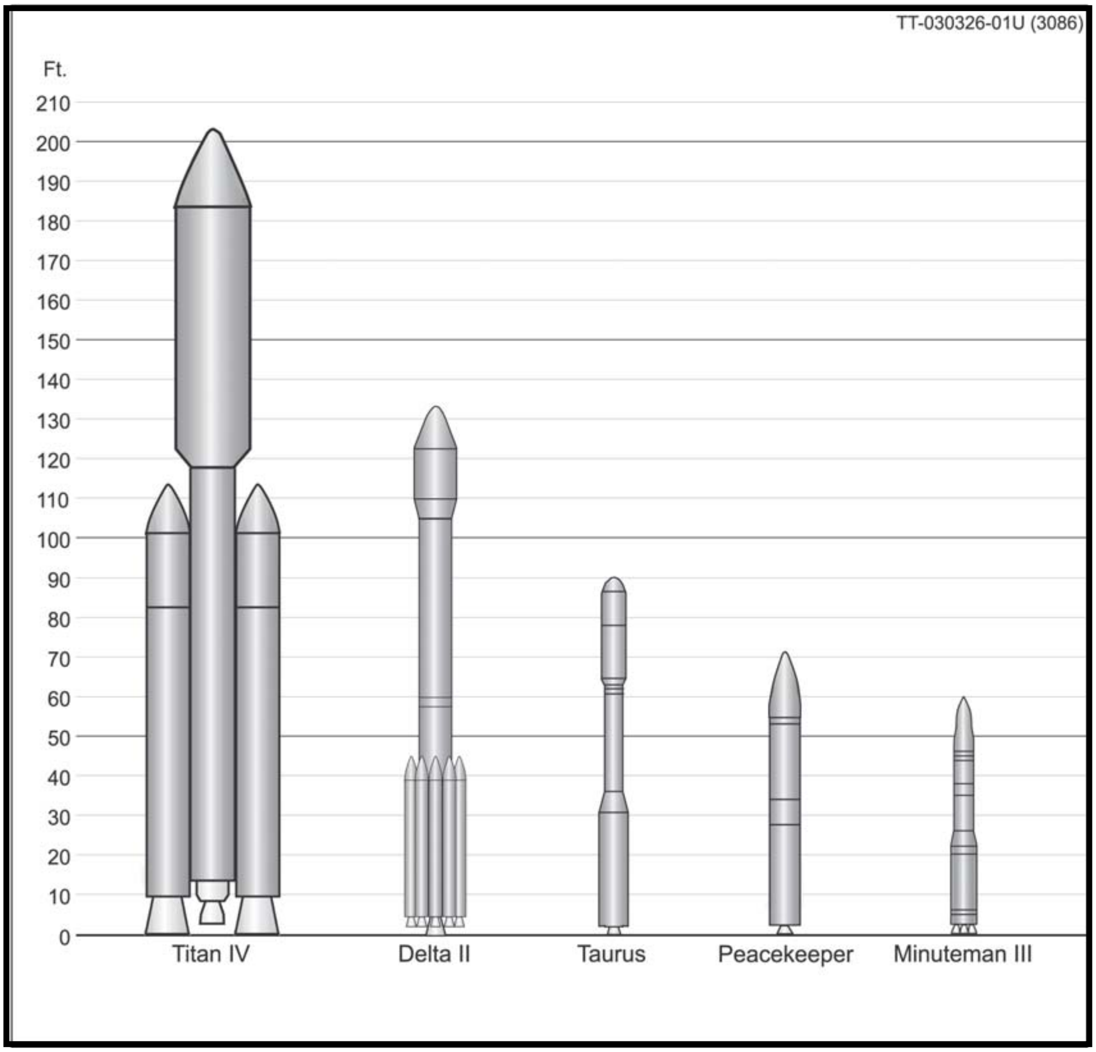

Figure 2-8. Comparison of Launch Vehicles

Once ready, the booster is transported in a TE to the designated LF near the north end of the base, where it is lowered into the underground silo. There are four LF silos at Vandenberg AFB for conducting MM III launches—LFs 04, 09, 10, and 26—which are used on a rotating basis in the launch cycle. The locations of these LFs are shown in Figure 2-9. Once the booster has been placed in the silo, ESQDs similar to those applied to the MPF are established for the LF.

After the booster is readied at the LF, the PSRE is removed from Building 1551 (where it was stored upon arrival at the base), and transported to the designated LF for placement on top of the booster. For safety purposes, Building 1551 has an ESQD of 1,250 ft (381 m) established around it. Following placement of the PSRE on the booster, the guidance set and instrumentation wafer are added.

At Vandenberg AFB, the RS is assembled at the Assembly, Surveillance, and Inspection (AS&I) facility (Munitions Assembly Building), which also has an ESQD of 1,250 ft (381 m) established around it. For the flight tests, the operational RVs that were removed at the Wing are replaced with one, two, or three test RVs. The test RVs serve to simulate operational RVs to help ensure that the weapon system is

