
Appendix D

Hawaii Range Complex Training

APPENDIX D

HAWAII RANGE COMPLEX TRAINING

Table D-1 lists descriptions of training areas in the Hawaii Range Complex (HRC).

Table D-1. Hawaii Range Complex Training Areas

Training Area	Description
OPEN OCEAN & OFFSHORE	
Northern Warning Areas	
W-188 Rainbow, W-189, W-190	The Northern Warning Areas lie north of Kauai and Oahu. These areas are available from the surface to an unlimited altitude and are used for surface and air operations.
Southern Warning Areas	
W-186, W-187, W-192, W-193, W-194	The Southern Warning Areas are located south of Kauai and Oahu. Available from the surface to an unlimited altitude, they are used for air and surface operations.
W-191	W-191, located directly south of Oahu, is available from the surface to 3,000 feet (ft) for air and surface operations.
W-196	W-196 is used only for surface and helicopter operations. The airspace extends from the surface to 2,000 ft, and is not available to fixed-wing aircraft.
Kapu/Quickdraw, Wela Hot Areas	Kapu/Quickdraw and Wela Hot Areas are located completely within W-192. These Areas are used for surface-to-air and air-to-air gunnery, air-to-surface bombing and gunnery, and jettisoning of ordnance.
Air Traffic Control Assigned Airspace (ATCAA)	
Nene	Nene is the only ATCAA associated with the Northern Warning Areas. It is typically activated for use during Hawaii Air National Guard intercept training.
Pali	Pali is a roughly 40-nautical-mile (nm) circular area over Oahu, from 25,000 ft to an unlimited altitude, although it is normally not available below 28,000 ft. Pali is used by high-altitude aircraft transiting between the Northern and Southern Warning Areas.
Taro	Taro overlies W-191, sharing the same borders and, when available, extending its airspace from 3,000 ft to 16,000 ft. This airspace allows aircraft to remain in controlled airspace while testing above W-191's 3000-ft ceiling.
Quint	Quint is located 45 nm southwest of Honolulu, with available airspace from flight level (FL) 250 to an unlimited altitude, although it is usually not available below FL 280.
Mela North, Mela Central, Mela South	The Mela ATCAAs connect the western border of W-192 with the southern border of W-186 (Pacific Missile Range Facility [PMRF]). They are available from the floor of controlled airspace (1,200 ft) to an unlimited altitude, except for Mela North which has a ceiling of 15,000 ft.
Mako, Lono West, Lono Central, Lono East	The Mako and Lono ATCAAs are available to extend the Special Use Airspace of Mela South, W-192, W-193, and W-194 by an additional 104 nm. All are available from the floor of controlled airspace to an unlimited altitude, and are activated to provide more southern area airspace.
Pele	Pele provides a transit corridor from W-194 and Lono East into R-3103 airspace over Pohakuloa Training Area on Hawaii. When activated, Pele extends from 16,000 ft to FL 290.

Table D-1. HRC Training Areas (Continued)

Training Area	Description
Kaula	
R-3107, W-187	Kaula is a 0.5-nm by 0.7-nm island surrounded by a 3-nm radius restricted area (R-3107), and a 5-nm radius warning area (W-187). Both R-3107 and W-187 extend from surface to 18,000 ft.
Pacific Missile Range Facility (PMRF)	
W-186, W-188	W-186 extends from surface to 9,000 ft, and W-188 extends from surface to unlimited. These two warning areas support activities at PMRF.
R-3101, Majors Bay	R-3101 extends from surface to unlimited and provides necessary airspace to support training and research, development, test, and evaluation activities at PMRF. Majors Bay lies beneath R-3101 and includes beach area on PMRF property.
Barking Sands Tactical Underwater Range (BARSTUR)	BARSTUR is an instrumented underwater range that provides approximately 120 nm ² of underwater tracking of participants and targets
Barking Sands Underwater Range Expansion (BSURE)	BSURE extends BARSTUR to the north, providing an additional 900 nm ² of underwater tracking capability.
Other Restricted Areas	
Ewa Training Minefield	The Ewa Training Minefield is an ocean area extending from Ewa Beach approximately 2 nm toward Barbers Point, and out to sea approximately 4 nm. This restricted area has been used in the past for surface ship mine avoidance training.
Submarine Operating Area	The Submarine Operating Area encompasses the entire ocean area of the Hawaii Range Complex. This area is bounded by 17N, 25N, 154W, and 162 W.
Naval Undersea Warfare Center (NUWC), Detachment Pacific Ranges	
Fleet Technical Evaluation Center (FTEC)	The FTEC Range Operations Building is located on the southern shore of Oahu, west of the former Barbers Point Naval Air Station. The FTEC supports SESEF events, and will support FORACS events in the future.
Shipboard Electronic Systems Evaluation Facility (SESEF)	The SESEF range is located south and west of FTEC. Ships operate and maneuver in this area as necessary to remain within electronic signal reception range of FTEC.
Fleet Operational Readiness Accuracy Check Site (FORACS)	The FORACS range includes an approximately 5-nm by 5-nm ocean area just offshore of the southwestern coast of Oahu, northwest of the SESEF range.
Explosive Ordnance Disposal (EOD) Ranges	
West Loch EOD Shore Area	The EOD shore area consists of a 2.75-acre facility at Naval Magazine Pearl Harbor West Loch.
Lima Landing Underwater Area	Lima Landing is a small underwater area just off an abandoned concrete pier at the approach to Pearl Harbor near the entrance of West Loch.
Puuloa Underwater Range	The Puuloa Underwater Range is a 1 nm ² area in the open ocean outside and to the west of the entrance to Pearl Harbor.

Table D-1. HRC Training Areas (Continued)

Training Area	Description
ONSHORE	
Kauai	Activities occur at the following PMRF locations: Main Base, Makaha Ridge, Kokee, Kamokala Magazine, Hawaii Air National Guard, Kauai Test Facility, Port Allen, Kikiaola Boat Harbor, and Mt. Kahili.
Niihau	Activities occur at Perch site, and other authorized areas.
Kaula	Kaula is used exclusively for air-to-ground bombing and gunnery training.
Oahu	Activities occur at Naval Inactive Ship Maintenance Facility, Pearl Harbor, EOD Land Range Naval Magazine Pearl Harbor West Loch, Marine Corps Training Area/Bellows, Ford Island, Marine Corps Base Hawaii, Hickam Air Force Base, Wheeler Army Airfield, Schofield Barracks (R-3109), Coast Guard Station Barbers Point/Kalaheo Airport, Makua Military Reservation (R-3110), Kahuku Training Area (A-311), Kaena Point, Mt. Kaala, Wheeler Network Communications Control, and Dillingham Military Reservation.
Maui	Activities occur at Maui Space Surveillance System, Maui High Performance Computing Center, and Sandia Maui Haleakala Facility.
Hawaii	Activities occur at Pohakuloa Training Area (R-3103) and adjacent leased property, Bradshaw Army Airfield, and Kawaihae Pier.

Anti-Air Warfare

Air Combat Maneuver

Air Combat Maneuver (ACM) includes basic flight maneuvers where aircraft engage in offensive and defensive maneuvering against each other. These maneuvers typically involve supersonic flight and use of chaff and flares. No air-to-air ordnance is released during this training event. ACM training events within the HRC are primarily conducted within W-188, W-189, W-190, W-192, W-193, and W-194 under Fleet Area Control and Surveillance Facility (FACSFAC) Pearl Harbor's control. These training events typically involve from two to eight aircraft. However, based on the training requirement, ACM training events may involve over a dozen aircraft. Sorties can be as short as 30 minutes or as long as 2 hours, but the typical ACM mission has an average duration of 1.5 hours. No live ordnance is used, only chaff and flares.

Baseline Training Events					
Air Combat Maneuver (ACM)	NTA	Area	Metric	Duration (Hours)	Total Training Events
	3.2.3	W-188, 189, 190, 192, 193, 194	Ops	1.5	738

Air-to-Air Missile Exercise

In an Air-to-Air Missile Exercise (A-A MISSILEX), missiles are fired from aircraft against unmanned aerial target drones such as BXM-34s and BQM-74s. Additionally, weapons may be fired against flares or Tactical Air Launched Decoys dropped by supporting aircraft. Typically, about half of the missiles fired have live warheads and half have telemetry packages. The fired missiles and targets are not recovered, with the exception of the BQM drones, which have parachutes and will float to the surface, where they are recovered by boat.

A-A MISSILEX training events include 1 to 6 jet target drones, 2 to 20 aircraft, 2 to 20 missiles, and a weapons recovery boat for target recovery, and are conducted within Pacific Missile Range Facility (PMRF) Warning Area W-188. Jet target drones are launched from an existing ground-based target launch site at PMRF Launch Complex, from a Mobile Aerial Target Support System (MATSS) located in the open ocean within the PMRF Warning Areas, or from an aircraft controlled by PMRF. The targets are engaged by aircraft equipped with air-to-air missiles. The targets are tracked by the aircraft and then the air-to-air missiles are launched at the targets. Recoverable target drones and all recoverable elements are refurbished and reused. Live and inert missiles can be fired during this training event.

Baseline Training Events					
A-A MISSILEX	NTA	Area	Metric	Duration (Hours)	Total Training Events
	3.2.3	W-188	Ops	2-6	12

Surface-to-Air Gunnery Exercise

A Surface-to-Air Gunnery Exercise (S-A GUNEX) requires an aircraft or missile that will fly high or low altitude threat profiles. Commercial aircraft also tows a target drone unit that ships track, target, and engage with their surface-to-air weapon systems. The training event involves 1 to 10 surface vessels, towed aerial targets, and/or jet aerial targets. Ship-deployed and air-deployed weapons systems are used, ranging from 20-mm to 5-inch caliber guns. GUNEX events are conducted within PMRF Warning Areas W-186 and W-188, Oahu Warning Areas W-187 (Kaula), W-194, and Restricted Airspace R-3107 (Kaula). Live and inert missiles can be fired during this training event.

Baseline Training Events					
Surface to Air Gunnery Exercise (S-A GUNEX)	NTA	Area	Metric	Duration (Hours)	Total Training Events
	3.2.7	W-188, 192, Mela South	Ops	3.1	86

Surface-to-Air Missile Exercise

A Surface-to-Air Missile Exercise (S-A MISSILEX) involves surface combatants firing live missiles (RIM-7 Sea Sparrows, SM-1 or SM-2 Standard Missiles) at target drones. The surface ship must detect, track, and engage the target using its onboard weapon systems. The purpose of the training event is to provide realistic training and evaluation of surface ships and their crews in defending against enemy aircraft and missiles.

Target drones representing enemy aircraft or missiles are flown or towed into the vicinity of the surface ship. The crew must identify the incoming object and respond with surface-to-air missiles as appropriate. There are two types of missiles: one type of missile is equipped with an instrumentation package, while the other type is equipped with a warhead. Recoverable target drones are refurbished and reused.

The training event consists of one or more surface ships, one or more target drones, and a helicopter and weapons recovery boat for target recovery. The surface-to-air missiles are launched from ships located within PMRF Warning Area W-188. Targets are launched from an existing ground-based target launch site at PMRF Launch Complex; from a MATSS located in the open ocean within the PMRF Warning Areas; or released from an aircraft. Live missiles are fired at target drones.

Baseline Training Events					
Surface-to-Air Missile Exercise (S-A MISSILEX)	NTA	Area	Metric	Duration (Hours)	Total Training Events
	3.2.7	W-188	Ops	5.1	17

Chaff Exercise

A Chaff Exercise (CHAFFEX) trains aircraft and shipboard personnel in the use of chaff to counter anti-ship missile threats. During a CHAFFEX, the ship combines maneuvering with deployment of multiple rounds of MK-36 super rapid bloom offboard chaff to confuse incoming missile threats, simulated by aircraft. In an integrated CHAFFEX scenario, helicopters deploy air-launched, rapid-bloom offboard chaff in pre-established patterns designed to enhance anti-ship missile defense. CHAFFEXs average 3.8 hours in duration. No ordnance is used during this training event.

Baseline Training Events					
Chaff Exercise (CHAFFEX)	NTA	Area	Metric	Duration (Hours)	Total Training Events
	3.2.9	Hawaii Operating Area	Ops	3.8	34

Amphibious Warfare

Naval Surface Fire Support Exercise (NSFS)

Navy surface combatants conduct Fire Support Exercise (FIREX) events at PMRF on a virtual range against "Fake Island," located on Barking Sands Tactical Underwater Range (BARSTUR). Fake Island is unique in that it is a virtual landmass simulated in three dimensions. Ships conducting FIREX training against targets on the island are given the coordinates and elevation of targets. PMRF is capable of tracking fired rounds to an accuracy of 30 feet (ft). Live gunnery rounds are fired into the ocean during this training event.

Baseline Training Events					
Naval Surface Fire Support Exercise NSFS	NTA	Area	Metric	Duration (Hours)	Total Training Events
	3.2.8	W-188	Ops	8.1	4

