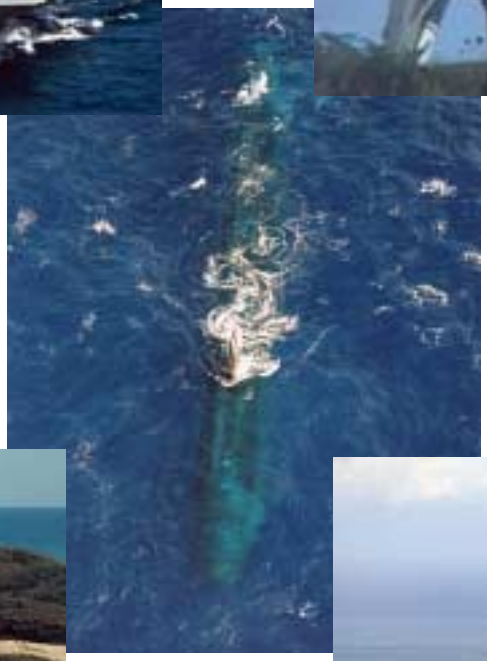
RANGE USER HANDBOOK

Pacific Missile Range Facility

Barking Sands, Kauai



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U.S. NAVY
PACIFIC MISSILE RANGE FACILITY

RANGE USER HANDBOOK

JUNE 2001

REV 0

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UNCLASSIFIED

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LIST OF ACRONYMS

A

AAF---------- Army Air Field
ACS ---------- Air Control Squadron
ACDS ---------- Advanced Combat Direction System
ADF ---------- Automatic Direction Finder
ADP ---------- Auxiliary Detection Processor
AFB---------- Air Force Base
AFFF ---------- Aqueous Film Forming Foam
AFS---------- Air Force Station
AIC ---------- Air Intercept Control
AIS---------- Automated Information Systems
AMPS ---------- Autonomous Mobile Periscope System
ANDVT ---------- Analog Narrow Digital Voice Transmission
ANDVT ---------- Advanced Narrow Band Digital Voice Terminal
APIS---------- Automated Precision IFF Reporting System
ARM---------- Anti-Radiation Missile
ASCM---------- Anti-Ship Cruise Missile
ASW---------- Anti Submarine Warfare
ATM ---------- Asynchronous Transfer Mode
AZ---------- Azimuth

B

BARSTUR ---------- Barking Sands Tactical Underwater Range
BMIC ---------- Battle Management Interoperability Center
BMT ---------- Ballistic Missile Target
BRI ---------- Basic Rate Interface
BS ---------- Barking Sands
BSURE ---------- Barking Sands Underwater Range Expansion

C

C&A ---------- Certification and Accreditation
CAF ---------- Combat Air Force
CB ---------- Citizens Band
CD ---------- Compact Disc
CEESIM ---------- Combat Electromagnetic Environment Simulator
CERAP ---------- Center Radar Approach Control
CINCPACFLT---------- Commander-in-Chief Pacific Fleet
COMSUBPAC ---------- Commander Submarines Pacific
CONUS---------- Continental United States
COPMRF ---------- PMRF Commanding Officer
COSIP ---------- Coherent Signal Processor
CRC---------- Control and Reporting Center
CRE ---------- Control and Reporting Element

CRO----------CRT Read Out
CRT ----------Cathode Ray Tube
CW ----------Continuous Wave
CWAT----------Continuous Wave Acquisition and Track

D

DAMA----------Demand Assigned Multiple Access
DCA ----------Defense Counter Air
Db or db ----------Decibels
DGPS----------Differential Global Positioning System
DISN ----------Defense Information Systems Network
DOD----------Department of Defense
DOE----------Department of Energy
DREN----------Defense Research Engineering Network
DSN----------Defense Switch Network
DSS ----------Defense Security Service
DVSG----------DISN Video Services Global

E

EA ----------Electronic Attack
ECDB ----------Enhanced Central Data Buffer
EL----------Elevation
EMATT ----------Expendable Mobile ASW Training Target
EMI ----------Electro Magnetic Interference
EMT ----------Expert Missile Tracker or Emergency Medical Technician
EOD----------Explosive Ordnance Demolition
EPABX ----------Electronic Private Automatic Branch Exchange
EP ----------Electronic Protection or Extended Performance
ERVS ----------Extended Range Video System
EW----------Electronic Warfare