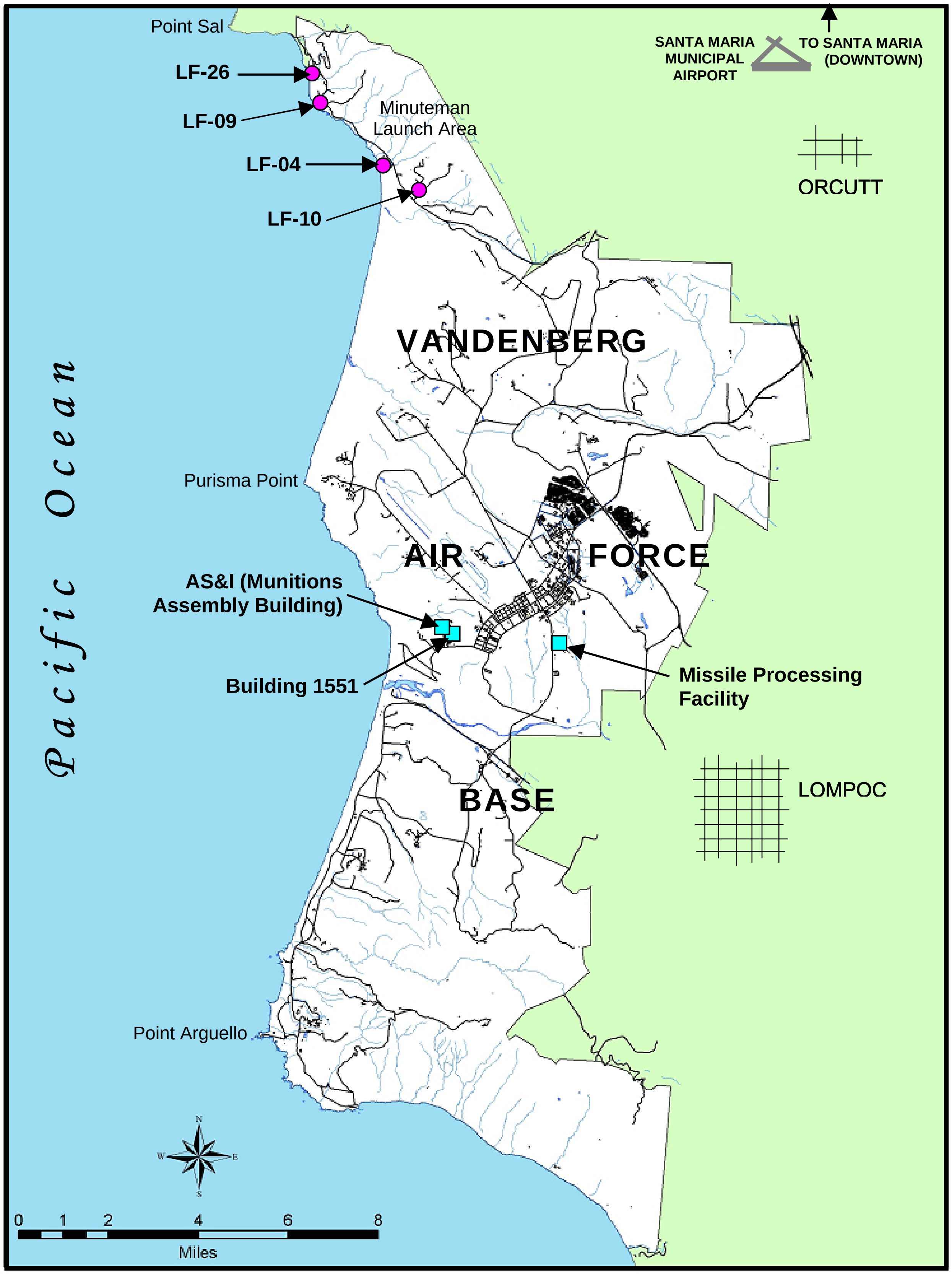

Figure 2-9. Minuteman III Flight Test Support Facilities at Vandenberg AFB, California

functioning correctly. The RV simulators do not contain any fissile materials; however, depending on mission requirements, some of them may contain varying quantities of hazardous materials, including high explosives, beryllium (Be), depleted uranium (DU)[1], and batteries. Such test RVs arrive at the base preassembled from the DOE. During assembly of the RS, various pieces of ordnance are installed (e.g., the shroud ejection motor, gas generators, etc.). An insulating sealant is applied to the joining edges of the shroud. Once completed, the RS, containing one to three test RVs, is loaded onto a payload transporter and taken to the LF for placement on top of the MM III booster.

Also, prior to each launch, a protective silicon rubber sealant is manually applied (not sprayed) to cable pass-through holes and other openings along the launch tube walls of the LF. This sealant prevents rocket exhaust gases from damaging the facility.

Flight Activities

Figure 2-10 shows a representative missile flight path and the booster drop zones for a MM III FDE test missile launched from Vandenberg AFB towards USAKA in the Marshall Islands. Following motor burnout and separation, the spent 1st-stage motor will splash down in the Pacific Ocean approximately 110 to 160 mi (180 to 260 km) off the California coast. Following in sequence, the spent 2nd-stage motor will also splash down approximately 870 to 950 mi (1,400 to 1,520 km) off the coast. As the missile travels along a flight path several hundred miles north of the Hawaiian Islands, it will reach an apogee several hundred miles in altitude. Prior to this point, the 3rd-stage motor will have separated from the post-boost vehicle. The spent 3rd-stage motor will travel on a ballistic course, splashing down in the open ocean approximately 60 to 270 mi (100 to 430 km) northeast of the Marshall Islands, as the post-boost vehicle steers the RVs toward designated target points in the vicinity of USAKA.

Prior to conducting each MM III FDE flight test, USAF and contractor personnel conduct a comprehensive safety analysis to determine specific missile launch and flight hazards. As part of this analysis, risks to off-base areas and non-participating aircraft, sea vessels, and personnel are determined. The results of this analysis are used to identify the launch hazard area, expended booster drop zones, post-boost vehicle impact area, and a terminal hazard area for the RVs. A flight termination boundary along the MM III flight path is also predetermined, should a missile malfunction or flight termination action occur. The flight termination boundary defines the limits at which command flight termination would be initiated in order to contain the missile and its debris within predetermined hazard and warning areas, thus minimizing the risk to test support personnel and the general public.

Typical launch hazard areas for each of the four MM III LFs are delineated in Figure 2-11, along with the range of launch trajectories. As part of standard procedures, commercial and private aircraft and watercraft are notified of all the hazard areas several days prior to launch through Notice to Airmen (NOTAM) and Notice to Mariners (NOTMAR), respectively. Within a day prior to each launch, radar, helicopters, and other remote sensors are used to verify that the hazard areas are clear of non-mission-essential aircraft, vessels, and personnel. Depending on which of the MM III LFs is used, range safety procedures may require closure of Point Sal State Beach located just north of LF-26—typically for less than a day—and the coordination and monitoring of any train traffic passing through the base.

[1] Natural uranium (U) is a silver-colored metal that is radioactive and nearly twice as dense as lead. Small amounts of U naturally occurring in soil, water, air, plants, and animals contribute to natural background radiation in the environment. DU is a byproduct of the enrichment process used to make weapons grade U-235. DU retains the natural toxicological properties of U, but approximately half of its radiological activity. DU is a non-fissile material.