Expeditionary Assault

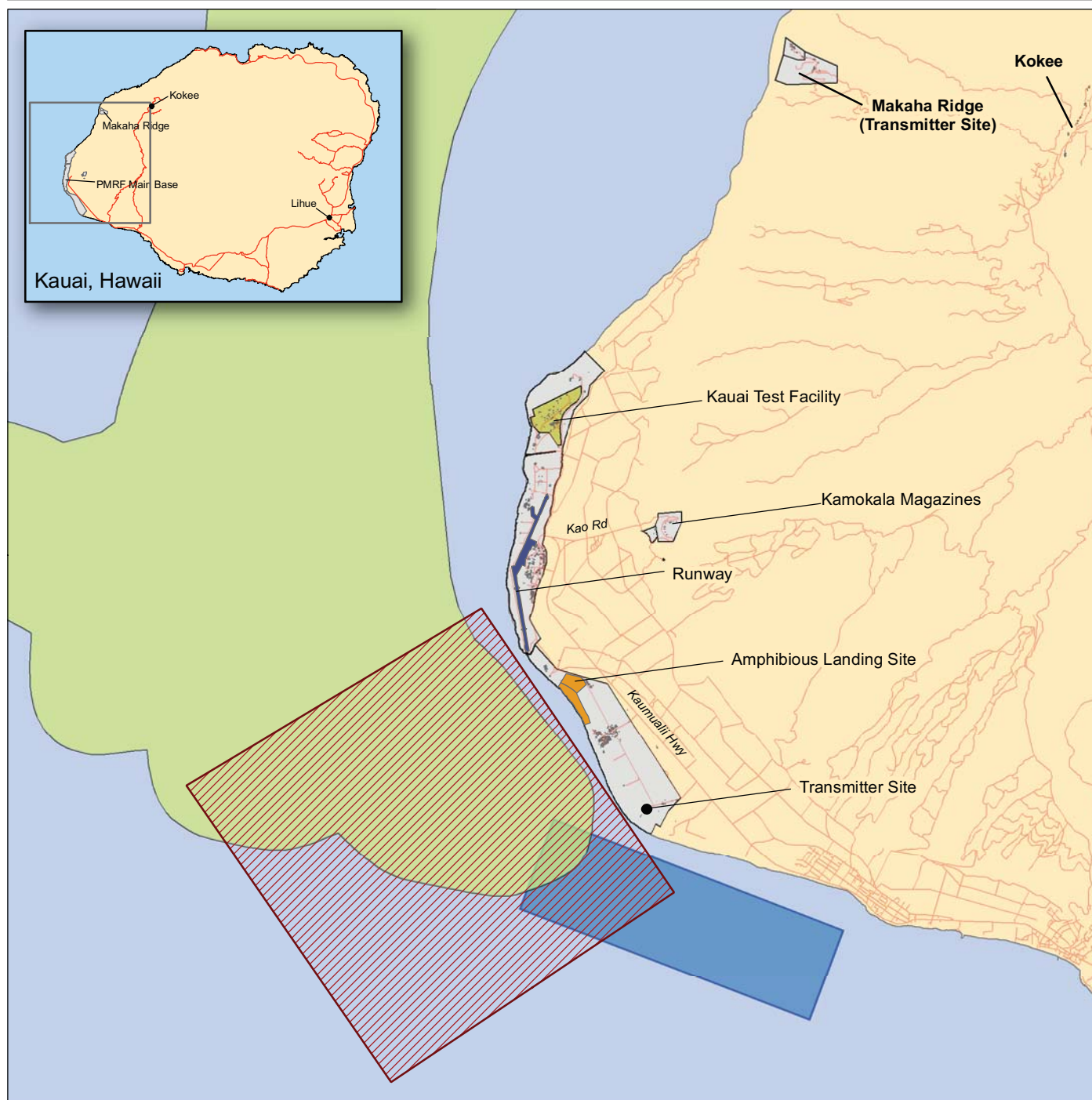
An Expeditionary Assault training event provides a realistic environment for amphibious training, reconnaissance training, hydrographic surveying, surf condition observance, and communication. Expeditionary Assault (formerly known as Amphibious Exercise) consists of a seaborne force assaulting a beach with a combination of helicopters, Vertical Takeoff and Landing (VTOL) aircraft, Landing Craft Air Cushion (LCAC), Amphibious Assault Vehicles (AAVs), Expeditionary Fighting Vehicle (EFV) and landing craft. More robust Expeditionary Assault events include support by Naval Surface Fire Support (NSFS), Close Air Support (CAS), and Marine artillery.

Types of amphibious landing craft and vehicles include:

- LCAC, an air-cushioned vessel equipped with an open-bay craft with roll-on, roll-off ramps capable of carrying tank-sized vehicles or up to 185 troops. The LCAC is approximately 88 ft by 47 ft.
- Landing Craft, Utility (LCU), a displacement hull craft designed to land very heavy vehicles, equipment, and cargo or up to 400 troops on the beach. The LCU is approximately 135 ft by 29 ft.
- AAV, a tracked, armored personnel carrier with a capacity of 21 troops. The AAV is approximately 24 ft by 13 ft.
- Combat Rubber Raiding Craft (CRRC), a lightweight, inflatable boat carrying up to 8 people used for raid and reconnaissance missions. The CRRC is approximately 16 ft by 6 ft.
- Rigid Hull, Inflatable Boat (RHIB), similar to the CRRC, but larger, carrying up to 15 people. The RHIB is approximately 24 ft by 9 ft.

An Expeditionary Strike Group (ESG) is normally a mix of three to five amphibious ships equipped with aircraft landing platforms for helicopter and fixed wing activities and well decks for carrying landing craft and AAVs. The ESG typically launches its aircraft and landing craft up to 25 miles from a training beachhead. AAVs are typically launched approximately 2,000 yards from the beach. The aircraft provide support while the landing craft approach and move onto the beach. The troops disperse from the landing craft and use existing vegetation for cover and concealment while attacking enemy positions. The landing craft and troops proceed to a designated area where they stay 1 to 4 days. When the Expeditionary Assault training event is complete, the backload takes place. The backload is normally accomplished over a 2- to 3-day period.

Amphibious landings are restricted to specific areas of designated beaches. Before each major amphibious landing training event is conducted, a hydrographic survey is performed to map out the precise transit routes through sandy bottom areas. During the landing, the crews follow established procedures, such as having a designated lookout watching for other vessels, obstructions to navigation, marine mammals (whales or monk seals), or sea turtles. The primary location for the amphibious landings is Majors Bay, PMRF, Kauai (Figure D-1). Amphibious landings could also occur at Marine Corps Base Hawaii (three beaches), Marine Corps Training Area–Bellows (MCTAB), Oahu (Figure D-2), and K-Pier boat ramp, Kawaihae, Hawaii. No ordnance is used during this training event.



EXPLANATION

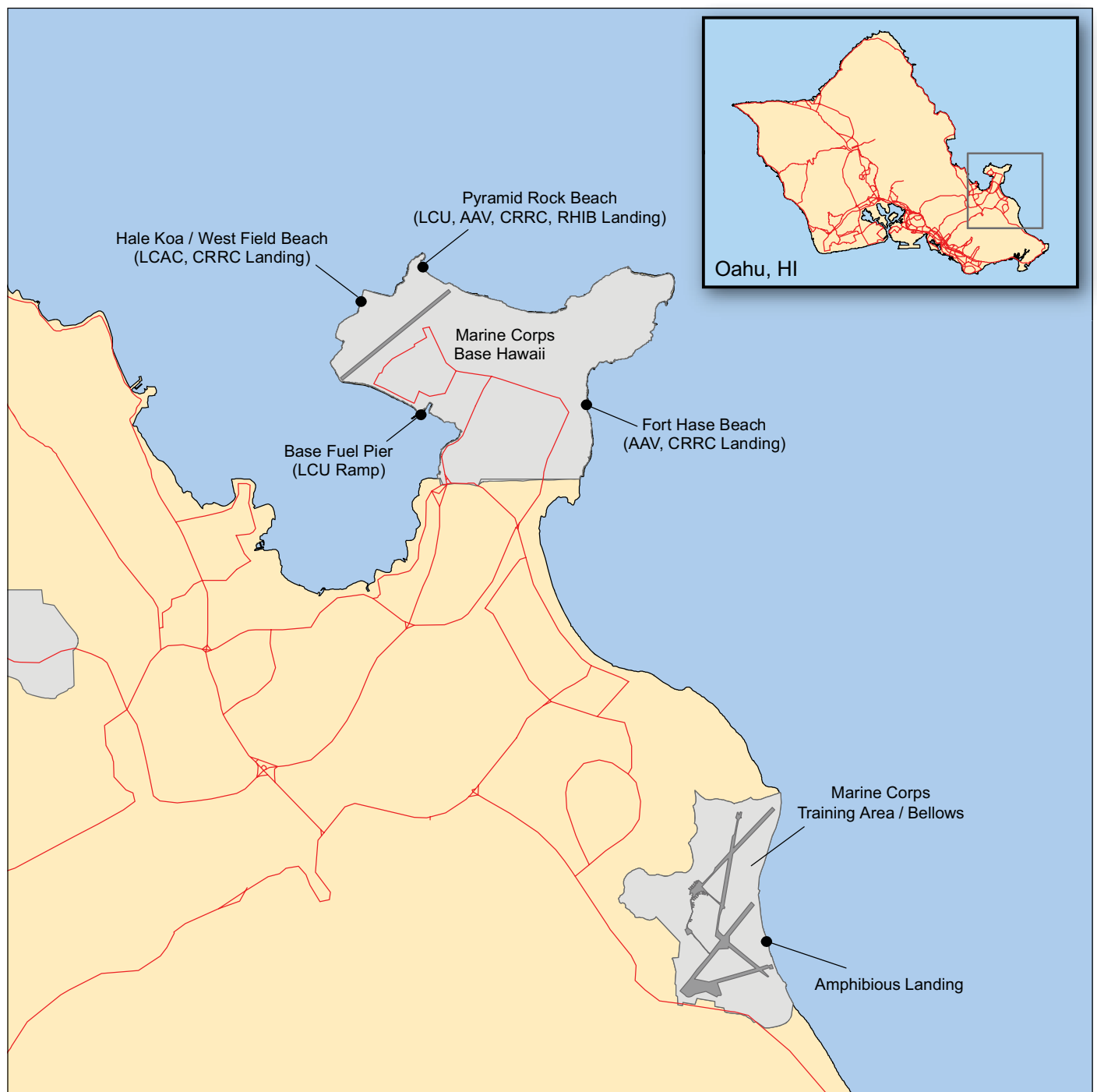
	Roads		RIMPAC Amphibious Landing Site
	Existing Kingfisher Area		Airfield
	Kauai Test Facility		Existing Structures
	PMRF Shallow Water Training Range (SWTR)		PMRF Installation Areas
	AMPHIBEX / Demolition Area		Land

Location of Pacific Missile Range Facility and Related Sites

Kauai, Hawaii

Figure D-1





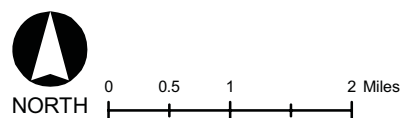
EXPLANATION

	Major Roads	AAV	Amphibious Assault Vehicle
	Airfield Runway	CRRC	Combat Rubber Raiding Craft
	Installation Areas	LCAC	Landing Craft, Air Cushioned
	Land	LCU	Landing Craft, Utility
		RHIB	Rigid Hull, Inflatable Boat

Marine Corps Base Hawaii and Marine Corps Training Area / Bellows

Oahu, Hawaii

Figure D-2



Baseline Training Events					
	NTA	Area	Metric	Duration (Hours)	Total Training Events
Expeditionary Assault	1.5.4	Pacific Missile Range Facility, Marine Corps Training Area-Bellows, Kawaihae Pier	Ops	48	11

Anti-Surface Warfare

Visit, Board, Search, and Seizure

Visit, Board, Search, and Seizure (VBSS) is conducted to train helicopter crews to insert personnel onto a vessel for the purpose of inspecting the ship's personnel and cargo for compliance with applicable laws and sanctions. VBSS training requires a cooperative surface ship. Typical duration of a VBSS is approximately 1.5 hours. No ordnance is used during this training event.

Baseline Training Events					
	NTA	Area	Metric	Duration (Hours)	Total Training Events
Visit, Board, Search, and Seizure (VBSS)	1.4.6	Hawaii Operating Area	Ops	1.5	60

Surface-to-Surface Gunnery Exercise

Surface-to-Surface Gunnery Exercises (S-S GUNEX) take place in the open ocean to provide gunnery practice for Navy and Coast Guard ship crews. S-S GUNEX training events conducted in the Offshore Operating Area (OPAREA) involve stationary targets such as an MK-42 Floating At Sea Target (FAST) or an MK-58 marker (smoke) buoy. An S-S GUNEX lasts approximately 2 to 4 hours, depending on target services and weather conditions.

The gun systems employed against surface targets include the 5-inch, 76-millimeter (mm), 25-mm chain gun, 20-mm Close In Weapon System, and .50-caliber machine gun. Typical ordnance expenditure for a single GUNEX is a minimum of 21 rounds of 5-inch or 76-mm ammunition, and approximately 150 rounds of 25-mm or .50-caliber ammunition. Both live and inert training rounds are used. After impacting the water, the rounds and fragments sink to the bottom of the ocean.

There are three new rounds of 5-inch gun ordnance nearing introduction to the Fleet. The High Explosive Electronically Timed Projectile is a standard High Explosive round with an improved electronically timed fuse. The Kinetic Energy Projectile, commonly called the "BB" round, contains 9,000 tungsten pellets and is designed to be fired down a bearing at incoming boats. The EX-171 Extended Range Guided Munition projectile is a major component of the Navy's littoral warfare concept. The 5-inch, rocket-assisted projectile is capable of carrying a 4-caliber submunition, and will be fired from the new 5-inch, 62-caliber gun being installed on Arleigh

Burke (DDG-51) class destroyers. Live gunnery rounds are fired at surface targets during this training event.

Baseline Training Events					
Surface-to-Surface Gunnery Exercise (S-S GUNEX)	NTA	Area	Metric	Duration (Hours)	Total Training Events
	3.2.1.1	W-191, 192, 193, 194, 196, Mela South,	Ops	2 to 4	14

Surface-to-Surface Missile Exercise

A Surface-to-Surface Missile Exercise (S-S MISSILEX) involves the attack of surface targets at sea by use of cruise missiles or other missile systems, usually by a single ship conducting training in the detection, classification, tracking and engagement of a surface target. Engagement is usually with surface-to-surface Harpoon missiles or Standard missiles. Targets include virtual targets or the seaborne powered target (SEPTAR) or ship deployed surface target.

S-S MISSILEX includes 4 to 20 surface-to-surface missiles, SEPTARs, a weapons recovery boat, and a helicopter for environmental and photo evaluation. All missiles are equipped with instrumentation packages or a warhead. Surface-to-air missiles can also be used in a surface-to-surface mode.

S-S MISSILEX activities are conducted within PMRF Warning Area W-188. Each training event typically lasts 5 hours. Future S-S MISSILEX could range from 4 to 35 hours. Live and inert missiles are fired against surface targets during this training event.

Baseline Training Events					
Surface-to-Surface Missile Exercise (S-S MISSILEX)	NTA	Area	Metric	Duration (Hours)	Total Training Events
	3.2.1.1	Pacific Missile Range Facility (W-188)	Ops	5.0	7

Air-to-Surface Gunnery Exercise

Air-to-Surface Gunnery Exercise (A-S GUNEX) training events are conducted by rotary-wing aircraft against stationary targets (FAST and smoke buoy). Rotary-wing aircraft involved in this training event include a single SH-60 using either 7.62-mm or .50-caliber door-mounted machine guns. A typical GUNEX lasts approximately 1 hour and involves the expenditure of approximately 400 rounds of .50-caliber or 7.62-mm ammunition. Live gunnery rounds are fired at surface targets during this training event.

Baseline Training Events					
Air-to-Surface Gunnery Exercise (A-S GUNEX)	NTA	Area	Metric	Duration (Hours)	Total Training Events
	3.2.1.1	Hawaii Operating Area	Ops	1.1	128

Air-to-Surface Missile Exercise

The Air-to-Surface Missile Exercise (A-S MISSILEX) consists of releasing a forward-fired, guided weapon at the designated towed target. The training event involves designating the target with a laser.

A-S MISSILEX training that does not involve the release of a live weapon can take place if a captive air training missile (CATM), simulating the weapon involved in the training, is carried. The CATM MISSILEX is identical to a Live Fire Exercise (LFX) in every aspect except that a weapon is not released. The training event requires a laser-safe range as the target is designated just as in an LFX.

From 1 to 16 fixed wing aircraft and/or helicopters, carrying air training missiles or flying without ordnance (dry runs), are used during the training event. Missiles include air-to-surface missiles and anti-radiation missiles (electromagnetic radiation source-seeking missiles). When a high-speed anti-radiation missile (HARM) is used, the event is called a HARMEX. At sea, SEPTARs, Improved Surface Towed Targets, and excess ship hulks are used as targets. Inert HELLFIRE missiles are fired at targets during this training event.