F

FAA----------Federal Aviation Administration
FACCON----------Facilities Control
FACSFAC ----------Fleet Area Control Surveillance Facility
FAST----------Floating At Sea Target
FIC----------Frequency Interference Control
FLTSATCOM ----------Fleet Satellite Communication
FM ----------Frequency Modulation
FTS----------Flight Termination System

G

GCC----------Guidance Control Computer
GCCS-M ----------Global Command and Control System - Maritime
GHz ----------Gigahertz
GMFCS----------Guided Missile Fire Control System

GMT----------Greenwich Mean Time
GPS----------Global Positioning System
GVH----------Gateway Virtual Host
GVT----------Gateway Virtual Terminal

H

HERO----------Hazardous Electromagnetic Radiation to Ordnance
HERP----------Hazard of Electromagnetic Radiation to Personnel
HIANG----------Hawaii Air National Guard
HIROC----------Hawaii Regional Operations Center
HSDS----------High Speed Data Switch
HSMST----------High Speed Mobile Sea Target
Hz----------Hertz

I

IATO----------Interim Authority to Operate
ICDRAM----------Integrated Circuit Digital Range Machine
IDS----------Intrusion Detection System
IFF----------Identification Friend or Foe
IDRAN----------Integrated Digital Ranger
IIP----------Instantaneous Impact Position
INMARSAT----------Commercial Communications Satellite
IPT----------Integrated Project Team
IRIG----------Inter-Range Instrumentation Group
IRV----------Inter-Range Vector
ISDN----------Integrated Services Digital Network
ISTT----------Improved Surface Tow Target
ITCS----------Intergrated Target Control System

J

JFMOPAC----------Joint Frequency Management Office Pacific
JTFX----------Joint Task Force Exercise
JTIDS----------Joint Tactical Information Distribution System (Link 16)

K

kHz----------Kilohertz
km----------Kilometer
KP----------Kokee Park
KTF----------Kauai Test Facility (Sandia National Laboratories Facility at PMRF)
kW----------kilo Watt

L

LAN----------Local Area Network
LATR----------Large Area Tracking Range
LEAP----------Lightweight Exoatmospheric Projectile
LEWT----------Lightweight Electronic Warfare Trainer
LOS----------Line Of Sight

M

MAB ---------- Missile Assembly Building
MAD ---------- Magnetic Anomaly Detection
MAGICC ---------- Multiple Aircraft GPS Integrated Command and Control
MATSS ---------- Mobile Aerial Target Support System
MHPCC ---------- Maui High Performance Computing Center
MCE ---------- Modular Control Equipment
MCU ---------- Multipoint Control Unit
MHz ---------- Megahertz
MIG ---------- MCE Interface Group
mm ---------- Multimode
MOA ---------- Memorandum of Agreement
MR ---------- Makaha Ridge
MFSO ---------- Missile Flight Safety Officer

N

NASA ---------- National Aeronautic & Space Agency
NAWCWD ---------- Naval Air Warfare Center, Weapons Division
NCTAMS ---------- Naval Computer and Telecommunications Area Master Station
NGFS ---------- Naval Gunfire Support
NIPRNET ---------- Non-Classified Internet Protocol Router Network
NISMF ---------- Naval Inactive Ship Maintenance Facility
NM ---------- Nautical Miles
NTADS ---------- Naval Tactical Analysis Display System
NTSC ---------- National Television Standards Committee
NTDS ---------- Naval Tactical Data System

O

OC ---------- Operations Conductor
OCA ---------- Offensive Counter Air
O&M ---------- Operations and Maintenance
OPSEC ---------- Operations Security
OR ---------- Operations Requirement
OSS ---------- Outboard Stimulator System
OTCIXS ---------- Officer in Tactical Command Information Exchange System
OTH ---------- Over The Horizon
OTH-T ---------- Over The Horizon Targeting

P

PADS ---------- Portable Air Defense System
PANS ---------- Programmable Acoustic Noise System
PARS ---------- Portable Automatic Radar Simulator
PC ---------- Personal Computer
PM ---------- Program Manager
PMRF ---------- Pacific Missile Range Facility

pps----------Pulse Per Second
PRF ----------Pulse Repetition Frequency
PRI ----------Primary Rate Interface
PSTN ----------Public Switched Telephone Network
PTES----------Portable Threat Emitter Simulator