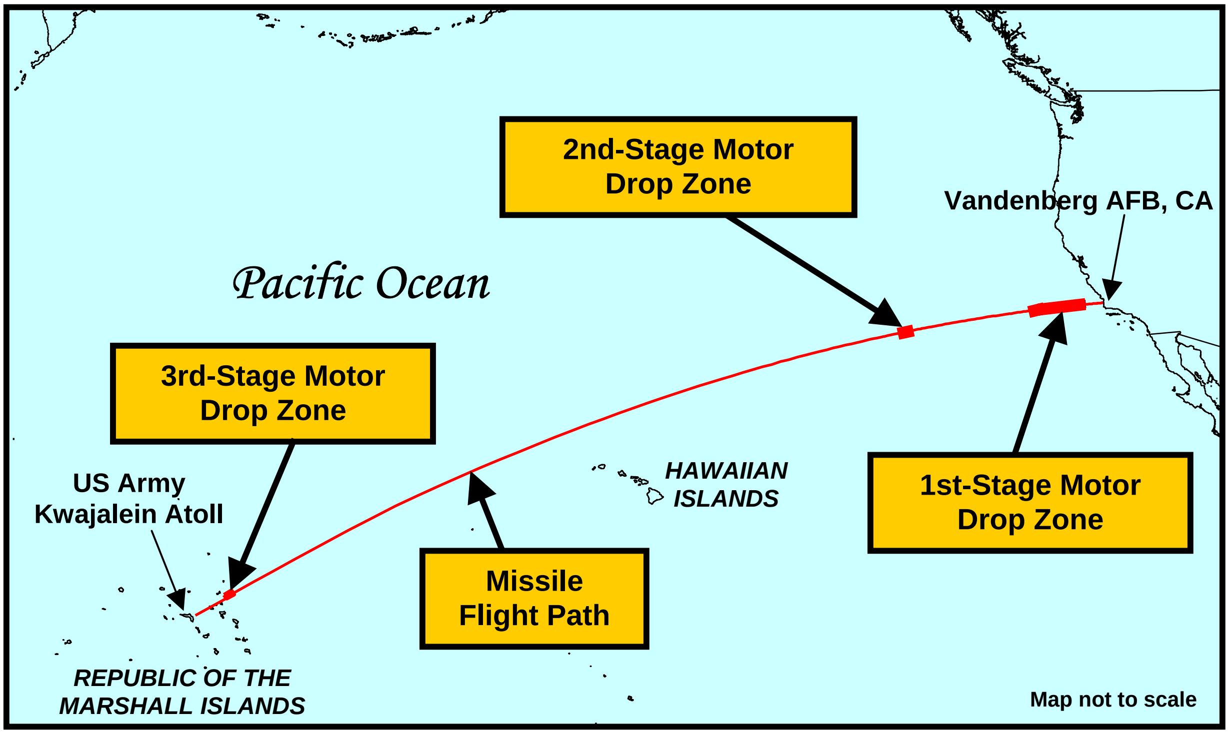

Figure 2-10. Representative Missile Flight Path and Motor Drop Zones for Minuteman III Flight Tests from Vandenberg AFB, California

Should a MM III missile head off course or should other problems occur during flight, the Missile Flight Control Officer would activate the destruct package on the missile. This would stop the vehicle's forward thrust, and the missile would then fall along a ballistic trajectory into the ocean.

Post-Launch Operations

Following each flight test, post-launch refurbishment of the LF is required for the replacement of cables and other damaged components, and the painting of components (e.g., missile suspension system) for corrosion control. In addition, the silicon rubber sealant applied to the tube walls, prior to launch, must be scraped from holes and openings, and collected in a single 55-gal (208-L) drum for disposal as a hazardous waste.

After every four flights, the walls of the launch tube are also hand brushed to remove accumulated blast residues. The residues are swept up and collected in 55-gal (208-L) drums for disposal as hazardous waste.

The expended rocket motors and other missile hardware are not recovered from the ocean following flight tests.

Console Equipment Maintenance

Similar to the MM III Wings, Vandenberg AFB has a number of ICBM command and control consoles used for training, testing, and maintenance purposes. Just as at the Wings, failed HDA and VDU units that cannot be repaired are declassified and sent to the local DRMO on base for resale, material recycling, and/or disposal as solid or hazardous waste.

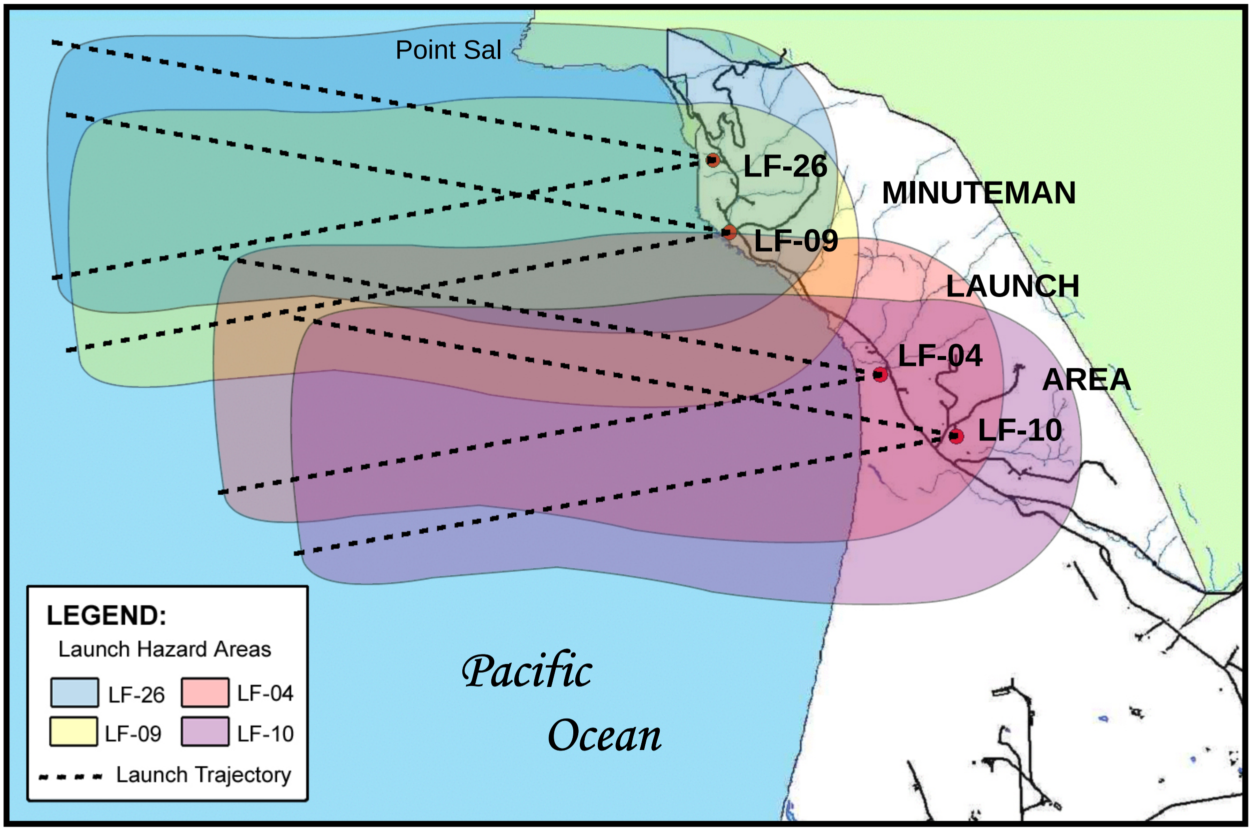

Figure 2-11. Range of Minuteman III Launch Trajectories and Launch Hazard Areas at Vandenberg AFB, California

2.2.4 US Army Kwajalein Atoll

Towards the terminal end of each MM III FDE flight, beyond the 3rd-stage motor drop zone, the post-boost vehicle fragments impact in a predetermined area of the ocean northeast of USAKA in the RMI. The hazard areas for missile impact are shown in Figure 2-12 for a representative MM III flight path. Traveling slightly farther, the one to three RVs (per flight) impact in designated deep ocean areas east of the Kwajalein reef, or in the vicinity of Illeginni Island, depending on mission requirements. Targets are carefully selected to minimize the impact of RV flight tests on threatened and endangered marine mammals, sea turtles, migratory birds, and other marine life; and on the coral reef and island habitats that are protected under the UES.