Baseline Training Events					
Air-to-Surface Missile Exercise (A-S MISSILEX)	NTA	Area	Metric	Duration (Hours)	Total Training Events
	3.2.1.1	Pacific Missile Range Facility (W-188)	Ops	5.5	36

Bombing Exercise (BOMBEX [Sea])

Fixed-wing aircraft conduct BOMBEX (Sea) against stationary targets (MK-42 FAST or MK-58 smoke buoy) at sea. An aircraft clears the area, deploys a smoke buoy or other floating target, and then sets up a racetrack pattern, dropping on the target with each pass. At PMRF, a range boat might be used to deploy the target for an aircraft to attack. Live and inert bombs are dropped on surface targets during this training event.

Baseline Training Events					
Bombing Exercise (BOMBEX) (Sea)	NTA	Area	Metric	Duration (Hours)	Total Training Events
	3.2.1.1	Hawaii Operating Area	Ops	6.0	35

Sinking Exercise

A Sinking Exercise (SINKEX) provides training to ship and aircraft crews in delivering live ordnance on a real target. Each SINKEX uses an excess vessel hulk as a target that is eventually sunk during the course of the training event. The target is an empty, cleaned, and environmentally remediated ship hull that is towed to a designated location where multiple types of weapons are used against the hulk. SINKEX vessels can number from one to as many as six during a Major Exercise. The duration of a SINKEX is unpredictable since it ends when the target sinks, sometimes immediately after the first weapon impact and sometimes only after multiple impacts by a variety of weapons.

Weapons can include missiles, precision and non-precision bombs, gunfire, and torpedoes. Examples of missiles that could be fired at the targets include AGM-142 from a B-52 bomber, Walleye AGM-62 from FA-18 aircraft, and a Harpoon from a P-3C aircraft. Surface ships and submarines may use either torpedoes or Harpoons, surface-to-air missiles in the surface-to-surface mode, and guns. Other weapons and ordnance could include, but are not limited to, bombs, Mavericks, and Hellfire.

If none of the shots result in the hulk sinking, either a submarine shot or placed explosive charges are used to sink the ship. Charges ranging from 100 to 200 pounds (lb), depending on the size of the ship, are placed on or in the hulk.

The vessels used as targets are selected from a list of U.S. Environmental Protection Agency (USEPA) approved destroyers, tenders, cutters, frigates, cruisers, tugs, and transports. USEPA granted the Department of the Navy a general permit through the Marine Protection, Research, and Sanctuaries Act to transport vessels “for the purpose of sinking such vessels in ocean waters...” (40 CFR Part 229.2) Subparagraph (a)(3) of this regulation states “All such vessel sinkings shall be conducted in water at least 1,000 fathoms (6,000 feet) deep and at least 50 nautical miles from land.” In Hawaii, SINKEX events take place within PMRF Warning Area W-188. Multiple types of live ordnance are fired on an excess vessel hulk during this training event.

Baseline Training Events					
Sinking Exercise (SINKEX)	NTA	Area	Metric	Duration (Hours)	Total Training Events
	3.2.1.1	Hawaii Operating Area	Ops	14.5	6

Anti-Surface Warfare Torpedo Exercise (Submarine-Surface)

Submarines conduct most of their torpedo firings at PMRF, and many of those are against surface targets. Surface targets will typically be PMRF range boats or targets, or Navy combatants. The Anti-Surface Warfare (ASUW) Torpedo Exercise (TORPEX) culminates with the submarine firing an MK-48 torpedo against the surface target.

Twice a year, “Hollywood” training events are conducted on PMRF as part of the Submarine Commander’s Course, which trains prospective submarine Commanding Officers and Executive Officers. These are integrated training events involving complex scenarios that will include a coordinated surface, air, and submarine force challenging the submarine Commanding Officers and crew. During these events, submarines engage in ASUW torpedo firings, as well as Anti-Submarine Warfare (ASW) Tracking Exercises (TRACKEX), and ASW TORPEX. Inert exercise torpedoes are fired during this training event.

Baseline Training Events					
Anti-Submarine Warfare Torpedo Exercise (ASUW TORPEX) (Submarine-Surface)	NTA	Area	Metric	Duration (Hours)	Total Training Events
	3.2.1.1	Hawaii Operating Area	Ops	12.3	35

Flare Exercise

A Flare Exercise is an aircraft defensive event in which the aircrew uses an infrared (IR) source or radar energy absorbing chaff to disrupt attempts to lock onto the aircraft. During IR break-lock (flare) training, a shoulder-mounted IR surface-to-air missile simulator is trained on the aircraft by an operator attempting to lock onto the aircraft’s IR signature. The aircraft maneuvers while expending flares. The scenario is captured on videotape for replay and debrief. No actual missiles are fired during this training event. Radar break-lock training is similar except that the energy source is an electronic warfare (EW) simulator, and the aircraft expels chaff during its defensive maneuvering. Chaff is a radar confusion reflector, consisting of thin, narrow metallic strips of various lengths and frequency responses, used to deceive radars.

Baseline Training Events					
Flare Exercise	NTA	Area	Metric	Duration (Hours)	Total Training Events
	3.2.9	Pacific Missile Range Facility (W-188)	Ops	5.7	6

Anti-Submarine Warfare

Other Anti-Submarine Warfare Exercises

Anti-Submarine Warfare Tracking Exercise

An Anti-Submarine Warfare Tracking Exercise (ASW TRACKEX) trains aircraft, ship, and submarine crews in tactics, techniques, and procedures for search, detection, and tracking of submarines. No torpedoes are fired during a TRACKEX. ASW TRACKEX includes ships, fixed wing aircraft, helicopters, torpedo targets, 1 to 10 submarines, and weapons recovery boats and/or helicopters. As a unit-level training event, an aircraft, ship, or submarine is typically used versus one target submarine or simulated target.

The target may be non-evading while operating on a specified track or it may be fully evasive, depending on the state of training of the ASW unit. Duration of a TRACKEX is highly dependent on the tracking platform and its available on-station time. A maritime patrol aircraft can remain on station for 8 hours, and typically conducts tracking events that last 3 to 6 hours. An ASW helicopter has a much shorter on-station time, and conducts a typical TRACKEX in 1 to 2 hours. Surface ships and submarines, which measure their on-station time in days, conduct tracking events exceeding 8 hours and averaging up to 18 hours. For modeling purposes, TRACKEX and TORPEX sonar hours are averaged resulting in a sonar time of 13.5 hours.

ASW TRACKEX events are conducted on ranges within PMRF Warning Area W-188, the Hawaii Offshore Areas and/or the open ocean. Whenever aircraft use the ranges for ASW training, range clearance procedures include a detailed visual range search for marine mammals and unauthorized boats and planes by the aircraft releasing the inert torpedoes, range safety boats/aircraft, and range controllers.

Sensors used during ASW training events include sonars, sonobuoys, non-acoustic sensors, such as radars. The use of sonobuoys is generally limited to areas greater than 100 fathoms, or 600 ft, in depth. Before dropping sonobuoys, the crew visually determines that the area is clear. When the sonobuoy is released, a small parachute (about 4 ft in diameter) retards its entry into the ocean. The sonobuoy is designed to float on the surface and, after a controlled period of time (no longer than 8 hours), the complete package (with the parachute) sinks to the bottom. No ordinance is used during this training event. Sonobuoys are released from aircraft, and active and passive sonar is used.

Anti-Submarine Warfare Torpedo Exercises

Anti-submarine Warfare Torpedo Exercises (ASW TORPEX) events train crews in tracking and attack of submerged targets, firing one or two exercise torpedoes or recoverable exercise torpedoes. TORPEX targets used in the Offshore Areas include live submarines, MK-30 ASW training targets, and MK-39 Expendable Mobile ASW Training Targets. The target may be non-evading while operating on a specified track, or it may be fully evasive, depending on the training requirements.

Submarines periodically conduct torpedo firing training events within the Hawaii Offshore OPAREA. Typical duration of a submarine TORPEX event is 22.7 hours, while air and surface ASW platform TORPEX events are considerably shorter. Inert exercise torpedoes are fired, and active and passive sonar is used during this training event. For modeling purposes, TRACKEX and TORPEX sonar hours are averaged resulting in a sonar time of 13.5 hours.

Baseline Training Events					
Anti-Submarine Warfare Tracking Exercise (ASW TRACKEX) and Anti-Submarine Warfare Torpedo Exercises (ASW TORPEX)	NTA	Area	Metric	Duration (Hours)	Total Training Events
	3.2.1.2	Hawaii Operating Area, Pacific Missile Range Facility	Ops	15	29

Major Integrated ASW Training Exercises

Integrated ASW training events conducted during a Major Integrated ASW Training Event are called a Major Exercise, which uses ships, submarines, aircraft, non-explosive training weapons, and other training systems and devices. No new or unique events take place during integrated training; it is merely the compilation of numerous ASW events as conducted by multiple units over a period of time ranging from 3 to 30 days. No ordinance is used during this training event. Sonobuoys are released from aircraft and active and passive sonar is used.

Baseline Training Events					
Major Integrated ASW Training Exercise	NTA	Area	Metric	Duration (Hours)	Total Training Events
	3.2.1.2	Hawaii Operating Area	Ops	Various	6

Extended Echo Ranging/Improved Extended Echo Ranging Training Exercise

The Extended Echo Ranging and Improved Extended Echo Ranging (EER/IEER) Systems are airborne ASW systems used in conducting "large area" searches for submarines. These systems are made up of airborne avionics ASW acoustic processing and sonobuoy types that are deployed in pairs. The IEER System's active sonobuoy component, the AN/SSQ-110 Sonobuoy, contains a small explosive charge that generates acoustic energy when detonated. If an underwater target is within range, the echo is received by the passive AN/SSQ-101 Air Deployable Active Receiver (ADAR) sonobuoy and transmitted to the aircraft. These sonobuoys are designed to provide underwater acoustic data necessary for naval aircrews to quickly and accurately detect submerged submarines. The sonobuoy pairs are dropped from a fixed-wing aircraft into the ocean in a predetermined pattern with a few buoys covering a very large area. Each training event includes approximately 12 events with 10 to 20 sonobuoys per event for a total of 120 to 240 sonobuoys per training event. The AN/SSQ-110 Sonobuoy Series is an expendable and commandable sonobuoy. Upon command from the aircraft, the bottom payload is released to sink to a designated operating depth. A second command is required from the aircraft to cause the second payload to release and detonate generating a "ping." There is only one detonation in the pattern of buoys at a time.

The ANJSSQ-101 ADAR Sonobuoy is an expendable passive sonobuoy. After water entry, the ADAR sonobuoy descends to a selected depth and deploys hydrophones. Once activated, the ADAR sonobuoy works in conjunction with the SSQ-110 sonobuoy sound source, receiving active echoes reflecting off any target or reverberant present, including submarine hulls, seamounts, bottom features, etc.

Ordnance is used during this training event. Sonobuoys are released from aircraft, and active and passive sonar is used.

Baseline Training Events					
Extended Echo Ranging and Improved Extended Echo Ranging (EER/IEER)	NTA	Area	Metric	Duration (Hours)	Total Training Events
		Hawaii Operating Area	Ops	4 to 8 hours	4

Electronic Combat

Electronic Combat Operations

Electronic Combat (EC) Operations consist of air-, land-, and sea-based emitters simulating enemy systems and activating air, surface and submarine electronic support measures and electronic countermeasures systems. Appropriately configured aircraft fly threat profiles against the ships so that crews can be trained to detect electronic signatures of various threat aircraft, or so that ship crews can be trained to detect counter jamming of their own electronic equipment by the simulated threat. No ordnance is expended during this training event.

Baseline Training Events					
Electronic Combat (EC) Operations	NTA	Area	Metric	Duration (Hours)	Total Training Events
	3.2.5	Hawaii Operating Area	Ops	6.1	50

Mine Warfare

Mine Countermeasures Exercise

Mine Countermeasures (MCM) Exercises train forces to detect, identify, mark, and/or disable mines using a variety of methods. No ordnance is expended during this training event. Active sonar is used.

Organic Mine Countermeasures

Organic Mine Countermeasures (OMCM) include systems deployed by air, ship, and submarine. Five Organic Airborne Mine Countermeasures (OAMCM) systems (Figure D-3) are deployed by the MH-60S Seahawk Multi-Mission, including:

- **Advanced Mine Hunting Sonar:** The AN/AQS-20A Advanced Mine Hunting Sonar is a single-pass multi-sonar system designed to detect, locate, and identify mines on the sea floor and in the water.
- **AN/AES-1 Airborne Laser Mine Detection System (ALMDS):** The AN/AES-1 ALMDS is a sensor designed to detect moored, near surface mines using light detection and ranging technology.



AN/AES-1



AN/ASQ-20A



AN/AWS-2



AN/ALQ-220 OASIS

Organic Mine Countermeasures

Figure D-3

- **AN/ALQ-220 Organic Airborne and Surface Influence Sweep (OASIS):** The AN/ALQ-220 OASIS System is a lightweight magnetic/acoustic system employed by the MH-60S.
- **AN/AWS-2 Rapid Airborne Mine Clearance System (RAMICS):** The AN/AWS-2 RAMICS is being developed to destroy near-surface and floating mines using a 30-mm cannon hydro-ballistic projectile, and includes a target reacquisition pod on the MH-60S.
- **AN/ASQ-235 Airborne Mine Neutralization System (AMNS):** The AN/ASQ-235 AMNS is a lightweight expendable system designed to rapidly neutralize bottom and moored mines.

One OMCM System, the Remote Minehunting System, is deployed from a surface ship. Another OMCM system, the Long-term Mine Reconnaissance System, is deployed from a submarine. The Remote Minehunting System and the Long-term Mine Reconnaissance System should be operational after FY 2007.

Baseline Training Events					
Mine Countermeasures Exercise (MCM)	NTA	Area	Metric	Duration (Hours)	Total Training Events
	1.3.1	Hawaii Operating Area, Kingfisher, Shallow-water Minefield Sonar Training Area	Ops	6-12	32

Mine Neutralization

Mine Neutralization involves the detection, identification, evaluation, rendering safe, and disposal of mines and unexploded ordnance (UXO) that constitutes a threat to ships or personnel. Mine neutralization training is conducted by a variety of air, surface, and sub-surface assets.

Tactics for neutralizing ground or bottom mines involve the diver placing a specific amount of explosives which, when detonated underwater at a specific distance from a mine, results in neutralization of the mine. Floating, or moored, mines involve the diver placing a specific amount of explosives directly on the mine. Floating mines encountered by fleet ships in open-ocean areas are detonated at the surface. In support of a military expeditionary assault, the Navy deploys divers in very shallow water depths (10 to 40 ft) to locate mines and obstructions.

Divers are transported to the mines by boat or helicopter. Inert dummy mines are used in training events. The total net explosive weight used against each mine ranges from 1 lb to 20 lb.

Various types of surveying equipment are used during RIMPAC Exercises. Examples include the Canadian Route Survey System that hydrographically maps the ocean floor using multi-beam side scan sonar, and the Bottom Object Inspection Vehicle used for object identification.