R

RAIT----------Range ACDS Interface Translator
RALACS ----------Radar Altimeter Low Altitude Control System
RCC----------Range Commanders Council or Range Contractor Controller
RCO----------Range Control Officer
RCS ----------Radar Cross Section
RDI ----------Range Doppler Images
RFCO----------Range Facility Control Office
RFI----------Radio Frequency Interference
RHIB ----------Rigid Inflatable Boat
RIMPAC----------Rim of the Pacific
RNDES----------Range NTDS Display Emulator Subsystem
RNUS----------Range NTDS Upgrade System
ROC ----------Range Operations Center
ROCC----------Range Operations Control Center
RPM----------Revolutions Per Minute
RSA ----------Range Safety Approval
RSOP----------Range Safety Operational Plan
RTC ----------Real Time Computer
RVS ----------Radar Video Simulator

S

SAM----------Surface to Air Missile
SAR ----------Search and Rescue
SDP ----------Service Delivery Point
SEPTAR ----------Seaborne Powered Target
SGS/AC ----------Shipboard Gridlock System with Automatic Correlation
SHOTS ----------Stabilized High Accuracy Optical Tracking System
SIPRNET ----------Secret Internet Protocol Router Network
sm ----------Single Mode
SNL----------Sandia National Laboratories
SNR ----------Signal to Noise Ratio
SOA ----------Southern Operating Area
SPARS ----------Sensor Positioning and Readback System
SPAWAR ----------Space & Naval Warfare Systems Command
STU ----------Secure Telephone Unit

T

T&C ----------Tracking and Control Room
T&E----------Test and Evaluation

TADIL ----------Tactical Digital Information Link
TADIXS----------Tactical Data Information Exchange System
TBM ----------Theater Ballistic Missile
TBMD ----------Theater Ballistic Missile Defense
TJHS ----------TADIL J Host Simulator
TES----------Threat Emitter Simulator
TM ----------Telemetry
TMD ----------Theater Missile Defense
TSPI----------Time, Space, and Position Information
TTTS ----------Twelve Target Tracking System
TWR----------Torpedo Weapon Retriever
TWS----------Track While Scan (Radar)
TWT ----------Traveling Wave Tube

U

UH-3H ----------PMRF Range Helicopter
UHF ----------Ultra-High Frequency

V

VLBI ----------Very Long Baseline Interferometer
VME ----------Virtual Machine Environment
VSAT----------Very Small Aperture Terminal
VTACS ----------Visual Tactical Analysis and Critique System
VTC ----------Video Teleconferencing Center
VTM ----------Versatile Tracking Mount

W

WAN ----------Wide Area Network
WNSC ----------Wheeler Network Segment Center
WRB ----------Weapon Recovery Boat
WTR----------Western Test Range

X

XDAS ----------X-Band Data Acquisition System
XOPMRF----------Executive Officer Pacific Missile Range Facility

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1. GENERAL INFORMATION

Figure 1-1 Aerial View of the Pacific Missile Range Facility

1.1 Scope

This manual provides a detailed description of the Pacific Missile Range Facility (PACMISRANFAC or PMRF) technical facilities, including both sensor systems and technical support systems. Information is included on major systems currently being installed, those in operation, and range support capabilities available to support operations at PMRF.

1.2 Introduction

1.2.1 Geographic Location

LATITUDE 22°01' North

LONGITUDE 159°43' West

The headquarters and primary operation control and instrumentation area at Barking Sands is along the western shore of the island of Kauai, in Hawaii. The nearest town, in a relatively isolated area of the island, is Kekaha, 8 miles to the south and east. Supporting instrumentation sites at Makaha Ridge, Kokee Park, and Niihau Island overlook the vast ocean test range area to the west and north of Kauai. PMRF's ability to extend operations northwest of Kauai in over a million square miles of expanded operational area provide the range with the capability to support a variety of missions involving great distances and large areas.

1.2.2 Climate

Situated just south of the Tropic of Cancer, PMRF enjoys a mild tropical climate with scattered clouds and generally light and variable trade winds from the northeast. Displaced high-pressure areas, passing frontal actions, and Kona storms can cause gusty winds in excess of 30 knots at Barking Sands. Makaha Ridge is less protected than Barking Sands and usually experiences 5 to 10 knot higher winds. Mean monthly temperatures remain in the 70's throughout the year; however, seasonal maxima in the low 90's and mid 50's are not uncommon.

Barking Sands, on the lee side of Kauai, is in one of the driest sections of the island. Annual rainfall averages about 20 inches. Average daytime relative humidity is in the mid 60's with nighttime average humidity in the mid 80's.

Ocean temperature at the surface ranges from the low 70's to the low 80's between the cooler and warmer months. Sea states are generally from 2 to 4, with sea states up to 5 1/2 when winds are above 30 knots.