To ensure the safe conduct of these types of tests, a Mid-Atoll Corridor Impact Area has been established across USAKA, as is shown in Figure 2-12. When a point of impact is to occur in this area, a number of strict precautions are taken to protect personnel. Such precautions may consist of evacuating nonessential personnel and sheltering all other personnel remaining within the Mid-Atoll Corridor. Just as at Vandenberg AFB, NOTAMs and NOTMARs are published and circulated in accordance with established procedures to provide warning to personnel, including natives of the Marshall Islands, concerning any potential hazard areas that should be avoided. Radar and visual sweeps of hazard areas are accomplished immediately prior to FDE flight tests to assist in the clearance of non-critical personnel. Only mission-essential personnel are permitted in hazard areas.

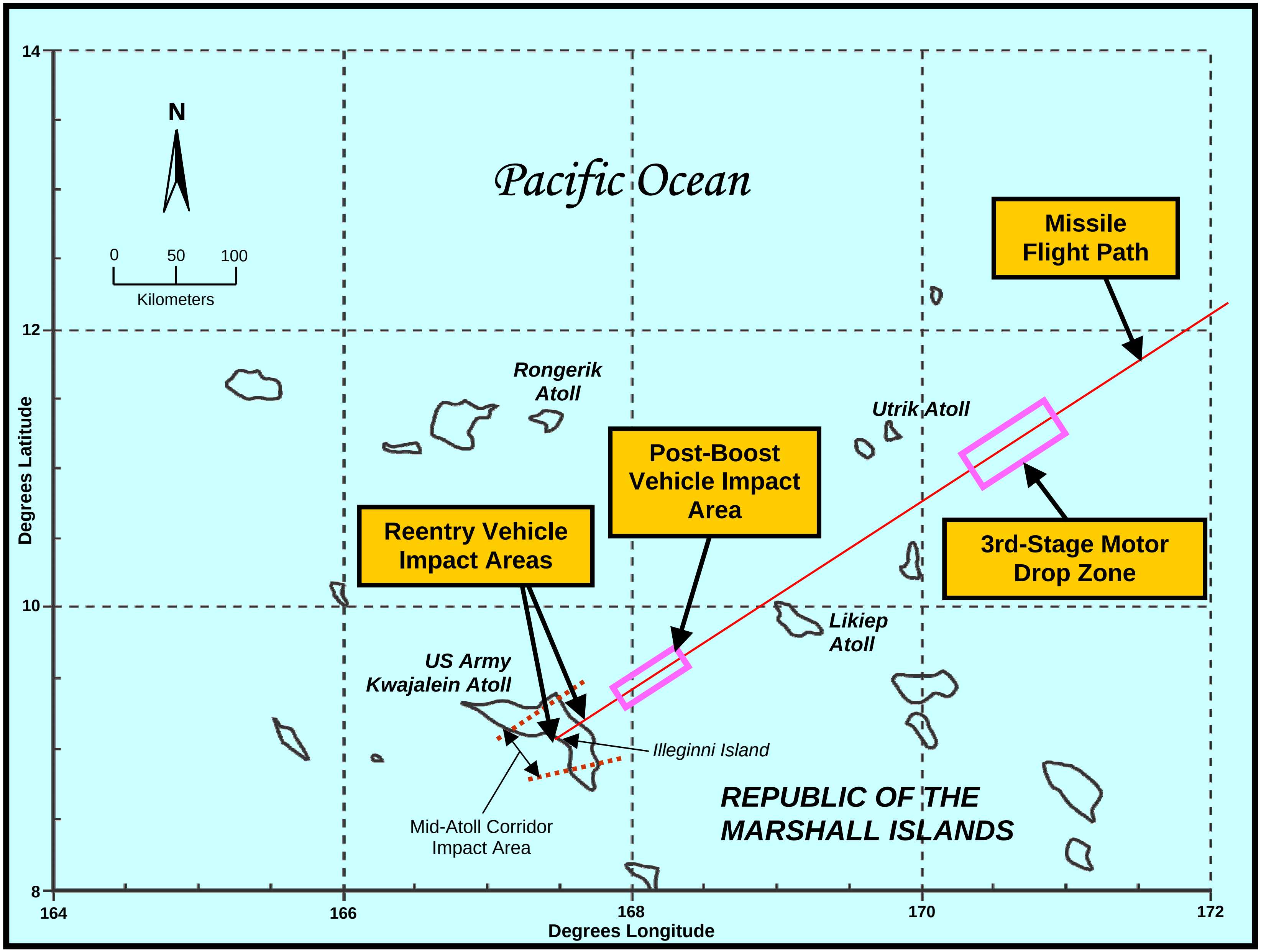

Figure 2-12. Representative Missile Flight Path and Hazard Areas for Minuteman III Tests at US Army Kwajalein Atoll

The Ronald Reagan Ballistic Missile Defense Test Site (RTS) at USAKA supports MM III FDE missions by providing tracking, sensing, and other technical and logistical support. An extensive array of missile tracking radars and optical sensors are located on several of the islands. Depending on mission requirements, other auxiliary sea-based, aircraft-based, and satellite-based sensors (optical and radar systems) may be involved in tracking the missile and collecting data. Test support is provided primarily by existing Government personnel and contractors based at USAKA.

RVs that impact in the ocean beyond shallow waters are not recovered. Debris from those RVs that impact on land or in the atoll lagoon is recovered. Post-test recovery operations at Illeginni Island require the manual cleanup and removal of any RV debris, including hazardous materials (e.g., DU), followed by filling in larger craters using a backhoe or grader. Both Lawrence Livermore National Laboratory (LLNL) and USAKA personnel are usually involved in these operations.