These units help to support mine detection prior to Special Warfare Operations (SPECWAROPS) and Expeditionary Assault.

Occasionally, marine mammals are used in mine detection training. The Navy's Very Shallow Water Mine Countermeasures Detachment of Commander Mine Warfare Command deploys trained Atlantic bottlenose dolphins (*Tursiops truncatus*) of their marine mammal mine-hunting systems in several missions. Each mission includes up to four motorized small craft, several crew members and a trained dolphin. Training events using dolphins are coordinated with other Navy units to avoid conflicts with other Navy activities, underwater acoustic emissions associated with those activities, or civilian craft. Any unplanned situation that has the potential for exposing a dolphin to dangerous or conflicting underwater acoustic emissions or other interference is mitigated by recalling it into a small craft and moving the dolphin out of the area. As such, these marine mammals are continuously protected. Transportation of these animals into the State of Hawaii is in accordance with the regulations of the Hawaii State Department of Agriculture.

Mine neutralization events take place offshore in the Puuloa Underwater Range (called Keahi Point in earlier documents), Pearl Harbor; Lima Landing; Barbers Point Underwater Range off-shore of Coast Guard Air Station Barbers Point/Kalaheo Airport (formerly Naval Air Station Barbers Point); PMRF, Kauai (Majors Bay area); PMRF and Oahu Training Areas; and in open-ocean areas.

All demolition activities are conducted in accordance with Commander Naval Surface Forces Pacific Instruction 3120.8F, Procedures for Disposal of Explosives at Sea/Firing of Depth Charges and Other Underwater Ordnance (U.S. Department of the Navy, 2003a). Before any explosive is detonated, divers are transported a safe distance away from the explosive. Standard practices for tethered mines in Hawaiian waters require ground mine explosive charges to be suspended 10 ft below the surface of the water. For mines on the shallow water floor (less than 40 ft of water), only sandy areas that avoid/minimize potential impacts on coral are used for explosive charges. Underwater detonations do occur during this training event.

Baseline Training Events					
	NTA	Area	Metric	Duration (Hours)	Total Training Events
Mine Neutralization	1.3.1	Puuloa Underwater Range, MCBH, MCTAB, Barbers Point Underwater Range, Naval Inactive Ship Maintenance Facility, Lima landing, Ewa Training Minefield	Ops	6	62

Mine Laying

Mine Laying events are designed to train forces to conduct offensive (deploy mines to tactical advantage of friendly forces) and defensive (deploy mines for protection of friendly forces and facilities) mining events. Mines can be laid from the air (FA-18/P-3) or by submarine.

Airborne Mine Laying involves one or more aircraft and either computer-simulated or inert exercise mines. Mine warfare events are limited to either the simulated laying of aircraft-deployed mines, where no actual mine ordnance is dropped, or the use of inert exercise mines or inert exercise submarine-deployed mines.

The use of inert exercise mines is generally limited to areas greater than 100 fathoms, or 600 ft in depth. Before dropping inert exercise mines, the crew visually determines that the area is clear. Although the altitude at which inert exercise mines are dropped varies, the potential for drift during descent generally favors release at lower altitudes, where visual searches for marine mammals are more effective. When the inert exercise mine is released, a small parachute retards its entry into the ocean. The mine can be designed to float on the surface or near surface or to sink on a tether. Ultimately the mine sinks carrying the parachute with it. Standard Navy procedures are followed for the deployment of inert mines from submarines.

Aerial mining lines are generally developed off the southwest coast of Kauai and the southeast coast of Niihau, within PMRF Warning Areas W-186 and W-188. Submarine mining events are conducted within PMRF Warning Area W-188. Air Operations are conducted within R3101. Inert mine shapes are released into the ocean during these training events.

Baseline Training Events					
Mine Laying	NTA	Area	Metric	Duration (Hours)	Total Training Events
	1.4.1	Pacific Missile Range Facility (R-3101)	Ops	6-12	22

Land Demolitions

Land demolitions events are designed to train forces to cause the explosion and the resulting destruction of enemy personnel, vehicles, aircraft, obstacles, facilities, or terrain on land. These events are also designed to develop and hone Explosive Ordnance Disposal (EOD) mission proficiency in locating, identifying, excavating, and neutralizing land mines. Land demolitions take place at the West Loch EOD Training Facility. In addition to Navy personnel, Honolulu Police, Federal Bureau of Investigation, and several research, development, test, and evaluation (RDT&E) companies conduct land demolitions at the EOD land facility. The EOD facility is limited to 2.5 lb of non-fragment producing explosives. EOD Range demolition events take approximately 4.5 hours to complete, and there are between 70 and 80 events per year. Land detonations occur during this training event.

Baseline Training Events					
Land Demolitions	NTA	Area	Metric	Duration (Hours)	Total Training Events
	1.4.4	Explosive Ordnance Disposal Land Range	Ops	4	85

Naval Special Warfare

Swimmer Insertion/Extraction

Naval Special Warfare (NSW) personnel conduct underwater swimmer insertion and extraction training in the Hawaii Offshore Areas using either the Sea, Air, Land (SEAL) Delivery Vehicle (SDV), or the Advanced SEAL Delivery System (ASDS). Both submersibles are designed to deliver special operations forces for clandestine activities. The SDV is an older, open-design delivery vehicle. The ASDS is a new dry compartment vehicle that keeps the SEALs warmer during transit. The battery-powered ASDS is capable of operating independently or with submarines.

Two types of training occur with the ASDS—unit and integrated. Unit training with the ASDS consists of the SDV Team operating the ASDS independently. Integrated training involves the SDV Team working with a submarine and the ASDS.

Underwater swimmer insertion and extraction training is focused on undersea operation of the SDV or ASDS, and does not typically involve SEAL personnel landing ashore or conducting shore training. Although undersea range areas are usually reserved for a 24-hour period, the insertion/extraction event itself lasts approximately 8 hours. Swimmer insertion and extraction events can also include the use of helicopters to insert or extract NSW personnel using a variety of techniques. No ordnance or sonar will be used during this training event.

Baseline Training Events					
Swimmer Insertion/Extraction	NTA	Area	Metric	Duration (Hours)	Total Training Events
	1.1.2.4	Hawaii Operating Area, Marine Corps Training Area-Bellows, Pacific Missile Range Facility (Main Base)	Days	8	132

Special Warfare Operations

SPECWAROPS are performed by Navy SEALs and U.S. Marines. Activities include special reconnaissance (SR), reconnaissance and surveillance, combat search and rescue (CSAR), and direct action (DA). SR units consist of small special warfare unit and utilize helicopters, submarines, and combat rubber raiding craft to gain covert access to military assets, gather intelligence, stage raids, and return to their host units. Reconnaissance inserts and beach surveys are often conducted before large-scale amphibious landings and can involve several units gaining covert access using a boat. CSAR activities are similar to SR (R&S), but the mission is to locate and recover a downed aircrew. DA missions consist of an initial insertion, followed by the helicopters/boats inserting additional troops to take control of an area. The helicopters may land for refueling. No ordnance or sonar will be used during this training.

Baseline Training Events					
	NTA	Area	Metric	Duration (Hours)	Total Training Events
Special Warfare Operations (SPECWAROPS)	1.5.6	PMRF (Main Base, Makaha Ridge), Puuloa underwater Range, MCBH, Barbers Point Underwater Range, Naval Station Pearl Harbor, Naval Inactive Ship Maintenance Facility, Lima Landing, U.S. Coast guard Air Station Barbers Point/Kalaheo Airport, Hickam AFB, Bradshaw Army Airfield, Makua Military Reservation, Kahuku Training Area, Kawaihae Pier, Dillingham Military Reservation, Wheeler Army Airfield, Niihau, MCTAB, Pohakuloa Training Area	Days	8	30

Strike Warfare

Bombing Exercise (Land)

Kaula also is used for BOMBEX training. BOMBEX events consist of air-to-ground delivery of small, 25-lb, inert MK-76 (a type of training ordnance); inert laser-guided bombs, such as the Hellfire, or the MK-82, a 500-lb bomb. BOMBEX events originate from an aircraft carrier or a land base. CSG fixed-wing aircraft account for all of the Navy BOMBEX events at Kaula. Only inert ordnance 500 lb or less is authorized for use on Kaula. Inert bombs will be dropped from aircraft during this training. Live and inert bombs may be used at Pohakuloa Training Area.

Baseline Training Events					
Bombing Exercise (BOMBEX) (Land)	NTA	Area	Metric	Duration (Hours)	Total Training Events
	3.2.6	Kaula, Pohakuloa Training Area	Ops	0.8	165

Air-to-Ground Gunnery Exercise

Kaula, a small island southwest of Kauai (shown in Figure 1.2-2), is used for air-to-ground gunnery training. Air-to-ground GUNEX includes live fire gunnery training from fixed- or rotary-wing aircraft. The use of 20-mm and 30-mm cannon fire is not allowed from November through May. Live gunnery rounds will be fired at land targets during this training event.

Baseline Training Events					
Air-to-Ground Gunnery Exercise (GUNEX)	NTA	Area	Metric	Duration (Hours)	Total Training Events
	3.2.6	Kaula, Pohakuloa Training Area	Ops	0.8	16

Other Training

Salvage Operations

The purpose of Salvage Operations is to provide a realistic training environment for battling fires at sea, de-beaching of stranded ships, and harbor clearance operations training by Navy diving and salvage units.

The Navy's Mobile Diving and Salvage Unit One (MDSU-1) (Figure D-4) and divers from other countries practice swift and mobile ship and barge salvage, towing, battle damage repair, deep ocean recovery, harbor clearance, removal of objects from navigable waters, and underwater ship repair capabilities.

Diving and salvage forces training include the following activities:








- SCUBA and surface supplied air and mixed gas (HeO₂) diving operations to depths of 300 ft of sea water
- Hyperbaric recompression chamber operations
- Underwater ship inspection, husbandry, and repair of coalition Naval ships and submarines
- Underwater search and recovery operations
- Underwater cutting employing hydraulic, pneumatic, and oxy-arc powered tools
- Underwater welding
- Removal of petroleum, oil, and lubricants (POL) exercising various POL offload techniques
- Restoring Buoyancy (Survey, Patch, De-water) to a grounded or sunken vessel or object of value
- Harbor clearance for removal of derelict vessels or other obstructions from navigable waterways and berthing
- Off-Ship fire fighting to simulate rescue and assistance operations battling fires

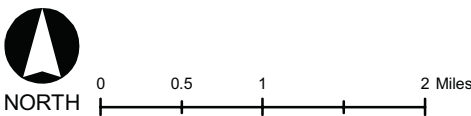
These activities take place at Puuloa Underwater Range, Pearl Harbor, and Keehi Lagoon. Staging for these activities is from the MDSU-1 Facility located on Bishop Point, an annex of Pearl Harbor, on the southwestern side of Hickam Air Force Base, Oahu. To capitalize on real-world training opportunities and to provide mutual benefit for both the U.S. Naval and Coalition Salvage Force and for the State of Hawaii, salvage training and harbor clearance events take place in any of the shoal waters, harbors, ports, and in-land waterways throughout the Hawaiian OPAREA.

The ship fire training lasts no more than 1 day per event. De-beaching activities last no more than 1 to 2 days per event. Deep ocean recovery training last up to 2 weeks and could be longer depending on the availability of missions.



EXPLANATION

- | | |
|---|--|
|  Road |  Existing Structure |
|  Ewa Training Minefield |  Installation Area |
|  Pu'uloa Underwater Range |  Land |
|  Pearl Harbor Naval Defense Sea Area | |



**Pearl Harbor Area /
Hickam Air Force Base**

Oahu, Hawaii

Figure D-4

The duration of Salvage Operations varies considerably. For a fire at sea or ship retraction of a grounded vessel, the training event lasts up to 4 days. For underwater cutting, welding, pumping, restoring buoyancy, and training that practice a single skill in a controlled environment, the event usually does not exceed 1 day. However, multiple iterations could extend throughout the duration of the training event. No ordnance or sonar will be used during this training.

All U.S. and Coalition Naval Salvage Force training event scenarios will be conducted in accordance with the following references:

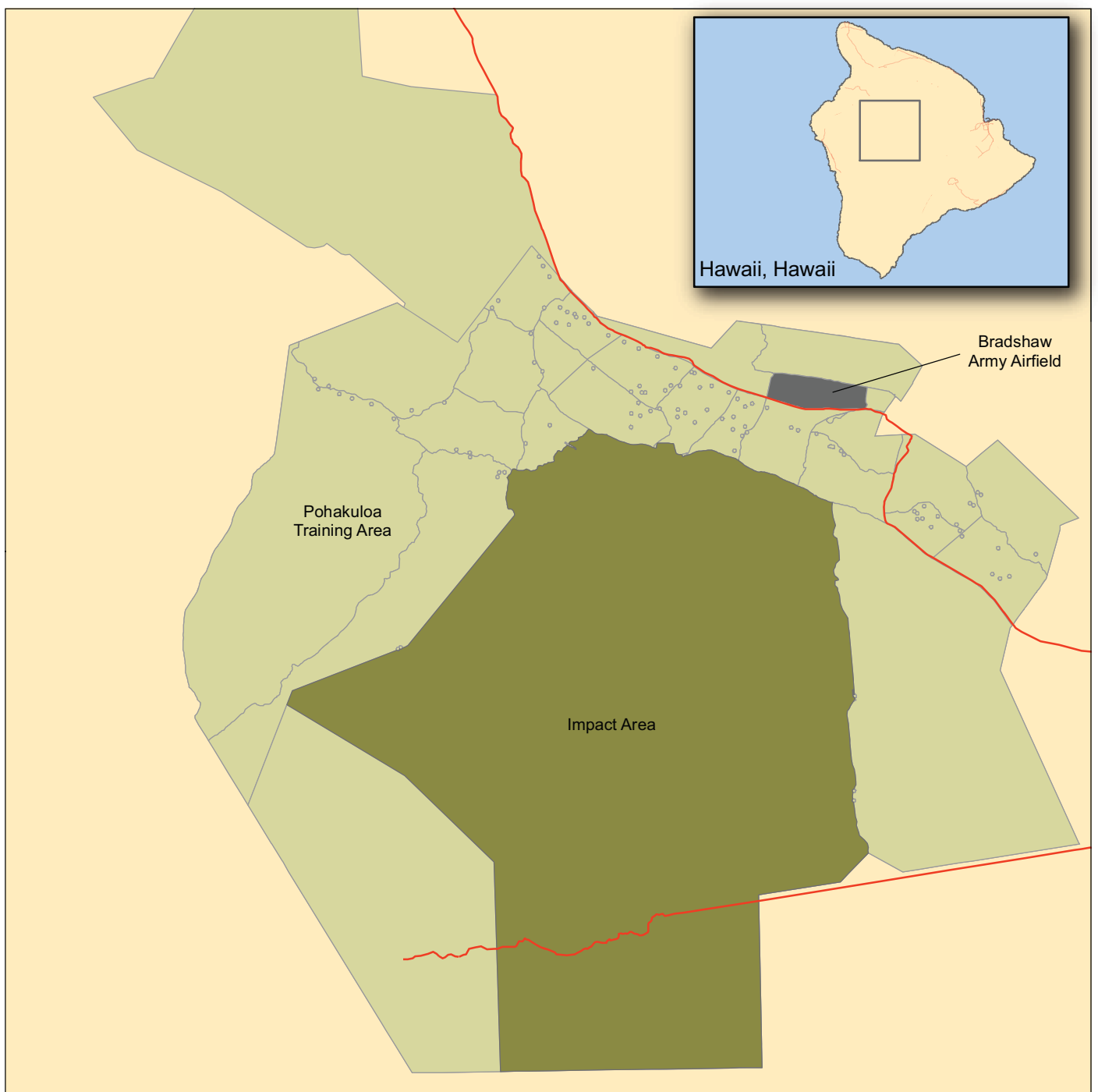
- a. U.S. Navy Diving Manual Revision 4, with a change dated March 2001
- b. U.S. Navy Salvage Safety Manual
- c. U.S. Navy Salvage Manual Vol. 1—Strandings
- d. U.S. Navy Salvage Manual Vol. 2—Harbor Clearance
- e. U.S. Navy Salvage Manual Vol. 3—Firefighting and Damage Control
- f. U.S. Navy Salvage Manual Vol. 5—Petroleum Oil and Lubricant Offload
- g. U.S. Navy Towing Manual
- h. OPNAVINST 5100.19B (safety manual)
- i. Fleet Exercise Publication—4, Chapter 12, Mobile Diving and Salvage Units and Chapter X, ARSs

Baseline Training Events					
	NTA	Area	Metric	Duration (Days)	Total Training Events
Salvage Operations	4.13	Naval Station Pearl Harbor, Puuloa Underwater Range, Naval Defensive Sea Area, Keehi Lagoon	Ops	1	3

Live Fire Exercise

Live Fire Exercise (LFX) provides ground troops with live fire training and combined arms LFX training, including aerial gunnery and artillery firing. These training events include platoon troop movements through numerous target objectives with various weapons. Aerial Gunnery Exercises and artillery and mortar training are also conducted as part of combined and separate training events. Live fire and blanks are used. Blanks are used outside of defined impact areas. LFX benefit ground personnel who receive semi-realistic training.