1.2.3 Range Function

The Pacific Missile Range is the largest instrumented multi-environment test range in the world. The overall mission of the range is to provide support services for fleet training, tactics development, and Test and Evaluation (T&E) of air, space, surface and subsurface systems. The primary users of PMRF are fleet aviation, surface and submarine units, task groups or task forces, Navy or Joint services, T&E agencies and other allied forces, primarily from countries within the Pacific Rim. Commercial organizations also utilize PMRF's services on a reimbursable basis.

1.3 PMRF Sites

1.3.1 Barking Sands

Barking Sands, 120 nautical miles from Pearl Harbor, is approximately one-half mile wide and six and a half miles long. The main entrance and Administrative Area of PMRF is in the central part of Barking Sands. The nominal elevation in Barking Sands is 15 feet above MSL except for the aerial target launching area, which is at 75 feet.

The Range Operations Control Center (ROCC), Bldg 105, is the operational center of PMRF. Three Tracking and Control (T&C) rooms are located in the ROCC Annex. The Battle Management Interoperability Center (BMIC), Data Processing and Display Systems, Communications and Network Control Centers, and Message Processing and Distribution Center are located within Building 105.

Two tracking and a surveillance radars are located at Barking Sands, as well as ordnance and target launching facilities. The main base at Barking Sands is serviced by an airfield, housing, billeting, personnel support and recreational facilities.

Tenant activities include Naval Undersea Warfare Center (NUWC), Sandia National Laboratories (SNL), National Institute of Standards and Technology (NIST) Hawaii Radio station WWVH, and Hawaii Air National Guard (HIANG) 154th Air Control Squadron.

1.3.2 Ocean Range Areas

Three off shore underwater range areas at PMRF are the Barking Sands Tactical Underwater Range (BARSTUR), the Barking Sands Underwater Range Expansion (BSURE) and the new Shallow Water Training Range (SWTR). Data from these ranges are brought ashore, via hydrophones and submerged cables for processing, recording, and display within the tracking and control rooms. BARSTUR, BSURE, and SWTR combined provide over 1,100 square miles of instrumented underwater range area capable of tracking submarines, underwater weapons and targets, and scoring for the Naval Gunfire Support System.

The PMRF SWTR expands the Barking Sands Tactical Underwater Range into water as shallow as 20 fathoms along the northwest coast of Kauai. This new addition makes PMRF the only range in the world which can provide underwater coverage in a seamless transition from shallow to deep open ocean environments. PMRF has the largest instrumented underwater tracking range existing in the world today.

Nominal ocean depth along the eastern third of the BARSTUR range is 1,800 feet. The depth falls off rapidly to 4,000 feet along a north-south escarpment and then gradually increases to more than 6,000 feet along the western edge of BARSTUR. North of BARSTUR, the BSURE range features water depths to 15,000 feet throughout most of its area.

Normal surface conditions of the BSURE range are typical for the mid-Pacific with swell periods of seven to ten seconds and wave heights of 2-4 feet. The mixing of the ocean swells from the east along the south shore of Kauai and from the north along the Na Pali, or western coast of Kauai, produce 3 to 5 second erratic swell periods and variable currents in the BARSTUR range. In addition, trade winds from the northeast create a diagonal wind shear through the southern part of BARSTUR with calmer waters to the south.

Bottom mounted hydrophones on all ranges detect submarines, underwater targets and weapons through reception of tracking pingers mounted on the vehicles. Hydrophone data is processed by the Underwater Tracking System (UTS), within the ROCC, to provide tracking data for recording and display. UTS provides real-time tracking of multiple vehicles throughout the three underwater ranges.