RV recovery/cleanup operations in the lagoon and ocean reef flats, within 500 to 1,000 ft (152 to 305 m) of the shoreline, are conducted similarly to land operations when tide conditions and water depth permit. A backhoe is used to excavate the crater. Excavated material is screened for debris and the crater is usually back-filled with coral ejected around the rim of the crater. When RVs impact in the deeper waters of the atoll lagoon, a dive team from USAKA is brought in to conduct underwater searches. Using a ship for recovery operations, a remotely operated vehicle is first used to locate the debris field on the lagoon bottom. Divers in scuba gear are then able to recover the debris manually.

In general, RV recovery operations are not attempted in deeper waters on the ocean side of the atoll. Searches for debris would be attempted out to depths of 50 to 100 ft (15 to 30 m). An underwater operation similar to a lagoon recovery would be used if debris were located in this area.

The potential impacts resulting from these types of ICBM tests at USAKA—including RV impacts in the vicinity of Illeginni Island—have been previously analyzed in the *Environmental Assessment for Department of Energy (DOE) Reentry Vehicles, Flight Test Program, US Army Kwajalein Atoll, Republic of the Marshall Islands* (USAF, 1992a), which is summarized in Appendix A.

2.3 PROPOSED ACTION

The RS Modifications would require hardware and software modifications to existing cables, mounting hardware, connectors, testers, and trainers at LFs located within the three MM Wings, and at several other USAF and contractor facilities supporting MM III operations. The activities would include development and implementation of the following items:

- New and modified RS hardware to mount the Mark 21 RV
- New RS electronic signal generator
- Changes to software programs and data collection systems
- Modifications to system test and evaluation hardware/software
- Modifications to personnel training hardware and software packages
- Flight test and evaluation of the modified MM III missile.

Console equipment activities would involve the replacement of MM III command and control console equipment, and related software upgrades, at all operational LCCs located within the three MM Wings, and at several other USAF and contractor facilities supporting MM III ICBM operations. The program activities can be broken down into three main efforts:

- Replacement of the mechanical HDA (a high-capacity computer hard disk), with a sealed solid-state design

- Replacement of the cathode ray tube (CRT) technology VDUs with more modern units (e.g., liquid crystal displays)

- Upgrade of the COP software and replacement of the EMAD module with a unit having more internal memory.

The RS-related activities would be multi-phased, involving system development, testing, and deployment activities, while the console equipment requires only deployment. For analysis purposes, the Proposed Action is divided into a flight test and evaluation phase for the modified RS, a deployment phase for the RS modification kits and Mark 21 RVs, and additional deployment-related activities associated with the new console equipment. These actions are described in the following sections.

2.3.1 Flight Test and Evaluation of the Reentry System Modification

MM III flight tests involving use of the modification hardware/software would be conducted at Vandenberg AFB. The purpose of the initial flight tests is to resolve technical issues and identify any areas of risk associated with the proposed MM III modification. Continuation of the FDE flight test program (described earlier in Section 2.2.3) would serve to ensure system safety, gather information to support accuracy and reliability estimates, and verify the ability of the system to meet ICBM mission requirements on a long-term basis.

Flight test operations would be conducted in a manner similar to that described for the No Action Alternative in Section 2.2.3, and would occur from the same four LFs previously identified for these types of tests (see Figure 2-9). No facility modifications or construction would be required at Vandenberg AFB for these flight tests. Approximately 45 existing Vandenberg AFB personnel would be involved in missile handling and post-launch operations at the base. Just as on prior FDE flights, some of the proposed test RVs may contain varying quantities of hazardous materials including high explosives, Be, DU, and batteries.

Along with the normal FDE launches, four additional flight tests would be conducted within the June and August 2005, and February and September 2006, timeframes to verify system operation and certify the modified weapon system. Operations for the modified FDE flights would be conducted in the same manner as for current FDE launches. Table 2-2 shows the MM III launch rates planned to occur through 2010.

At the terminal end of each flight, the post-boost vehicle fragments would impact in the open ocean northeast of USAKA. Traveling slightly farther, the RVs would impact east of the Kwajalein reef or in the vicinity of Illeginni Island, within the Mid-Atoll Corridor Impact Area—the same general areas now used for FDE flights (Figure 2-12). Targets would be carefully selected to minimize the impact of RV flight tests on threatened and endangered marine mammals, sea turtles, migratory birds, and other marine life; and on the coral reef and island habitats that are protected under the UES. Similar tracking, sensing, RV recovery, and other technical and logistical support, as previously described for the No Action Alternative in Section 2.2.4, would be provided for these flight tests.

In conjunction with each flight test, a replacement MM III booster would be assembled at Hill AFB and shipped to the applicable MM Wing for purposes of reactivating the affected LF. This particular action would be conducted in the same manner as previously described for the No Action Alternative in Sections 2.2.1 and 2.2.2.

Table 2-2. Planned MM III Launch Rates for Vandenberg AFB, California							
Planned Actions	MM III Launches per Fiscal Year						
	2004	2005	2006	2007	2008	2009	2010
Current FDE Flights	3	3	3	1	0	0	0
Modified FDE Flights	0	0	0	3	4	4	4
Additional Flight Tests	0	2	2	0	0	0	0
Total Flights Planned	**3**	**5**	**5**	**4**	**4**	**4**	**4**

[shaded box] = Tests incorporate RS modification kits and software upgrades, and the newer Mark 21 RV simulators or Mark 12A RV simulators. All other tests utilize older Mark 12- or 12A-related hardware/software.

2.3.2 Deployment of Reentry System Modification Kits and Mark 21 Reentry Vehicles

As described under Section 2.3, deployment efforts would include new and modified hardware for MM III RSs. The RS modification kits (including hardware for mounting Mark 21 RVs on the RS, and new electronic flight equipment), new support equipment, new and modified software, and modifications to training hardware would be shipped directly from existing contractor facilities to the MM III Wings, Vandenberg AFB, and Hill AFB starting in 2004. Deployment of the RS modification kits onto fielded missiles at the Wings would begin in 2006 and continue through 2011, when Full Operational Capability would be reached.

At each operational LF, USAF personnel would remove the currently deployed RS from the missile and transport it back to the Wing support base for modifications using methods similar to those previously described for the No Action Alternative in Section 2.2.1. Existing base personnel would then perform system modifications, involving the replacement of RVs, RS attachment hardware, and a new electronic signal generator, before reinstalling the modified RS at the LF.

Under current USAF planning, all of the MM III RSs would receive the proposed modification to accommodate either the Mark 21 RV or the current Mark 12A RV. The US Air Force Space Command would determine the specific quantities and configurations of RVs at each missile Wing. In addition to deployment of the newer Mark 21 RVs, the older Mark 12 RVs would be removed from the operational MM III ICBM force. The long-term storage and/or disposition requirements for the Mark 12 RVs, however, represent separate actions that are not part of the proposed MM III modification.