LFX typically consists of ground troops and special forces, including a sniper unit, of about 2 to 18 people, a helicopter, artillery, mortars, and miscellaneous small arms. In the future, up to a brigade of U.S. or foreign troops could receive LFX training during a Major Exercise. LFX is conducted at Pohakuloa Training Area (Figure D-5) and Makua Military Reservation (Figure D-6). Live rounds will be fired at Pohakuloa Training Area, and inert rounds (blanks) will be fired at Makua Military Reservation.



EXPLANATION

-  Road
-  Pohakuloa Training Area
-  Bradshaw Army Airfield
-  Impact Area
-  Land

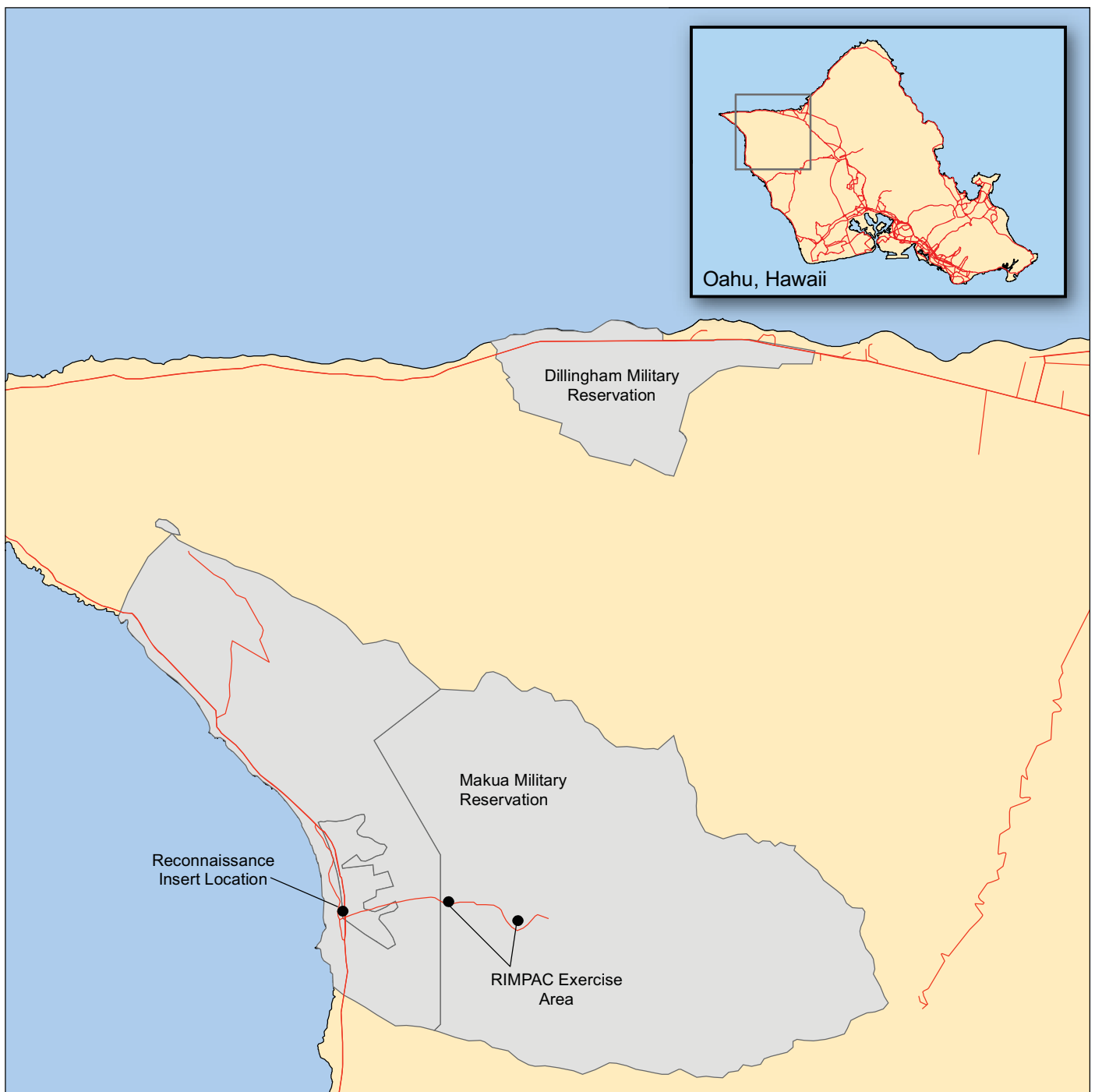
Pohakuloa Training Area and Bradshaw Army Airfield

Hawaii, Hawaii




Figure D-5



NORTH 0 1 2 4 Miles



EXPLANATION

-  Roads
-  Installation Areas
-  Land

Makua Military Reservation and Dillingham Military Reservation

Oahu, Hawaii

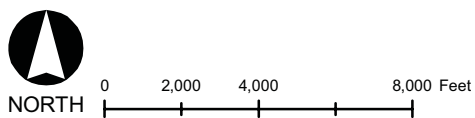


Figure D-6

Baseline Training Events					
LFX	NTA	Area	Metric	Duration (Hours)	Total Training Events
	3.2.2	Makua Military Reservation, Pohakuloa Training Area	Ops	1 - 24	3

Humanitarian Assistance Operation/Non-combatant Evacuation Operation

The purpose of Humanitarian Assistance Operation/Non-combatant Evacuation Operation (HAO/NEO) is to provide training in providing humanitarian assistance in an increasingly hostile setting, which could require the evacuation of personnel and troops. Marine Corps Base Hawaii is used for HAO/NEO and direct action training. MCTAB, Kahuku Training Area, Majors Bay at PMRF, and Niihau are also used for HAO/NEO.

HAO/NEO training events, which last approximately 4 days, involve approximately 150 personnel, troops, and specialists who initially provide assistance to civilians and then evacuate them when necessary. This scenario is also used to simulate a prisoner-of-war camp or place where people are interned. A Direct Action Exercise (lasting several hours) is another scenario included in the HAO/NEO. It is much quicker and involves approximately 50 personnel and 150 troops who gain access to an area by boat or helicopter, storm the location, recover the mission target, and return to their units.

HAO/NEO events use trucks, helicopters, LCAC, LCU, and/or CRRC to shuttle supplies. Evacuations may be made using helicopters, and/or LCAC vehicles. Direct Actions may use CRRC, RHIB, trucks, and/or helicopters. Existing building and facilities are used to the extent practicable, but in some instances tents and other temporary structures may be used. No ordnance is used during this training.

Baseline Training Events					
Humanitarian Assistance Operation/Non-combatant Evacuation Operation (HAO/NEO)	NTA	Area	Metric	Duration (Days)	Total Training Events
	6.2.1	Niihau, MCBH, MCTAB, Kahuku Training Area, Pacific Missile Range Facility (Main Base)	Ops	4	1

Humanitarian Assistance/Disaster Relief

The purpose of Humanitarian Assistance/Disaster Relief (HA/DR) is to provide training in responding to a United Nations request for complex emergency support. HA/DR training events involve approximately 125 to 250 troops and 125 to 200 refugee actors. An amphibious landing craft off-loads approximately 4 transport trucks, 3 support vehicles, 3 water supply vehicles, water and food supply, and 125 troops. They travel along authorized highways to the HA/DR site. A safe haven camp is established in existing facilities or temporary facilities (tents, etc.).

The HA/DR training event lasts for approximately 10 days. Future HA/DR training events could range from 2 to 18 days. The camp is established in 2 days. Personnel are provided water, shelter, food, sanitation, and communications for 5 days. Takedown takes about 2 days.

For each training event, there are two sites: a refugee camp and a Civil–Military Operations Center area. There are roughly 30 five-person Red Cross tents within the refugee camp, with a few larger tents for various support functions including meals, showers, recreation, administration, and storage. The Civil–Military Operations Center section contains more storage, communication links, staff housing, experimentation (including information management and high-bandwidth informatics support, digital transcription facilities to interview refugees for war-crimes documentation, and solar powered computer systems), and various public relations areas for visitors. Approximately 18 portable latrines are at the sites. Buses and/or trucks, and military helicopters as needed, are used to transport refugees.

A safe haven refugee camp would be established within the Marine Corps Base Hawaii, MCTAB, and/or Kahuku Training Area. An amphibious landing craft or trucks would offload equipment, vehicles, troops, and refugees. Airstrips at these locations would be used to transport personnel.

The HA/DR training event takes place near an existing training trail. The access road to the site would be graded before the event, if required. Grading would be within the existing roadway in accordance with standard procedures. Equipment and personnel would be transferred to the camp location via transport trucks and buses, respectively. Training map overlays that identify the transit route, camp location, and any nearby restricted areas or sensitive biological and cultural resource areas would be used by participants. No ordnance is used during this training.

Baseline Training Events					
Humanitarian Assistance/Disaster Relief HA/DR	NTA	Area	Metric	Duration (Days)	Total Training Events
	6.2.3	MCBH, MCTAB, Kahuku Training Area	Ops	10	1

Table D-2 includes the current and future RDT&E activities conducted within the HRC.

Table D-2. Baseline and Planned RDT&E Activities

Mission Area	Activity	Activity Description
Pacific Missile Range Facility (PMRF)	Anti-Air Warfare RDT&E	Testing and training on Aegis-capable ships after refurbishment or overhaul.
	Anti-Submarine Warfare	Sensor, fire control, and weapon testing.
	Combat System Ship Qualification Trial	Conducted for new ships and for ships that have undergone modification and/or overhaul of their combat systems, can include operating any or all of a ship's combat systems.
	Electronic Combat/Electronic Warfare (EC/EW)	Tests designed to assess how well EC/EW training and RDT&E activities are performed.
	High Frequency	Use of high-frequency radio signals and the evaluation of their effectiveness.
	Missile Defense	Aerial targets launched from PMRF, mobile sea-based platforms, or military cargo aircraft. A ballistic missile target vehicle is launched from PMRF and intercepted by a ship- or land-launched missile.
	Joint Task Force Wide Area Relay Network	Demonstration of advanced Command, Control and Communications technologies in a highly mobile, wireless, wide-area relay network in support of tactical forces.
Naval Undersea Warfare Center Ranges	Shipboard Electronic Systems Evaluation Facility (SESEF) Quick Look Tests	Evaluate ship, shore, and aircraft systems that emit or detect electronic emissions. These systems include those used for radio communications, data transfer, navigation, radar, and identification of friend and foe.
	SESEF System Performance Tests	Provide accuracy checks of ship and submarine sonar, both in active and passive modes, and to evaluate the accuracy of a ship's radar.
	Fleet Operational Readiness Accuracy Check Site (FORACS) Tests	Provide accuracy checks of ship and submarine sonar, both in active and passive modes, and to evaluate the accuracy of a ship's radar.
Future RDT&E Activities	Additional Chemical Simulant	Target launches from PMRF would incorporate additional chemical simulants to include larger quantities of tributyl phosphate (TBP) and various glycols.
	Intercept Targets launched into PMRF Controlled Area	Launches from Wake Island, the Reagan Test Site at U.S. Army Kwajalein Atoll (USAKA), and Vandenberg AFB towards the vicinity of PMRF are proposed. Intercept areas would be in the Broad Ocean Area and Temporary Operating Area.
	Launched SM-6 from Sea-Based Platform (AEGIS)	Capability to launch the Extended Range Active Missile, tentatively designated SM-6, from a sea-based platform. Similar to ongoing launches of the current version of the Standard Missile from Aegis ships.
	Micro-Satellites Launch	A joint venture between PMRF, the Department of Energy at the Kauai Test Facility, and the University of Hawaii to launch micro-satellites into space.
	Test Unmanned Surface Vehicles	Remote-controlled boats equipped with modular packages to potentially support surveillance and reconnaissance activities, mine warfare, anti-terrorism/force protection, port protection, Special Forces operations, and possibly anti-submarine warfare.
	Test Unmanned Aerial Vehicles	Remotely piloted or self-piloted aircraft that include fixed-wing, rotary-wing, and other vertical takeoff vehicles. Can carry cameras, sensors, communications equipment, weapons, or other payloads. Could support intelligence, surveillance, and reconnaissance; suppression of enemy air defenses; electronic attack; anti-surface ship and anti-submarine warfare; mine warfare; communications relay; and derivations of these themes.