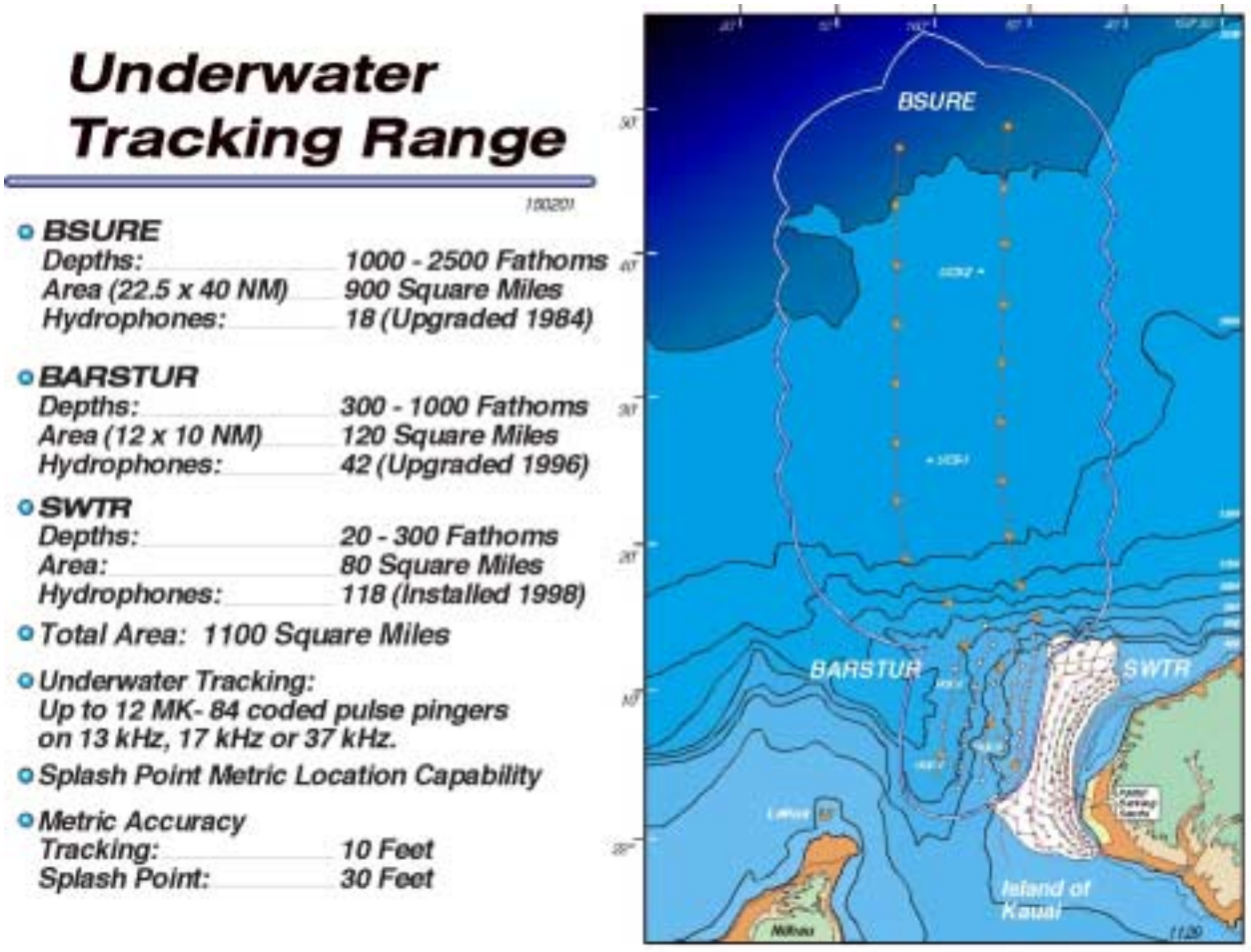

Figure 1-2 Underwater Range

1.3.3 Makaha Ridge

Instrumentation facilities at Makaha Ridge, approximately seven nautical miles north of Barking Sands, overlook the BARSTUR, BSURE, and SWTR ranges. Site elevations are between 1,500 and 1,700 feet, providing line of sight coverage to 60 nautical miles from the southwest to the north. Makaha Ridge is accessible from Highway 550, which can be entered through Kekaha or Waimea.

There are four tracking radars, two surveillance radars, and the primary PMRF telemetry station at Makaha Ridge. Frequency Interference Control (FIC), Electronic Warfare and Communication Facilities are also located at Makaha Ridge.

Figure 1-3 Makaha Ridge

1.3.4 Kokee Park

Figure 1-4 Kokee Park Site D

Kokee Park is divided into five distinct areas, known as Sites A through E, which house different equipment. Approximately one-half mile beyond the turn off to Makaha Ridge, on Highway 550, a road to the right reaches Site A, and a road to the left reaches Sites B, C, D, and E. This area was formerly part of a NASA Tracking Station. The tracking radars and telemetry equipment at Kokee Park continue in use for PMRF range support. Coherent Signal Processor (COSIP), MK74, and X-band radars, Flight Termination System (FTS), and a supporting communication facility have been added to the area. The Kokee Park instrumentation, at an elevation above 3,800 feet, extends the line of sight coverage from Kauai to 90 nautical miles.

1.3.5 Port Allen

Port Allen is a state harbor facility, located approximately 17 miles from Barking Sands, on the southern coast of Kauai. The Navy leases office, storage, and berthing space at the Port Allen pier for range vessels and surface target support. The channel at Port Allen is at least 25 feet deep. The dock is 400 feet long.