No facility modifications or new construction would be required for these deployment activities. Once deployed, the modified RS would have little or no change to existing maintenance, sustainment, and logistics procedures for personnel and facilities.

2.3.3 Deployment of New Console Equipment

As previously described, the MM III command and control modifications involve the replacement of console equipment, and related software upgrades, at all operational LCCs located within the FE Warren AFB, Malmstrom AFB, and Minot AFB missile Wings. The replacement of console equipment and software upgrades would also occur at various trainer and support facilities at each Wing support base, Hill AFB, Vandenberg AFB, and at other USAF/contractor locations.[2]

Generally, the HDA, VDU, and EMAD modifications would be performed on each console. A breakdown of the approximate number of new console equipment components to be deployed, by location, is provided in Table 2-3. Also shown in the table is the lifetime supply of spares for selected components. At each location, new components would be stored in existing facilities until needed.

Table 2-3. Quantities of New Console Equipment to be Deployed

Deployment Location	VDU	HDA	EMAD	COP
FE Warren AFB, WY	68	16	15	17
Malmstrom AFB, MT	92	21	20	22
Minot AFB, ND	68	16	15	17
Vandenberg AFB, CA	42	6	5	7
Hill AFB, UT	10	6	12	6
Other Deployment Locations	10	5	2	5
Spare Units	44	120	20	-
Total Units	334	190	89	74

Note: Quantities shown are approximate.

Console equipment deployment at all trainer units would be completed in 2005. Operational facilities would likely receive the COP upgrade and replacement EMAD modules in 2006. Deployment of the remaining HDAs and VDUs would occur as part of routine maintenance, or by forced deployment over a 3-year period beginning at the end of 2005 or 2006. Generally, no more than two or three personnel would be required for the equipment change-out at each console location.

Following each console upgrade, the old VDUs and HDA would be declassified and turned over to the local or regional DRMO for resale, material recycling, and/or disposal as solid or hazardous waste. The old EMAD module would be placed in storage and would not undergo disposal. FE Warren AFB is the only Wing support base without an on-site DRMO. In this case, the failed equipment would be turned over to the base supply organization, which then ships it to Fort Carson's DRMO in Colorado Springs. Approximate numbers of old VDUs and HDAs to be processed at DRMOs are listed by location in Table 2-4.

As an alternative for DRMO processing, a few of the old HDAs and VDUs could be considered for placement in the USAF Museum Program. This would allow such items to be given to one or more receiving Air Force Museums across the country for historical displays and interpretive collections.

2.4 ALTERNATIVES ELIMINATED FROM FURTHER CONSIDERATION

As an alternative for the proposed Mark 21 deployment on MM III ICBMs, a Mark 12 RV life-extension program was considered, but eliminated as unreasonable because of excessive costs for implementing such a modification.

[2] Because the number of new console equipment components going to "other" individual USAF and contractor deployment locations is minimal (see Table 2-3), no further environmental analyses of those sites are necessary.

Table 2-4. Quantities of Old Console Equipment Planned for Defense Reutilization and Marketing Office Processing		
DRMO Location	**VDU**	**HDA**
Fort Carson, CO (for FE Warren AFB, WY)	78	24
Malmstrom AFB, MT	103	29
Minot AFB, ND	78	24
Vandenberg AFB, CA	44	13
Hill AFB, UT	25	79
Total Units	328	169

Note: Quantities shown are approximate.

Though computer simulations, modeling, and other laboratory tests are used during the design and early evaluation of the MM III modification, such methods cannot provide all of the information needed to ensure that the MM III weapon system is functioning correctly. Thus, an alternative relying solely on such methods was deemed unreasonable.

No other reasonable alternative sites for conducting MM III launches were identified. Other than Vandenberg AFB, there are no other alternative launch sites within the United States and its territories that can perform MM III launches using existing facilities in a safe and secure operational-like manner. Also, USAKA is the only reasonable alternative location that is capable of tracking and monitoring RV impacts, and that can provide adequate safety and security for such missions. For potential RV land impacts, Illeginni Island is the only leased property within USAKA that does not have critical range instrumentation vulnerable to damage from such tests. Eliminating the vicinity of Illeginni Island as a target area would eliminate the few opportunities to photograph such impacts (using remote-controlled equipment) and to recover RV fragments, both of which can provide important information on weapon system performance.

Consideration was also given to a reduced number of flight tests from Vandenberg AFB. The four flight tests planned in 2005 and 2006, however, represent the minimum number of added flights necessary to validate and certify the proposed MM system modifications.

For the command and control console equipment modifications, other HDAs and VDUs were considered, but were found to be unreasonable because they did not meet form, fit, and function requirements associated with the existing MM III consoles. The replacement components must be comparable to the existing units, and they must employ logistically supportable technologies.

2.5 COMPARISON OF ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION AND THE NO ACTION ALTERNATIVE

Table 2-5 presents a comparison of the potential environmental consequences of the Proposed Action and the No Action Alternative for those locations and resources affected. A detailed discussion of these potential impacts is presented in Chapter 4.0 of this EA.

Table 2-5. Comparison of Potential Environmental Consequences		
Locations and Resources Affected	**No Action Alternative**	**Proposed Action**
FE Warren Air Force Base, WY; Malmstrom Air Force Base, MT; and Minot Air Force Base, ND		
Health and Safety	By adhering to established and proven safety standards and procedures, the level of risk to military personnel, contractors, and the general public should be minimal. Regarding rocket motor transportation over public roads, accident rates for ongoing operations have historically been very low (e.g., 0.000002 accidents per mile for USAF vehicles driven within the FE Warren AFB Wing area). Thus, no significant impacts to public or occupational health and safety are expected to occur.	Missile handling and transportation operations would be conducted in the same manner as for the No Action Alternative, and RS modifications would be conducted during normal ongoing maintenance operations. Thus, Proposed Action activities would not substantially alter the findings identified for the No Action Alternative; namely, that no significant impacts to public or occupational health and safety are anticipated.
Hazardous Materials and Waste Management	All hazardous materials would be managed in accordance with well-established policies and procedures. Hazardous wastes would be properly disposed of, in accordance with all Federal, state, local, DOD, and USAF regulations. Each installation has a plan in place that provides guidelines and instructions to prevent and control accidental spills of hazardous materials. Appropriate permits are also in place and workers are trained. Hazardous material and waste handling capacities would not be exceeded, and management programs would not have to change. Consequently, no adverse impacts from the management of hazardous materials and waste are expected.	The same policies, procedures, and regulations followed under the No Action Alternative would apply. Hazardous material and waste handling capacities would not be exceeded, and management programs would not have to be changed. Thus, no adverse impacts from the management of hazardous materials and waste are expected.
Hill Air Force Base, UT		
Health and Safety	MM III booster operations are routine activities at Hill AFB. By adhering to established and proven safety standards and procedures, the level of risk to military personnel, contractors, and the general public would be minimal. Consequently, no significant impacts to public or occupational health and safety are expected.	The Proposed Action activities would not substantially alter the findings identified for the No Action Alternative; namely, that no significant impacts to public or occupational health and safety are anticipated.
Hazardous Materials and Waste Management	All hazardous materials would be managed in accordance with well-established policies and procedures. Hazardous wastes would be properly disposed of, in accordance with all Federal, state, local, DOD, and USAF regulations. The base has a plan in place that provides guidelines and instructions to prevent and control accidental spills of hazardous materials. Appropriate permits are also in place and workers are trained. Hazardous material and waste handling capacities would not be exceeded, and management programs would not have to change. Consequently, no adverse impacts from the management of hazardous materials and waste are expected.	The same policies, procedures, and regulations followed under the No Action Alternative would apply. Hazardous material and waste handling capacities would not be exceeded, and management programs would not have to be changed. Thus, no adverse impacts from the management of hazardous materials and waste are expected.
Vandenberg Air Force Base, CA		
Air Quality	Although rocket motor exhaust emissions would be released in the lower atmosphere, they would be rapidly diluted and dispersed by prevailing winds.	Proposed Action activities would not substantially alter the findings identified for the No Action Alternative. A review