Table D-2. Baseline and Planned RDT&E Activities (Continued)

Mission Area	Activity	Activity Description
Future RDT&E Activities	Test Hypersonic Vehicles	Development of air-breathing hypersonic vehicles that are capable of maximum sustainable cruising speeds in excess of Mach 4, as potential ordnance delivery systems.
Offshore Enhancements	Portable Undersea Tracking Range	Provide submarine training in areas where the ocean depth is between 300 ft and 12,000 ft and at least 3 nm from land.
PMRF Enhancements	Large Area Tracking Range Upgrade	Upgraded with ground relay stations to cover training throughout much of the HRC. Proposed ground relay stations would be modifications to existing facilities.
	Enhanced Electronic Warfare Training	Capability for EW training would be enhanced to include sites on other islands (e.g., Maui and Hawaii).
	Expanded Training Capability for Transient Air Wings	Provide dedicated equipment to enable Mid-Pacific and transiting strike groups to participate in either live or virtual activities.
	Kingfisher Underwater Training Area	Underwater training area would be approximately 2 mi off the southeast coast of Niihau at a depth of between 300 and 400 ft.
	FORCEnet Antenna	Effort to integrate military personnel, sensors, networks, command and control, platforms, and weapons into a fully netted, combat force. Existing building or a portable trailer.
	Enhanced Auto ID System and Force Protection Capability	AIS equipment installed on each island so each ship would have sensor connectivity and communication connections.
	Construct Range Operations Control Building	Build a new, almost 90,000 sq-ft range operations building to consolidate the activities currently in 13 buildings.
	Improve Fiber Optics Infrastructure	Installation of approximately 23 mi of fiber optic cable, which would be hung on existing Kauai Island Utility Cooperative poles between PMRF/Main Base and Kokee.
Pearl Harbor Enhancements	MK-84/MK-72 Pinger Acoustic Test Facility	New open-water Acoustic Test Facility capability near the Naval Undersea Warfare Center's Ford Island facility in Pearl Harbor.
	Mobile Diving and Salvage Unit Training Area	Establish an underwater training area in which Mobile Diving and Salvage Unit-1 can conduct military diving and salvage training, including submerging a 100-ft by 50-ft barge.
Future RDT&E Activities	Directed Energy	Develop the necessary standard operating procedures and range safety requirements necessary to provide safe operations associated with future high-energy laser tests.
	Advanced Hypersonic Weapon	Launches of long range (greater than 3,400 miles) missiles deploying an unpowered payload. A four-missile launch program, with the first two tests using a Strategic Target System booster launched from Kauai Test Facility (KTF) at PMRF. The payload would travel approximately 2,500 mi from PMRF to Illeginni Island in USAKA.

RIMPAC and USWEX

The Commander, U.S. THIRD Fleet, conducts RIMPAC within the HRC every other year. The biennial RIMPAC is a multinational, sea control and power projection Major Exercise that consists of various phases of activity by Army, Marine Corps, Navy, and Air Force forces, as well as the military forces of several Pacific Rim nations. During the month-long Major Exercise, individual training events occur in open ocean, offshore, and onshore areas. Table D-3 shows the matrix of training events used during previous RIMPAC Exercises by location.

USWEX includes a single Strike Group, training in the HRC for up to 4 days, four times per year. Table D-4 shows the matrix of training events generally used during a USWEX Exercise by location.

Under Alternative 1 the Navy proposes to continue RIMPAC and USWEX Exercises described in the No-action Alternative. USWEX frequency would increase from four to six times per year. RIMPAC would include two Strike Groups, and FCLPs would occur in association with transiting Strike Groups participating in Major Exercises. The training associated with Major Exercises would be chosen from the appropriate matrix of training events, in Table D-5.

Under Alternatives 2 and 3, up to three Strike Groups would conduct training events simultaneously in the HRC. The Strike Groups would not be homeported in Hawaii, but would stop in Hawaii en route to a final destination. The Strike Groups would be in Hawaii for up to 10 days per event. Proposed training would be similar to current training events for the RIMPAC and USWEX Exercises. Also included in the training would be FCLP events conducted at the following airfields: Marine Corps Base Hawaii and PMRF. The events associated with Multiple Strike Group training would be chosen from the appropriate matrix of training events listed in Table D-6.

Table D-3. Rim of the Pacific 06 Exercise Matrix

[illegible]

Table D-4. Example Undersea Warfare Exercise Matrix

Service	Location	Island	IN-PORT/ SUPPORT	C2	AAW/ACM						ASUW / ASW		Training Events						HAO/NEO	HADR	SPECWAROPS	DEMO	SALVAGE OPS	Expeditionary Assault	SUBOPS	Seaglider
					AIROPS	MISSILEX	A-A MISSILEX/ ACM	A-S MISSILEX	S-S MISSILEX	ASW	MINEX	MCM			ASUW			LFX								
												SMWEX	Air MIWEX	UMWEX	STW/ CASEX	GUNEX	SINKEX									
Navy	Pacific Missile Range Facility*	Kauai																								
	Niihau	Niihau																								
	Kaula	Kaula																								
	Pearl Harbor**	Oahu																								
	Lima Landing	Oahu																								
	Puuloa Underwater Range – Pearl Harbor	Oahu																								
	Barbers Point Underwater Range	Oahu																								
	Coast Guard AS Barbers Point/ Kalaheola Airport	Oahu																								
	PMRF Warning Areas#	Ocean Areas																								
	Oahu Warning Areas#	Ocean Areas																								
	Open Ocean Areas#	Ocean Areas																								
	U.S. Command Ship	Ocean Areas																								
Marines	Marine Corps Base Hawaii	Oahu																								
	Marine Corps Training Area Bellows	Oahu																								
Air Force	Hickam Air Force Base	Oahu																								
Army	Kahuku Training Area	Oahu																								
	Makua Military Reservation	Oahu																								
	Dillingham Military Reservation	Oahu																								
	Wheeler Army Airfield	Oahu																								
	K-Pier, Kawaihae	Hawaii																								
	Bradshaw Army Airfield	Hawaii																								
	Pohakuloa Training Area	Hawaii																								
State	Keahi Lagoon	Oahu																								

* Includes Port Allen and Makaha Ridge ** Includes Ford Island and all other areas within the harbor.

† These areas are included in the HRC. The HRC is now used to define the outer limits of the ocean areas used during Major Exercises.

‡ These areas are included in the HRC. The HRC is now used to define the outer limits of the ocean areas used during Major Exercises.

Training Events:

A-A MISSILEX Air-to-Air Missile Exercise (formerly AAMEX)
 AAW Anti-Air Warfare
 AIROPS Air Operations
 AMPHIBEX Amphibious Landing Exercise (now Expeditionary Assault)
 Air MIWEX Air Mine Warfare Exercise (formerly AMWEX)
 A-S MISSILEX Air-to-Surface Missile Exercise (formerly ASMEX)
 ASUW/ASW[‡] Anti-Surface Warfare/
 Anti-Submarine Warfare Exercise (formerly ASWEX)
 ASW Anti-Submarine Warfare Exercise (formerly ASWEX)
 CASEX Close Air Support

Locations where training events occur

USWEX training events

SALVAGE OPS

S-A MISSILEX

SINKEX

SMWEX

SPECWAROPS

S-S MISSILEX

STW

SUBOPS

SUPPORTEX

UMWEX

Command and Control

Demolition Exercise

Guntery Exercise

Humanitarian Assistance/Disaster Relief

Humanitarian Assistance Operation/

Non-Combatant Evacuation Operation

In-port Briefings and Activities

Live Fire Exercise

Mine Countermeasures

MCM

MINEX

Mine Warfare

MCM

MINEX

MCM

MINEX

MCM

MINEX

MCM

MINEX

MCM

MINEX

Note: Since the publication of the RIMPAC C2 Programmatic (U.S. Department of the Navy, 2002a), new terminology and/or categories of exercises have come into use. They are as follows:

1 AAW includes AIROPS, S-A MISSILEX, A-A MISSILEX, and A-S MISSILEX.

2 ASUW includes GUNEX, S-S MISSILEX, and ASW.

3 ASW includes S-S MISSILEX and ASW.

4 MCM encompasses two subsets, MINEX and MCM. MINEX is the act of laying mines. MCM is the act of locating and countering mines by others and includes SMWEX, AMWEX, and UMWEX.

Table D-6. Proposed Multiple Carrier Strike Group Matrix

Service	Location	Island	IN-PORT/ SUPPORT/EX	C2	AAW				ASUW / ASW		MIW						ASUW				LFX	HAO/NEO	HA/DR	SPECWAROPS	DEMO	SALVAGE OPS	Expeditionary Assault	SUBOPS	Seabilder	FCPL
					A-ROPS	S-A MISSILEX	A-A MISSILEX/ ACM	A-S MISSILEX	S-S MISSILEX	ASW MISSILEX	MINEX	MCM			CASEX	GUNEX	SINKEX													
												SMWEX	Air MIWEX	UMWEX																
U.S. Navy	Pacific Missile Range Facility*	Kauai																												
	Niihau	Niihau																												
	Kaula	Kaula																												
	Pearl Harbor**	Oahu																												
	Lima Landing	Oahu																												
	Puuloa Underwater Range - Pearl Harbor	Oahu																												
	Barbers Point Underwater Range	Oahu																												
	Coast Guard AS Barbers Point/Kalaheo Airport	Oahu																												
	PMRF Warning Areas*	Ocean Areas																												
	Oahu Warning Areas*	Ocean Areas																												
	Open Ocean Areas*	Ocean Areas																												
	U.S. Command Ship	Ocean Areas																												
U.S. Marines	Marine Corps Base Hawaii	Oahu																												
	Marine Corps Training Area Bellows	Oahu																												
U.S. Air Force	Hickam Air Force Base	Oahu																												
U.S. Army	Kahuku Training Area	Oahu																												
	Makua Military Reservation	Oahu																												
	Dillingham Military Reservation	Oahu																												
	Wheeler Army Airfield	Oahu																												
	K-Pier, Kawaihae	Hawaii																												
	Bradshaw Army Airfield	Hawaii																												
	Pohakuloa Training Area	Hawaii																												
State	Keahi Lagoon	Oahu																												

* Includes Port Allen and Makaha Ridge

** Includes Ford Island and all other areas within the harbor.

These areas are included in the HRC. The HRC is now used to define the outer limits of the ocean areas used during Major Exercises.

Training Events:

A-A MISSILEX Air-to-Air Missile Exercise (formerly AAMEX)
 AAW¹ Anti-Air Warfare
 AROPS Air Operations
 AMPHIBEX Amphibious Landing Exercise (now Expeditionary Assault)
 Air MIWEX Air Mine Warfare Exercise (formerly AMWEX)
 A-S MISSILEX Air-to-Surface Missile Exercise (formerly ASMEX)
 ASUW/ASW² Anti-Surface Warfare/
 Anti-Submarine Warfare Exercise (formerly ASWEX)
 ASW Anti-Submarine Warfare Exercise (formerly ASWEX)
 CASEX Close Air Support

Locations where events can occur

C2 Command and Control
 DEMO Demolition Exercise
 GUNEX Gunnery Exercise
 HADR Humanitarian Assistance/Disaster Relief
 HAONEO Humanitarian Assistance Operation/
 Non-Combatant Evacuation Operation
 IN-PORT In-Port Briefings and Activities
 LFX Live Fire Exercise
 MCM Mine Countermeasures
 MINEX Mine Exercise
 MIW³ Mine Warfare

Multiple Carrier Strike Group

SALVAGE OPS Salvage Operations
 SINKEX Surface-to-Air Missile Exercise (now S-A MISSILEX)
 SINKEX Sinking Exercise
 SINKEX Ship Mine Warfare Exercise
 SPECWAROPS Special Warfare Operations
 SSMEX Surface-to-Surface Missile Exercise (now S-S MISSILEX)
 STWEX Strike Warfare Exercise
 SUBOPS Submarine Operations
 SUPPORTEX In-Port Support Exercise
 UMWEX Underwater Mine Warfare Exercise

Note: Since the publication of the RIMPAC C2 Programmatic (U.S. Department of the Navy, 2002a), new terminology and/or categories of exercises have come into use. They are as follows:

¹ AAW includes AROPS, S-A MISSILEX, A-A MISSILEX, and A-S MISSILEX² ASUW includes GUNEX, S-S MISSILEX, and ASW³ MIW encompasses two subsets, MINEX and MCM. MINEX is the act of laying mines. MCM is the act of locating and countering mining by others and includes SMWEX, AMWEX, and UMWEX.

Appendix E

Weapon Systems

APPENDIX E

WEAPON SYSTEMS

Table E-1. Typical Missile Exercise Weapons Used at Pacific Missile Range Facility

TYPE	CHARACTERISTICS				
	Weight	Length	Diameter	Range	Propulsion
Surface-to-Air Missiles					
<u>Short Range</u>					
Stinger (FIM-92A)	10.0 kg (22 lb)	1.5 m (5 ft)	70 mm (2.8 in)	4.8 km (3.4 nm)	Solid fuel
Sea Sparrow (RIM-7)	204 kg (450 lb)	3.7 m (12 ft)	203-2 mm (8 in)	14.8 km (10.6 nm)	Solid fuel
Rolling Airframe (RIM-116)	73.5 kg (162 lb)	2.8 m (9 ft 3 in)	127 mm (5 in)	7 km (5.0 nm)	Solid fuel
<u>Medium Range</u>					
Standard SM-1 MR (RIM-66B)	499 kg (1,100 lb)	4.5 m (14 ft 8 in)	342.9 mm (13.5 in)	46.3 km (33 nm)	Solid fuel
Standard SM-2 (RIM-66C)	612 kg (1,350 lb)	4.4 m (14 ft 7 in)	342.9 mm (13.5 in)	74.1 km (53 nm)	Solid fuel
<u>Long Range</u>					
Standard SM-2 ER (RIM-67A/B and 67-C/D)	1,325 kg (2,920 lb)	8.2 m (27 ft)	342.9 mm (13.5 in)	166.7 km (90 nm)	Solid fuel
Standard SM-2 AER (RIM-67B)	1,452 kg (3,200 lb)	6.7 m (22 ft)	342.9 mm (13.5 in)	150 km (107.1 nm)	Solid fuel
Air-to-Air Missiles					
<u>Short Range</u>					
Sidewinder (AIM-9)	84.4 kg (186 lb)	2.9 m (9 ft 6 in)	127 mm (5 in)	18.5 km (10 nm)	Solid fuel
<u>Medium Range</u>					
Sparrow (AIM-7)	231 kg (510 lb)	3.6 m (11 ft 10 in)	203.2 mm (8 in)	55.6 km (30 nm)	Solid fuel
<u>Long Range</u>					
Phoenix (AIM-54)	447 kg (985 lb)	4 m (13 ft)	381 mm (15 in)	203.9 km (110 nm)	Solid fuel
Air-to-Surface Missiles					
<u>Short Range</u>					
Skipper II (AGM-123)	582 kg (1,283 lb)	4.3 m (14 ft)	355.6 mm (14 in)	9.6 km (5.2 nm)	Solid fuel

Notes:

ft	feet	lb	pounds
in	inches	m	meters
kg	kilograms	mm	millimeters
km	kilometers	nm	nautical miles

Table E-1. Typical Missile Exercise Weapons Used at Pacific Missile Range Facility (Continued)