Dockside facilities include 110/220/440-volt alternating current power, potable water, lights, fire hydrants, and a 20-ton crane. Fuel oil, diesel fuel, and gasoline are available locally by truck.

PMRF range recovery and target boats, berthed at Port Allen, transit to the range for operations. A request for the use of Port Allen by any boat or ship not attached to PMRF requires the approval of the State Harbormaster located at Nawiliwili. Requirements should be submitted through the PMRF Program Manager.

Figure 1-5 Port Allen

1.3.6 Kamokala Caves

This is an explosive storage area consisting of ten magazines, two miles east of Barking Sands. Requests for temporary explosive storage should be submitted through the PMRF Program Manager. Two additional magazines are being constructed to support Theatre Ballistic Missile Defense (TBMD) activities.

1.3.7 Oahu Sites and Services

Personnel at two instrumentation sites on Oahu provide equipment installations on ships and aircraft, and in-port and on-deck electronic warfare training services.

Mauna Kapu, overlooking Pearl Harbor and the ocean area south and west of Oahu, is a primary Frequency Interference Control (FIC) and Electronic Warfare (EW) facility on Oahu. It is located in the Waianae Mountain Range at an elevation of 2,571 feet. The geodetic coordinates of the site are Latitude 21°23'55"N and Longitude 158°06'18"W.

Instrumentation equipment, aircraft pods and mobile units are maintained from yard and shop space in Buildings 1769 and 1767, Barbers Point. Equipment and pod installations on aircraft at Kaneohe Marine Corps Base Hawaii (MCBH) or Hickam Air Force Base (HAFB), and on ships and target hulks in Pearl Harbor, are staged from this facility. Mobile and transportable units are operated in and around Pearl Harbor to provide Electronic Warfare training support.

1.3.8 Niihau

The privately owned island of Niihau is 17 nautical miles west southwest of Barking Sands. Through agreements with the owners of the island, PMRF operations are supported in several ways.

A remotely operated APS-134 radar is located on Paniau Ridge, and provides surveillance of the shoreline waters north and west of Kauai, and extends the radar coverage of the areas west and north of Niihau. Electronic Warfare exercises are enhanced by establishing additional threat axes from sites on Niihau.

Figure 1-6 Niihau

A Test Vehicle Recovery site is located in the uninhabited northern plains area of the island. This is used for land recovery of test vehicles which would be subjected to costly decontamination processes or possible total loss associated with ocean recovery. PMRF also has several small instrumentation sites in this area.

The Niihau Ranch operates a Government Furnished Equipment (GFE) LCM-8 landing craft to support government requirements on the island. A commercial helicopter operates between Kauai and Niihau. The services of these craft can also be obtained to support PMRF operations. Access to the island for operations support is only authorized by the Niihau Ranch Manager and can be arranged through PMRF Range Programs.

1.3.9 Mobile Site

The Mobile Aerial Target Support System (MATSS) is a converted floating dry dock section, which is berthed at Pearl Harbor. The purpose of MATSS is to provide government and commercial organizations with a large, stable, mobile, open ocean platform to support various operations. MATSS is currently being fitted to serve the range as a floating instrumentation platform. Optics, mobile telemetry, COSIP radar, and communications are some of the platform capabilities.

Figure 1-7 MATSS

1.3.10 Special Training Areas

Operations in Special Training Areas on the islands of Oahu, Niihau, and Hawaii can be supported with PMRF transportable resources.

1.4 Support Services

1.4.1 Visitor Control

A security clearance is necessary to enter Bldg 105 and other designated operational areas. A Visitor Center, Building 353, is located at the Main Gate.

Personnel intending to visit the facility should send a visit request, message, or letter to:

Commanding Officer
Pacific Missile Range Facility
Code 7001-3.2
P.O. Box 128
Kekaha, Hawaii 96752-0128
Phone: (808) 335-4842
Fax: (808) 335-4844

The request should be submitted in sufficient time to allow processing and reply. Access to classified areas or information will be authorized on an as-needed basis and only if an appropriate security clearance is submitted or on file. Upon arriving at the facility, visitors should report to the main gate Visitor Center for processing, badge issue, and automobile passes.