Table 2-5. Comparison of Potential Environmental Consequences		
Locations and Resources Affected	**No Action Alternative**	**Proposed Action**
	No violation of air quality standards or health-based standards for non-criteria pollutants is anticipated. When compared to the amount of emissions released on a global basis, the flight tests will not be statistically significant in contributing to cumulative impacts on the stratospheric ozone layer. Overall, no significant impacts to air quality would occur.	of the General Conformity Rule resulted in a finding of presumed conformity with the State Implementation Plan. Additionally, no changes to existing or new air emission permits are required. As a result, no long-term adverse impacts are anticipated.
Noise	MM III launches would generate noise levels ranging from 125 dB (unweighted) in the immediate vicinity of the launch site, to around 105 dB (unweighted) or lower in some populated areas off base. While these noise exposure levels can be characterized as very loud, they would occur infrequently, are very short in duration (about 20 seconds per launch), and would have little effect on the Community Noise Equivalent Level off base. Sonic booms generated by the missile flights would occur down range, some 25 nautical miles downrange of the launch site, and thus would not affect coastal land areas. As a result, no significant impacts to the noise environment would occur.	An increase in flight test operations for a 2-year period would not substantially alter the findings identified for the No Action Alternative; namely, that no significant impacts to the noise environment would occur.
Biological Resources	Exposure to short-term noise from MM III launches and helicopter overflights could cause startle effects in marine mammals and migratory birds. However, a NMFS incidental "take" permit is in place that authorizes incidental harassment of pinnipeds. Helicopter overflights are required to maintain minimal distances away from protected seal haul-outs/rookeries and bird roosting/nesting areas. Studies have shown that it is unlikely for the launch noise exposures documented to date to present a serious risk to seal hearing. On the basis of prior monitoring studies, the NMFS has determined that rocket launch activities have a negligible impact on marine mammal populations and stocks at Vandenberg AFB. Launch emissions have the potential to acidify nearby surface waters. However, surface water monitoring conducted for larger launch systems at Vandenberg AFB has not shown long-term acidification of surface waters. Because the MM III represents a smaller launch system producing fewer emissions, the potential for adverse effects is minimal. In addition, the constant deposition of acid-neutralizing sea salt would reduce the acidification of surface waters. The probability for an aborted MM III launch to occur is extremely low. If an early abort were to occur, base actions would immediately be taken to remove unburned propellant and any other hazardous materials that had fallen on the beach or in shallow waters. Any propellants remaining in	An increase in flight test operations for a 2-year period would not substantially alter the findings identified for the No Action Alternative; namely, that no long-term adverse impacts are anticipated.

Table 2-5. Comparison of Potential Environmental Consequences		
Locations and Resources Affected	**No Action Alternative**	**Proposed Action**
	the off-shore waters would be subject to constant wave action and currents; thus, water circulation would help to prevent localized build-up of perchlorate concentrations, which has proven to be a slow process. As a result, no significant impacts on biological resources would be expected. Some temporary distress to vegetation near the launch site from launch emissions can be expected, but no long-term adverse effects would occur.	
Health and Safety	Safety procedures and practices at the base are well developed and constantly in use. Notices to mariners and airmen are published in advance to warn of launch hazard areas to be avoided. In addition, detailed flight safety analyses are conducted prior to each mission. As a result, no significant impacts to public or occupational health and safety are anticipated.	An increase in flight test operations for a 2-year period would not substantially alter the findings identified for the No Action Alternative. Thus, no significant impacts to public or occupational health and safety are anticipated.
Hazardous Materials and Waste Management	All hazardous materials would be managed in accordance with well-established policies and procedures. Hazardous wastes would be properly disposed of, in accordance with all Federal, state, local, DOD, and USAF regulations. The base has a plan in place that provides guidelines and instructions to prevent and control accidental spills of hazardous materials. Appropriate permits are also in place and workers are trained. Hazardous material and waste handling capacities would not be exceeded, and management programs would not have to change. Consequently, no adverse impacts from the management of hazardous materials and waste are expected.	The same policies, procedures, and regulations followed under the No Action Alternative would apply. Hazardous material and waste handling capacities would not be exceeded, and management programs would not have to be changed. Thus, no adverse impacts from the management of hazardous materials and waste are expected.
Over-Ocean Launch Corridor		
Biological Resources	Sonic boom overpressures from launch vehicles could be audible to protected marine species underwater. While 218 dB (referenced to 1 micropascal) is considered the lower limit for inducing temporary threshold shift (TTS) in marine mammals and sea turtles, the resulting underwater pressures generated by MM III sonic booms are expected to be less than 140 dB (referenced to 1 micropascal). Because the resulting pressures would be relatively low, and very short in duration, no long-term adverse effects are anticipated. For marine animals, the potential exists for direct contact or exposure to underwater shock/sound waves from the splashdown of spent rocket motors. However, the likelihood for a protected marine mammal or sea turtle to be located within several meters of the impact point is extremely low. The MM III flight tests would occur only a few times per year, and motor impacts from each flight would likely not occur at the exact same locations. As a	An increase in flight tests for a 2-year period would not substantially alter the findings identified for the No Action Alternative; namely that no long-term adverse impacts are anticipated.