TYPE	CHARACTERISTICS				
	Weight	Length	Diameter	Range	Propulsion
Air-to-Surface Missiles (Concluded)					
<u>Medium Range</u>					
HARM (AGM-88)	366.1 kg (807 lb)	4.2 m (13 ft 9 in)	254 mm (10 in)	18.5 km (10 nm)	Solid fuel
Shrike (AGM-45)	177 kg (390 lb)	3 m (10 ft)	203.2 mm (8 in)	18.5 km (10 nm)	Solid fuel
Sidearm (AGM-122)	90.7 kg (200 lb)	3 m (10 ft)	127 mm (5 in)	17.8 km (9.6 nm)	Solid fuel
<u>Long Range</u>					
Harpoon (AGM-84/ RGM-84/UGM-84)*	797 kg (1,757 lb)	5.2 m (17 ft 2-in)	342.9 mm (13.5 in)	278 km (150 nm)	Solid fuel
Surface-to-Surface Missiles (Cruise)					
Harpoon (AGM-84/ RGM-84/UGM-84)*	797 kg (1,757 lb)	5.2 m (17 ft 2-in)	342.9 mm (13.5 in)	278 km (150 nm)	Solid fuel

Source: U.S. Department of the Navy, 1998a

Notes:

*Characteristics vary according to variant. Those for RGM-84F are shown.

ft	feet	lb	pounds
in	inches	m	meters
kg	kilograms	mm	millimeters
km	kilometers	nm	nautical miles

Table E-2. Typical Aerial Target Drones and Missiles Used at Pacific Missile Range Facility

TYPE	CHARACTERISTICS			
	Length	Speed (Maximum)	Operational Altitude (Maximum)	Time on Station (Maximum)
Subsonic				
BQM-34S	7 m (23 ft)	Mach 0.9	15,240 m (50,000 ft)	60 minutes
BQM-74C	4 m (13 ft)	430 knots	10,668 m (35,000 ft)	75 minutes
Supersonic				
MQM-8G (ER)	7.6 m (25 ft)	Mach 2.7	1,524 m (5,000 ft)	N/A
AQM-37C	4.1 m (13.6 ft)	Mach 4.0	30,480 m (100,000 ft)	N/A

Source: U.S. Department of the Navy, 1998a

Notes:

ft	feet
m	meters
N/A	Not Applicable

Table E-3. Typical Existing Target Systems Used at Pacific Missile Range Facility

Type	Category	Name	Propellant Type
Ballistic Missile			
	Small	AQM-37C	Liquid
		Black Brant V	Solid
		Hawk	Solid
		Recruit	Solid
		Malemute	Solid
		HERMES	Solid
		Lance	Liquid
		Standard	Solid
		Tomahawk (Rocket)	Liquid/Solid
		Honest John (Booster)	Solid
		Nike (Booster)	Solid
		PATRIOT as a Target (PAAT)	Solid
		Apache	Solid
		Cajun	Solid
		Genie (14" diameter)	Solid
	Medium	Terrier	Solid
		Talos	Solid
		Castor	Solid
		STRYPI	Solid
		Antares (Stack)	Solid
		Aries	Solid
		Spartan	Solid
		Talos	Solid
		SR-19 (Air Drop)	Solid
		STORM	Solid
		MA-31	Liquid
		Liquid Fuel Target System	Liquid
	Large	Strategic Target System	Solid
		Hera	Solid
		Terrier	Solid
	Supersonic	AQM-37C	Liquid
		Vandal	Liquid/Solid

**Table E-3. Typical Existing Target Systems Used at Pacific Missile Range Facility
(Continued)**

Type	Category	Name	Propellant Type
Aircraft			
	Subsonic	QF-4	Liquid
		AF-16	Liquid
Balloon			
		Balloon	N/A
Towed			
	Aerial	TDU-34A	N/A
Subsurface			
		MK-30 Mod 1	Liquid
		EMATT	Liquid
		SPAT-1 (Self Prop Acoustic Target)	Liquid
		MK-17 (Stationary Target for MK-46)	N/A
Surface			
		QST 35	Liquid
		HULK (TBD)	N/A
		ISTT (Improved Surface Towed Target)	N/A
Cruise Missiles			
	Subsonic	BQM-34S	Liquid
		BQM-74/CHUKAR	Liquid
		AQM-34	Liquid
		MQM-107	Liquid
		Harpoon	Liquid
		Liquid Fuel Target System	Liquid
		Tactical Air Launched Decoy (TALD ADM-141A)	Liquid
		ITALD (Improved version ADM-141C)	Liquid
	Supersonic	Vandal	Liquid/Solid
		MA-31	Liquid
		Terrier	Solid
		GQM-163A (Coyote)	Solid
		Liquid Fuel Target System	Liquid

Source: U.S. Department of the Navy, 1988a

Notes: N/A Not Applicable

Table E-4. Typical Existing Weapon Systems Used at Pacific Missile Range Facility

Type	Category	Name	Propellant Type (Liquid/Solid)
Missiles			
	Ship	ASROC	Liquid/Solid
	Ship	Harpoon (RTM-84)	Liquid
	Ship	MK-46 VLA	Liquid/Solid
	Ship	SM-2 BLK II	Solid
	Ship	SM-2 BLK III	Solid
	Ship	SM-2 BLK IV	Solid
	Ship	Sparrow (A1M7)	Solid
	Surf/Ship/Sub	Harpoon (R/UGM-84)	Liquid/Solid
	Air	AGM-45 (SHRIKE)	Solid
	Air	Harpoon (AGM-84)	Liquid
	Air	Phoenix	Solid
	Air	Sidewinder	Solid
	Air	Sparrow	Solid
	Air/Surf/Sub	Tomahawk	Liquid/Solid
	Land	Hawk	Solid
	Land	MEADS	Solid
	Land	PATRIOT	Solid
	Land	THAAD	Solid
	Land/Ship	Stinger	Solid
Guns			
	Ship	Naval Guns	N/A
	Ship	Phalanx/Vulcan	N/A
	Air	Aircraft Mounted Guns	N/A
	Land	Howitzer	N/A
Weather Rocket			
	Land	PWN-11D	Solid
	Land	PWN-12A	Solid
Torpedoes			
	Sub	MK-48 ADCAP	Liquid
	Sub	MK-48	Liquid
	Air/Ship	MK-44 (PLLT)	Battery
	Air/Ship	MK-30	Battery
	Air/Ship	MK-50	Liquid
	Air/Ship	MK-54	Liquid
	Air/Ship	Type 80 (Japanese)	Liquid
	Air/Surf	MK-46	Liquid

Source: U.S. Department of the Navy, 1998a

Note: N/A Not Applicable

Table E-4. Typical Existing Weapon Systems Used at Pacific Missile Range Facility (Continued)

Type	Category	Name	Propellant Type (Liquid/Solid)
Sub Launched Mines			
	Sub	MK-67-2 Sub Launched Mobile Mine (SLMM)	Battery
Air Deployed Mines			
	Air	MK-25	N/A
	Air	MK-36	N/A
	Air	MK-36 DST	N/A
	Air	MK-52	N/A
	Air	MK-76	N/A
Bombs			
	Air	BDU-45	N/A
	Air	MK-82	N/A

Source: adapted from U.S. Department of the Navy, 1998a

Note: N/A Not Applicable

Table E-5. Typical Electronic Warfare Assets Used at Pacific Missile Range Facility

TYPE		CHARACTERISTICS	
	Frequency Bands	Power Output (Maximum)	Location Used
Air and Seaborne Electronic Warfare Assets			
<u>Airborne Simulator Systems</u>			
APS-504(V)5	8.9925 to 9.375 GHz	8 kW	Pacific Missile Range Facility (PMRF) RC-12F Aircraft
MK-67	907.2 kg (2,000 lb)	4.00 m (13 ft 5 in)	533 mm (21 in)
<u>Expendable Radar Transmitter Sets</u>			
AN/DPT-1(V)	7.8 to 9.6, 14.0 to 15.2 GHz	80 kW	BQM-334S Targets
AN/DPT-2(V)	9.375 GHz	20 kW	BQM-74C Targets
<u>Airborne Electronic Countermeasures Systems</u>			
Traveling Wave Tube Countermeasures System	425 to 445 MHz, 902 to 928 MHz, 2 to 4 GHz	100 W	PMRF RC-12F Aircraft
ALT-41	425 to 445 MHz	100 W	PMRF RC-12F Aircraft
ALT-42	902 to 928 MHz	100 W	PMRF RC-12F Aircraft
DLQ-3	2 to 4 GHz	100 W	PMRF RC-12F Aircraft
ULQ-21	8 to 10.5 GHz	100 W	PMRF RC-12F Aircraft

**Table E-5. Typical Electronic Warfare Assets Used at Pacific Missile Range Facility
(Continued)**

TYPE	CHARACTERISTICS		
	Frequency Bands	Power Output (Maximum)	Location Used
<u>Seaborne Simulator Systems</u>			
AN/DPT-1(V)	7.8 to 9.6, 14.0 to 15.2 GHz	80 kW	Range Boats
AN/DPT-2(V)	7.8 to 9.6, 14.0 to 15.2 GHz	150 kW	Range Boats
Land-Based Electronic Warfare Assets			
<u>Simulator Systems - Fixed</u>			
AN/DPT-1(V)	7.8 to 9.6, 14.0 to 15.2 GHz	70 kW	Makaha Ridge, Kauai
ENSYN	2 to 4, 7 to 11 GHz	1 kW	Makaha Ridge, Kauai
I/J-TES	7.8 to 9.6, 14.0 to 15.2 GHz	70 kW	Makaha Ridge, Kauai
AN/DPT-1(V)	7.8 to 9.6, 14.0 to 15.2 GHz	70 kW	Mauna Kapu, Oahu
<u>Simulator Systems - Mobile</u>			
AN/DPT-1(V)	2.9 to 3.1, 7.8 to 9.6, 14.0 to 15.2 GHz	70 kW	Barking Sands, Kauai
AN/UPT-2A(V)	2.9 to 3.1, 7.8 to 9.6, 14.0 to 15.2 GHz	150 kW	Barking Sands, Kauai
AN/D/DPT-1(V)	7.8 to 9.6, 14.0 to 15.2 GHz	70 kW	Perch Site, Niihau
AN/UPT-2A(V)	2 to 4, 8 to 18 GHz	150 kW	Perch Site, Niihau
ENSYN	2 to 4, 8 to 18 GHz	1 kW	Naval Air Station (NAS) Barbers Point, Oahu
AN/DPT-1(V)	2.9 to 3.1, 7.8 to 9.6, 14.0 to 15.2 GHz	70 kW	NAS Barbers Point, Oahu
<u>Electronic Countermeasures Systems - Fixed</u>			
ALT-41	425 to 445 MHz	100 W	Makaha Ridge, Kauai
ALT-42	902 to 928 MHz	100 W	Makaha Ridge, Kauai
ULQ-26	2 to 4 GHz	100 W	Makaha Ridge, Kauai
ULQ-21	8.0 to 10.5-GHz	100 W	Makaha Ridge, Kauai
<u>Electronic Countermeasures Systems - Mobile</u>			
DLQ-3	425 to 445 MHz 14.0 to 15.2 GHz	100 W	Range Boats, Remote Sites
ULQ-26	425 to 445 MHz 14.0 to 15.2 GHz	100 W	Range Boats, Remote Sites
ULQ-21	425 to 445 MHz 14.0 to 15.2 GHz	100 W	Range Boats, Remote Sites
ALT-41/42	425 to 445 MHz 14.0 to 15.2 GHz	100 W	Range Boats, Remote Sites

Source: adapted from U.S. Department of the Navy, 1998a

Notes:

ft	feet	in	inches	kW	kilowatts	m	meters	mm	millimeters
GHz	gigahertz	kg	kilograms	lb	pounds	MHz	megahertz	W	watts

Table E-6. Existing Pacific Missile Range Facility Radars, Locations, and Characteristics

Emitter	Comments	Location	Power Peak (kW)	Scan Rate	Frequency (MHz)		Pulse Width (μS)	PRF (PPS)	Ant. Gain (dBi)	Ant. Elev. (m)	Remarks
					Low	High					
AN/MPS-25	Monopulse Tracking (2 each)	Main Base	1,000	--	5,400	5,900	0.25, 0.5, 1	160, 640	46	18	AZ=0 to 360 degrees. Elevation=-5 to +185 degrees
AN/SPS-10	Surveillance	Main Base	250	15 rpm	5,450	5,825	0.5, 1.3	640	30	22	
AN/UPX-27	AN/SPS-10 IFF Interrogator	Main Base	1	15 rpm	1,030	1,030	0.8	640	23	22	Uses AN/SPS-10 antenna
AN/FPS-106	Weather Radar	Main Base	500		5,450	5,650	0.5	320	35	20	
AN/WRF-100	DOE Radar Facility	Main Base	250	--	9,375	9,375	1	640	32	10	
THAAD Radar	X-Band Tracking	Main Base			8,000	12,000				22	
AN/MPS-25	Monopulse Tracking (2 each)	Makaha Ridge	1,000	--	5,400	5,900	0.25, 0.5, 1	160, 640	46	500	AZ=0 to 360 degrees. Elevation=-5 to +185 degrees
AN/FPQ-10	Monopulse Tracking (2 each)	Makaha Ridge	1,000	--	5,400	5,900	0.25, 0.5, 1	160, 640	43	473	AZ=0 to 360 degrees. Elevation=-5 to +90 degrees
AN/SPS-48E	Track-While-Scan Surveillance	Makaha Ridge	2,400	15 rpm	2,908	3,110	27	Various	39.1	462	
AN/UPX-27	AN/SPS-48E IFF Interrogator	Makaha Ridge	1	15 rpm	1,030	1,030	0.8	Various	19	462	
AN/APS-134	Surface Surveillance	Makaha Ridge	500	15 rpm	9,500	10,000	0.5	500	42	457	Linear frequency chirp each pulse
AN/FPS-16	Monopulse Tracking	Kokee	1,000	--	5,400	5,900	0.25, 0.5, 1	160, 640	43	1,155	AZ=0 to 360 degrees. Elevation=-5 to +185 degrees
AN/FPQ-10	Monopulse Tracking	Kokee	1,000	--	5,400	5,900	0.25, 0.5, 1	160, 640	43	1,150	AZ=0 to 360 degrees. Elevation=-5 to +90 degrees
USB	Unified S-Band System	Kokee	20	--	2,090	2,120	CW	CW	44	1,110	
AN/FPS-117	Surveillance	Kokee	24.75	5 rpm	1,215	1,400	51.2, 409.6	241	38.6	1,310	
OX-60/FPS-117	AN/FPS-117 IFF Interrogator	Kokee	2	5 rpm	1,030	1,030	Various	241	21	1,310	
AN/APS-134	Surveillance	Niihau	500	15 rpm	9,500	10,000	0.5	500	42	375	
R73-6	Raytheon Pathfinder (3 each)	Weapons Recovery Boat and Torpedo Weapons Recovery	10	24 rpm	9,410	9,410	0.08, 0.4, 0.8, 1.2	2,000, 1,500, 750, 500	16	8	
APS-134	Surveillance	HIANG Kokee	500	15 rpm	9,500	10,000	0.5	500	42	375	