1.4.2 Airfield

The airfield at Barking Sands is a single 6,000 feet by 150-feet wide asphalt runway (16-34) with a 100 feet overrun at each end. The runway is 14 feet above mean sea level with magnetic headings of 158° and 338°. The runway is lighted and is equipped with two arresting gear systems. Aircraft parking with tie-down capability is available on 13,000 square yards of apron. There are four helicopter landing pads, one of which is designated as the primary hot fuel area for helicopters.

The Air Operations Center is located in the Main Hanger, Building 384. The airfield Control Tower and Crash/Fire facilities are included in Building 300. The height of the tower with antennas is 77 feet MSL.

Use of the airfield is on a Prior Permission Required (PPR) basis for military and commercial aircraft. PMRF Commanding Officer approval is obtained through the Air Operations Officer, telephone (808) 335-4310 or 4311. Aircraft on SAR and MEDEVAC missions are authorized to land or take off at the discretion of the aircraft commander with the tower unmanned. Contractor Line and Fueling services are normally only available during periods when the airfield is open.

Normal airfield operating hours are from 7:00 AM to 6:00 PM, Monday through Friday except holidays. Requests to open the airfield at other times must be approved by the PMRF Commanding Officer. A minimum of 24 hours advance notification is required except for emergencies and SAR operations.

Under the DOD uniform direct cost funding policy, no reimbursable charges will accrue to an airfield user during the normal weekday operating hours. If the field is used outside these hours, on holidays, or weekends, direct costs will be charged to the user.

The Truck Aircraft Loader Unloader (TALU) enables support of oversized cargo associated with C-5, C-117, and C-141 aircraft. Ordnance personnel have been certified in the proper operation of this equipment and are available to support in the on- and off-loading of oversized cargoes.

Additional airfield and flight information pertaining to PMRF (PHBK) can be found in the Pacific Flight Supplement Manual.

1.4.3 Emergency Services

1.4.3.1 Crash/Fire

Crash/Fire is located in the base of the Air Traffic Control Tower, Building 300. Personnel are trained to respond to activities such as aircraft fire fighting and rescue in support of airfield operations plus structure and brush fire

fighting, fire prevention instruction and fire inspections.

1.4.3.2 Medical

Ambulance and Class II Emergency Medical Technician services are provided by EMT's assigned to Crash/Fire. These contractor operated services are available to military, civil service and non-government personnel at PMRF, 24 hours a day, seven days a week.

A Dispensary, Building 278, is located in the Barking Sands Administrative Area. An Independent Duty Corpsman provides limited emergency medical care for active duty personnel at PMRF. The Dispensary is a branch of the Pearl Harbor Medical Clinic.

More extensive emergency medical services are available from the West Kauai Medical Center in Waimea, 10 miles from the Main Gate at Barking Sands.

1.4.4 HAZMAT Response

Contract employees working in the Ordnance and Fire Department sections are trained to respond to certain types of hazardous accidents. Individual programs are responsible for spills, accidents, and clean up. Currently, PMRF personnel have level B protection gear. Level A protection gear is being purchased.

A private organization, Clean Islands Council, located in Honolulu, is the first respondent to oil spills at Port Allen. The Coast Guard then performs an investigation and lends assistance, utilizing manpower and equipment from Honolulu.

1.4.5 Department of Agriculture Services

Aircraft arriving from CONUS must complete a Department of Agriculture (DOA) Declaration. If any prohibited items are declared, PMRF Air Operations will coordinate with DOA to resolve any discrepancies. DOA Inspectors must inspect aircraft arriving from outside CONUS or departing directly from PMRF to CONUS. Inspections require 48 hours advance scheduling. Charges for the inspection are the responsibility of the range user. Scheduling and reimbursement of charges will be arranged by assigned PMRF Program Manager in coordination with PMRF Air Operations Department, (808) 335-4310.

1.4.6 Other Services

Additional information concerning services provided by PMRF can be found on the official web site:

www.pmrf.navy.mil

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2. PROGRAMS AND DOCUMENTATION

2.1 Introduction

The Pacific Missile Range Facility is the "Range of Possibilities." A key to realizing these possibilities is to closely coordinate with PMRF program management personnel to use the planning and scheduling processes. This section briefly describes the Universal Documentation System and program planning responsibilities.

2.2 Command Structure

The Commanding Officer, Pacific Missile Range Facility, (COPMRF) is responsible and accountable for the safety, scheduling, operations and maintenance of the range and facility resources at the PMRF. See Figure 2-1 Command Structure.

2.3 Range Programs

PMRF provides training support to Fleet and other DoD units, participates in Research, Development, Test and Evaluation (RDT&E) programs, and supports foreign military and industry are also supported.