Table 2-5. Comparison of Potential Environmental Consequences		
Locations and Resources Affected	**No Action Alternative**	**Proposed Action**
	result, the impacts of spent rocket motors are not expected to cause any long-term adverse effects on marine mammals or sea turtles in the open ocean. Residual amounts of battery electrolytes, hydraulic fluid, propellant, and other materials could lead to the contamination of seawater. However, the risk of marine life coming in contact with, or ingesting, toxic levels of solutions is not considered significant because of the rapid dilution of any contaminants, and the rapid sinking of any contaminated components.	
US Army Kwajalein Atoll		
Biological Resources	The brief sonic boom overpressures associated with RV flights [estimated at 91 to 150 dB (referenced to 20 micropascals)] are likely to cause startle effects in migratory birds on some islands of the Kwajalein Atoll, but the birds are not expected to abandon nests. At Illeginni Island, the migratory bird population appears to be stabilized, if not increasing, even after years of RV tests in the area. The sonic booms could also affect marine mammals and sea turtles underwater. However, at 117 to 176 dB (referenced to 1 micropascal), the resulting underwater pressures would be well below the lower limit of 218 dB (referenced to 1 micropascal) for inducing TTS in such animals. Because the resulting pressures would be relatively low, and very short in duration, no long-term adverse effects are anticipated. Like the spent MM III rocket motors, an RV impacting in the ocean or Kwajalein Atoll lagoon would result in underwater shock/sound waves, but with much higher pressure-levels being generated. The pressure levels could prove fatal to protected marine mammals and sea turtles within several feet of the impact point, and induce TTS in animals within 128 ft (39 m) from the splashdown site. However, the number of groups (small pods or schools) of these animals to be struck or exposed to harmful underwater shock/sound waves is estimated to be no higher than 0.000003 to 0.000009 per RV test event, depending on the number of RV simulators carried on the launch vehicle. When considering that (1) only three to four MM III launches are conducted every year, (2) RV target locations are not always the same, and (3) the probability for marine mammals and sea turtles to be impacted by underwater shock/sound waves is extremely low, the risk of animals being injured or killed is minimal.	An increase in RV flight tests for a 2-year period would not alter the findings identified for the No Action Alternative. Targets are normally selected to minimize damage to protected reef areas and identified wildlife habitats. As a result, no long-term significant impacts are anticipated in Kwajalein lagoon or in the vicinity of Illeginni Island. Additionally, no long-term adverse impacts are expected for ocean areas near Kwajalein Atoll.

Table 2-5. Comparison of Potential Environmental Consequences		
Locations and Resources Affected	**No Action Alternative**	**Proposed Action**
	In the event that an RV would directly impact on Illeginni Island or in the shallow coral reefs of Kwajalein Atoll, a crater would form. Post-test recovery and cleanup operations on Illeginni would also cause some short-term disturbance. Such impacts could potentially result in the loss of some protected migratory birds, mollusks, sponges, corals, and other marine life; and damage small areas of migratory bird habitat, sea turtle nesting sites, and coral reef habitat; all of which represents an irreversible or irretrievable commitment of resources. However, wildlife populations and habitat conditions would be expected to recover. Surveys have shown that bird populations and the local reef environment appear to be thriving after years of RV testing. Because the frequency of such occurrences is very low (estimated to be four to five instances over a 20-year period) and the amount of area affected would be minimal, no long-term significant impacts are anticipated. Following an aerial detonation or ocean/lagoon impact by a test RV, the resulting debris would disseminate any on-board hazardous materials around the impact point and some distance downwind. However, the Be and DU particles or fragments deposited by some RVs are very insoluble, and the dilution and mixing of the ocean and lagoon are so great that the concentration in water would be no different than natural background levels. For impacts on Illeginni Island, there is the potential for migratory birds to breath respirable dust particles of Be and DU, or consume particles deposited on vegetation. However, the relatively short-term exposures immediately following each test are unlikely to result in significant accumulations, particularly when considering the small amount of unrecovered material that may persist in the environment. As a result, no long-term significant impacts are anticipated.	
Cultural Resources	Given the extremely limited potential for any remaining traditional/ prehistoric remains on Illeginni Island, the likelihood of impacts to any resources must be considered either non-existent or extremely low. Though several buildings on the island are of the Cold War era, they currently do not meet RMI criteria for historic significance. Additionally, there is a low probability for the buildings to be impacted by RV tests. As a result, little or no impacts to cultural resources are expected.	An increase in RV flight tests for a 2-year period would not alter the findings identified for the No Action Alternative. Thus, no significant impacts to cultural resources are anticipated.
Health and Safety	Safety procedures and practices at USAKA are well developed. Notices to mariners and airmen are published and circulated to provide advance	An increase in RV flight tests for a 2-year period would not alter the findings identified for the No Action Alternative.

Table 2-5. Comparison of Potential Environmental Consequences		
Locations and Resources Affected	**No Action Alternative**	**Proposed Action**
	warning to personnel and natives of the Marshall Islands concerning any potential hazard area that should be avoided. In addition, detailed flight safety analyses are conducted prior to each mission. As a result, no impacts to public or occupational health and safety are anticipated. Each RV test at USAKA would release hazardous and toxic materials (including Be and DU) around the impact point and some distance downwind. For a land impact on Illeginni Island, such debris would occur close to the point of impact. As a result, the major potential health concern is for workers visiting the island, and the long-term management and restoration of the island. However, modeling and post-test sampling results from prior RV flight tests have shown that air sampling levels for contaminants are far below Federal guidelines, and similar to pre-test background levels. Various post-test safety and health procedures are followed. Thus, no significant impacts to either occupational or public health and safety would occur.	Thus, no significant impacts to public or occupational health and safety are anticipated.
Hazardous Materials and Waste Management	The limited amount of hazardous materials used for RV test operations would be managed in accordance with well-established policies and procedures. Any residual fragments of RVs (including DU or high explosive materials) would be recovered from land or shallow water areas and properly disposed of in accordance with all UES and DOE/LLNL regulations and requirements. As previous air and soil sampling results have shown, levels of Be and DU contaminants in the air and soil at Illeginni Island continue to remain at or near background levels, even after years of testing. Hazardous material and waste handling capacities at USAKA would not be exceeded, and management programs would not have to change. Consequently, no adverse impacts from the management of hazardous materials and waste are expected.	For the Proposed Action, the same policies, procedures, and regulations followed under the No Action Alternative would apply. Hazardous material and waste handling capacities would not be exceeded, and management programs would not have to be changed. Thus, no adverse impacts from the management of hazardous materials and waste are expected.

2.6 IDENTIFICATION OF THE PREFERRED ALTERNATIVE

The USAF's preferred alternative is the Proposed Action as described in Section 2.3 of this EA.