Source: U.S. Department of the Navy, 1998a

Table E-7. Representative Proposed Target Systems

Type	Name	Propellant Type
Ballistic Missile		
	New Advanced Hypersonic Weapon 1st stage	Solid
	New Advanced Hypersonic Weapon 2nd stage	Solid
	Super STRYPI	Solid

Table E-8. Target Launch Pad—Rail and Stool Requirements

Item/Facility Type	Requirements 0 to 1,200 kilometers (0 to 647.9 nautical miles)
Dimensions of Launch Pads/Construction Materials Assumed	12.2 meters x 15.2 meters + 15.2 meters (40 x 50 feet + 50 feet) for environmental shelter = 12.2 meters x 30.5 meters (40 x 100 feet) = 371.6 square meters (4,000 square feet). Concrete pad with outer gravel or coral area.
Cleared Area/No Vegetation Zone Surrounding Launch Pad	15.2 to 30.5 meters (50 to 100 feet)
Explosive Safety Quantity-Distance (ESQDs) by Category Type (Intraline [IL], Public Transportation Route [PTR], Inhabited Building [IB])	85.3 meters (280 feet) IL 228.6 meters (750 feet) PTR 381 meters (1,250 feet) IB ESQD
Ground Hazard Area (GHA) Radius	For most unguided systems, GHA = 609.6 meters (2,000 feet) For guided systems, GHA = 1,828.8 to 3,048 meters (6,000 to 10,000 feet)
Electromagnetic Radiation Constraints to Personnel, Fuels, or Ordnance	Consider HERO (ordnance electronic triggering mechanisms potentially set off due to electromagnetic radiation).
Launch Pad Fencing/Security Needs	Should have access control to the hazardous operations/launching area. The target payload may be classified.
Utilities to Launch Pad/Type Needed	Will bring some portable electrical generator capability (campaign). Will require a power distribution system, fuel storage, and containment area to avoid soil contamination.
Road Access to Launch Pad/Hazardous Transportation Route/ % Grade	Prefer gravel road of less than 6 percent grade. Prefer to stay off public highways.
Environmental Shelter/Pad/Dimensions	Depends on the type of missile system and site environmental constraints (some missiles are temperature, humidity, and salt spray dependent). At Kauai Test Facility, only tarps are used in some cases. Some booster rockets must be maintained between 15.5 to 26.7 degrees Celsius (60 to 80 degrees Fahrenheit). Also stool launch items will require wind protection.
Soil Conditions Desired	Stable soil, cleared gravel or paved area around the launcher.
Minimum Distance to Shoreline If Any	None. Consider waves, salt spray.

Source: U.S. Department of the Navy, 1998a

Table E-9. Target Support/Preparation and Launch Control Facilities Requirements

Item/Facility Type	Requirements
Missile Assembly—Need missile assembly building on Island or Build-up at Another Location (Specify if Known), Ship by Aircraft or Barge to Island, or Other Logistics Based on Distance, Weight, Airfield, etc.	No new missile assembly building needed. Build up at Pacific Missile Range Facility (PMRF). Transport by aircraft or barge to island. May have an environmental shelter (stool) and/or clamshell (rail) at the launch site.
Vertical Target Missile Service Tower Needed, Dimensions	None required.
Launch Control Van or Building	Mobile Launch Control Van [could be a van brought in by air or barge or a trailer like Kokole Point at PMRF with a berm (if a rail), or a van in a hardened van shelter (if a stool)].
Launch Pad Equipment Building	Equipment building [8 x 8 feet] next to pad.
Missile Storage Facility	May need missile storage if the number of launches per year justifies the cost.
Warehousing	Would use existing warehousing if available. If not, keep supplies on a barge or fly in/out. May use military vans or enclosed semi trailers.
Road Access Dimensions/Minimum Radii	12 feet wide road minimum, 50 feet turning radius to launch pad, 8 feet minimum to launch control.
Min. Distance to Shoreline If Any	None. Consider wave action, salt spray.
Utilities to Facilities/Type Needed	Electricity.
Security/Fencing/Clear Zone Needed/Dimensions	Not required unless there is a need to provide security protection or to mitigate for bird control (site specific—Tern). Dimensions undefined.
Electromagnetic Radiation Constraints to Personnel, Fuels, or Ordnance	Consider HERO (ordnance electronic triggering mechanisms potentially set off as a result of electromagnetic radiation).
View of Launch Pad Needed from Control Van/Building	Desired.

Source: U.S. Department of the Navy, 1998a

Table E-10. Representative Defensive Missile Systems

Type	Category	Name	Propellant Type (Liquid/Solid)
Missiles			
	Ship	SM-2 BLK IVA	Solid
	Ship	SM-3	Solid
	Ship	SM-6	Solid
	Air	AMRAAM	Solid
	Land	MEADS	Solid
	Land	PATRIOT (PAC-2)	Solid
	Land	PAC-3	Solid
	Land	THAAD	Solid

Source: U.S. Department of the Navy, 1998a

Table E-11. Land-based Interceptor Launch Site (Mobile) Requirements

Item/Facility Type	Requirements 0 to 1,200 kilometers (0 to 647.9 nautical miles)
Desired Operational Launch Orientation/Flight Path	Need target range of between 350 and 1,000 kilometers (217.5 and 621.4 miles)
Dimensions of Launch Pads/Construction Materials Assumed	Need a hardstand area (prefer gravel or coral) and relatively level ground. Need an area of approximately 42.1 x 20.1 meters = 846 square meters (138 x 66 feet = 9,108 square feet). The launchers are to be sited within the 120 degree angle of the radar signal (60 degrees either side of the boresight). The launchers are to be located between 130.1 meters (427 feet) and 10 kilometers (6.2 miles) from the radar set. Several launchers may be sited within this area.
Cleared Area/No Vegetation Zone Surrounding Launch Pad	None. Consider security/visibility.
Explosive Safety Quantity-Distance (ESQD) by Category Type (Intraline [IL], Public Transportation Route [PTR], Inhabited Building [IB])	381 meters (1,250 feet) for IB ESQD, 85.3 meters (280 feet) IL, 228.6 meters (750 feet) PTR Note—Should plan for 381 meters (1,250 feet)—Dual mode Area Interceptors.
Ground Hazard Area (GHA) Radius	1,829-meter (6,000-foot) radius
Electromagnetic Radiation Constraints to Personnel, Fuels, or Ordnance	120.1 meters (394 feet) in front of the radar - 60 degrees both sides of boresight (refer to PAC-3 environmental document).
Launch Pad Fencing/ Security Needs/Dimensions	Security guards required.
Utilities to Launch Pad/Type Needed	Utilities are required for aerospace ground equipment and test instrumentation.
Road Access to Launch Pad/Percent Grade	Require road access through rough terrain, gravel preferred. Turning radius of 15.2 meters (50 feet). System designed to be mobile.
Soil Conditions Desired	Stable soil. Gravel surface desirable. Do not want equipment to sink.
Environmental Shelter/Pad/Dimensions	Re-enforced structures for Command and Control trailers.
Minimum Distance to Shoreline If Any	None. Consider wave action, salt spray.

Source: U.S. Department of the Navy, 1998a

Table E-12. Telemetry, Optics, and Radar Instrumentation Requirements

Item/Facility Type	Requirements
Instrumentation Devices/Facilities Required—Targets	<p>Targets—Short- and medium-range multi-participant target and interceptor tracking and telemetry reception, additional range safety monitoring, and additional data products needed.</p> <p>Makaha Ridge: Radars (COSIP), optics, lasers, electronic warfare, telemetry (receivers, recorders, antennas) and internal power plant upgrades</p> <p>Kokee Parcel A: Radar (x band), Communications (CEC [tower], voice, data [telephone poles])</p> <p>Parcel C: Telemetry antenna (phase array or dish), building (40x60)</p> <p>Parcel D: Radar (COSIP), telemetry antenna</p>
Instrumentation Device(s)/Facilities Required - Interceptors	Area Interceptors—Assumes that Range assets are fixed or trailer mounted (portable).
Number of Interceptor Personnel Working/How Long	Radar site requires 15 people working 2 to 3 weeks.
Mobile Instrumentation Alternative	May consider mobile instrumentation at some sites if no or inadequate on-ground facilities exist. Example is the Wallops Flight Facility (NASA) system. Requires C-141 accessibility for airborne assets. On-ground assets require concrete pad for mobile radar pedestal, line of sight, adequate safety clear zone, and generator use. May also consider military P-3 aircraft use.

Source: U.S. Department of the Navy, 1998a

Table E-13. Communications, Command, and Control Requirements

Item/Facility Type	Requirements
Number of Interceptor Personnel Working/How Long	Battle management, communications, command, and control, and intelligence—15 people for 2 to 3 weeks.
Command and Control Enhancements—Targets/ Interceptors	<p>Command and control needed; enhanced range safety monitoring needed; and FTS enhancement needed.</p> <p>Possible use of Building 105—Control Center at PMRF.</p> <p>Expand fiber optics.</p> <p>Expand office space.</p> <p>Add transmitters and receivers, other communication equipment.</p> <p>Could be mobile in aircraft.</p>

Source: U.S. Department of the Navy, 1998a

Table E-14. Support Infrastructure Requirements

Item/Facility Type	Requirements
Electric Power/Portable Generator/Backup	For Interceptors—Need power under Test mode, no power under Tactical mode. Self contained. For Targets—Power needed, either local power or a generator.
Sanitation/Septic/Waste Treatment	For Interceptors—Total sanitation need is for 47 personnel for 2 to 3 weeks/launch. For Targets—Total sanitation need is for 6 to 10 personnel for 1 to 2 weeks/launch.
Solar Power	None for Interceptors. Targets—No need defined.
Natural Gas/Propane	None for Interceptors. Targets—No need defined.
Potable Water/Fire Flow/Storage	Interceptors and Targets—Drinking water for personnel, minor fire control.
Solid Waste Disposal/Transfer	Interceptors and Targets—Temporary on site storage and/or transport away.
Hazardous Materials Temporary Storage Transfer—Liquid and Storage	Interceptors and Targets—Temporary storage.
Storage/Warehousing/ Logistics Support and Services—Campaign Only	Interceptors and Targets—Use existing space, if available.
On-Island Road Access/Vehicle Storage, Maintenance, and Parking—Campaign Only	Interceptors and Targets—Semi-trailer road access to assets required. Campaign—No storage.
Off-Island Transportation (Air, Barge, Other)	Interceptors and Targets—Air transport (C-130, C-141, and C-5/C-17) and landing craft or ship. Aircraft use desirable.
Fire Station/Pumper/Training/Equipment/ Emergency Medical Team	As defined by PMRF Safety.
Security Forces/Training	Interceptors and Targets—Security guards will be required during launches. No permanent support.
Recreation Facilities/Services	Interceptor and Targets—No need defined.
Fuel Storage	Interceptor and Targets—Electric generator and vehicle fuel storage.
Transient Quarters/Berthing Quarters-Barges	Interceptor and Targets—Need defined. Self-contained onshore camp concept or ship/barge quarters. See personnel numbers. Depends on frequency/location.
Permanent Housing (Base UEPH/Family Housing or Private Rental Housing)	Interceptor and Targets—No need defined.
Administrative Services/Office Space/ Campaign Trailer	Interceptor and Targets—Possible use of Building 105 at PMRF or SNL/KTF complex. Possible use of campaign trailer(s).
Medical Facility and Services	Interceptors and Targets—No special facilities required. Typical services assumed.
Mess Hall/Laundry Facility and Services	Interceptors and Targets—Self-contained onshore camp concept or ship/barge facilities.
Communications Facility and Services	Interceptors and Targets—No need defined.
Liquid Propellant Storage (Hypergolic)	Interceptor—May require temporary storage. Targets—Need defined for targets.

Table E-14. Support Infrastructure Requirements (Continued)

Item/Facility Type	Requirements
Small Explosives/Igniter/Squib Storage/Setbacks	Interceptor—No need defined. Targets—May require squib storage.
Heavy Equipment/Crane	Interceptor—No need defined. Targets—May require crane.
Lightering Boat and Marine Crew Services/Stevedoring	Interceptor and Targets—Need defined.
Berthing/Moorage/Dock and Ramp	Interceptor and Targets—Need defined if no adequate airfield.
Helipad	Interceptor and Targets—Need helipad support capability for emergency medical evacuation and supplies delivery, or airfield capability.
Aircraft Runway (C-130, C-141, C-5, C-17 or Other)/Airfield operations and maintenance/Hotpad/Aircraft Parking and Maintenance	C-130, C-141, and C-5/C-17.

Source: U.S. Department of the Navy, 1998a

Table E-15. Representative Missile Propellant and Exhaust Components

Missile	Propellant Class	Major Propellant Components	Major Exhaust Components
Weapon Systems			
MEADS	Solid	Aluminum, HTPB	Aluminum Oxide, Carbon Dioxide, Carbon Monoxide, Hydrogen, Hydrogen Chloride, Nitrogen, Water
PAC-2	Solid	Aluminum, Ammonium Perchlorate, Iron Oxide, Polymer Binder	Aluminum Oxide, Carbon Dioxide, Carbon Monoxide, Hydrogen, Hydrogen Chloride, Nitrogen, Water
PAC-3	Solid	Aluminum, HTPB	Aluminum Oxide, Carbon Dioxide, Carbon Monoxide, Hydrogen, Hydrogen Chloride, Nitrogen, Water
Standard Missile	Solid	Aluminum, Ammonium Perchlorate, HMX	Aluminum Chloride, Aluminum Oxide, Ammonia, Carbon Dioxide, Carbon Monoxide, Ferric Chloride, Ferric Oxide, Hydrogen, Hydrogen Chloride, Nitric Oxide, Nitrogen, Water
THAAD	Solid	Aluminum, Ammonium Perchlorate, Binder	Aluminum Oxide, Carbon Dioxide, Carbon Monoxide, Hydrogen, Hydrogen Chloride, Nitrogen, Water
Target System			
HERA	Solid	Aluminum, Ammonium Perchlorate, CTPB, HMX, Nitrocellulose-Nitroglycerine	Aluminum Oxide, Carbon Dioxide, Carbon Monoxide, Hydrogen, Hydrogen Chloride, Nitrogen, Water
LANCE	Liquid	IRFNA (Hydrogen Fluoride, Nitric Acid, Nitrogen Dioxide), UDMH, Water	Carbon Dioxide, Carbon Monoxide, Nitrogen, Oxygen, Water
STRYPI	Solid	Aluminum, Ammonium Perchlorate, CTPB, Nitrocellulose-Nitroglycerine, Polysulfide Elastomer	Aluminum Oxide, Carbon Dioxide, Carbon Monoxide, Chlorine, Hydrogen, Hydrogen Chloride, Hydrogen Sulfide, Nitrogen, Sulfur Dioxide, Water

Source: U.S. Department of the Navy, 1998a

Notes:

CTPB = Carboxyl-terminated Polybutadiene

HMX = Cyclotetramethylenetetranitramine

IRFNA = Inhibited Red Fuming Nitric Acid

HTPB = Hydroxyl-terminated Polybutadiene

UDMH = Unsymmetrical Dimethyl Hydrazine