For operations conducted within the PMRF operational areas, the Facility provides normal range services as requested. Range operational support includes range scheduling, program management, safety, range surveillance control, radar, underwater tracking, telemetry, electronic warfare, target launch, ground/radio/underwater communications, data recording/reduction, command and flight termination control, air intercept control, frequency interference monitoring, and weapon/ target recovery.

2.4 Program Planning

2.4.1 Program Planning Guide

A PMRF Program Planning Guide provides the potential range user an overview of the process for introduction of a new program to PMRF. The Program Planning Guide contains the following subjects to assist the range user:

- Time Lines
- Finance
- Environmental Documentation
- Real Estate License, Leases & Easements
- Site Approval & Explosive Safety
- Construction & Base Support
- Range Safety
- Aerial Targets
- Weather Services
- Transportation Services
- Airfield Support
- Logistics
- Range Frequency Management
- Telephonic Communications
- Classified Voice/Data Comm
- FM Mobile Comm
- Base Network
- Video Teleconferencing
- Supply/Material Support
- Fuel Support
- Hazardous Material
- Visitor Control
- Foreign Visitor Control
- Operations Security (OPSEC)
- Classified Information Security
- Security Support
- Classified Meetings

2.4.2 UDS Documentation

Range Users desiring PMRF support services are requested to submit documentation in accordance with the Range Commanders Council (RCC), National Range Universal Documentation System (UDS).

UDS provides a common language and format for stating requirements and preparing support responses to promote effective communication between a Range User and PMRF. The system provides a flexible and dynamic method that documents the support requirements of simple, complex, small, or large programs.

PMRF is currently using RCC 501-97, Appendix C data entry and mail or email transmissions. Electronic and paper copies are available from PMRF Program Managers.

Current Command Hierarchy

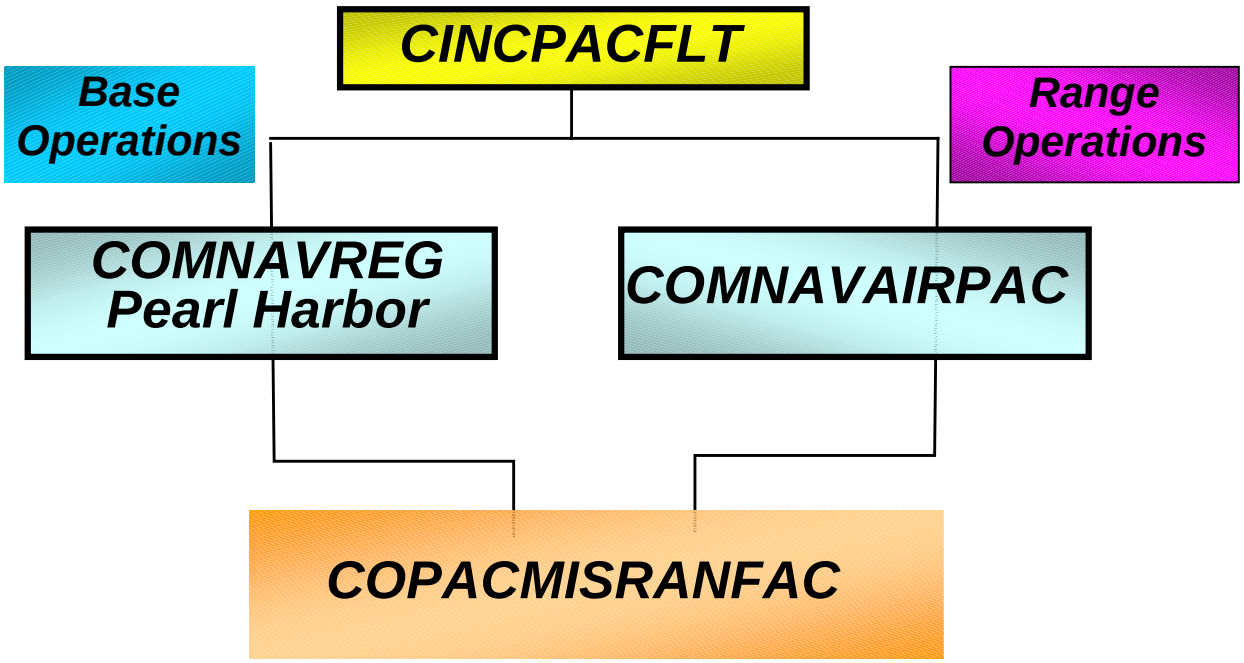

Figure 2-1 Command Structure

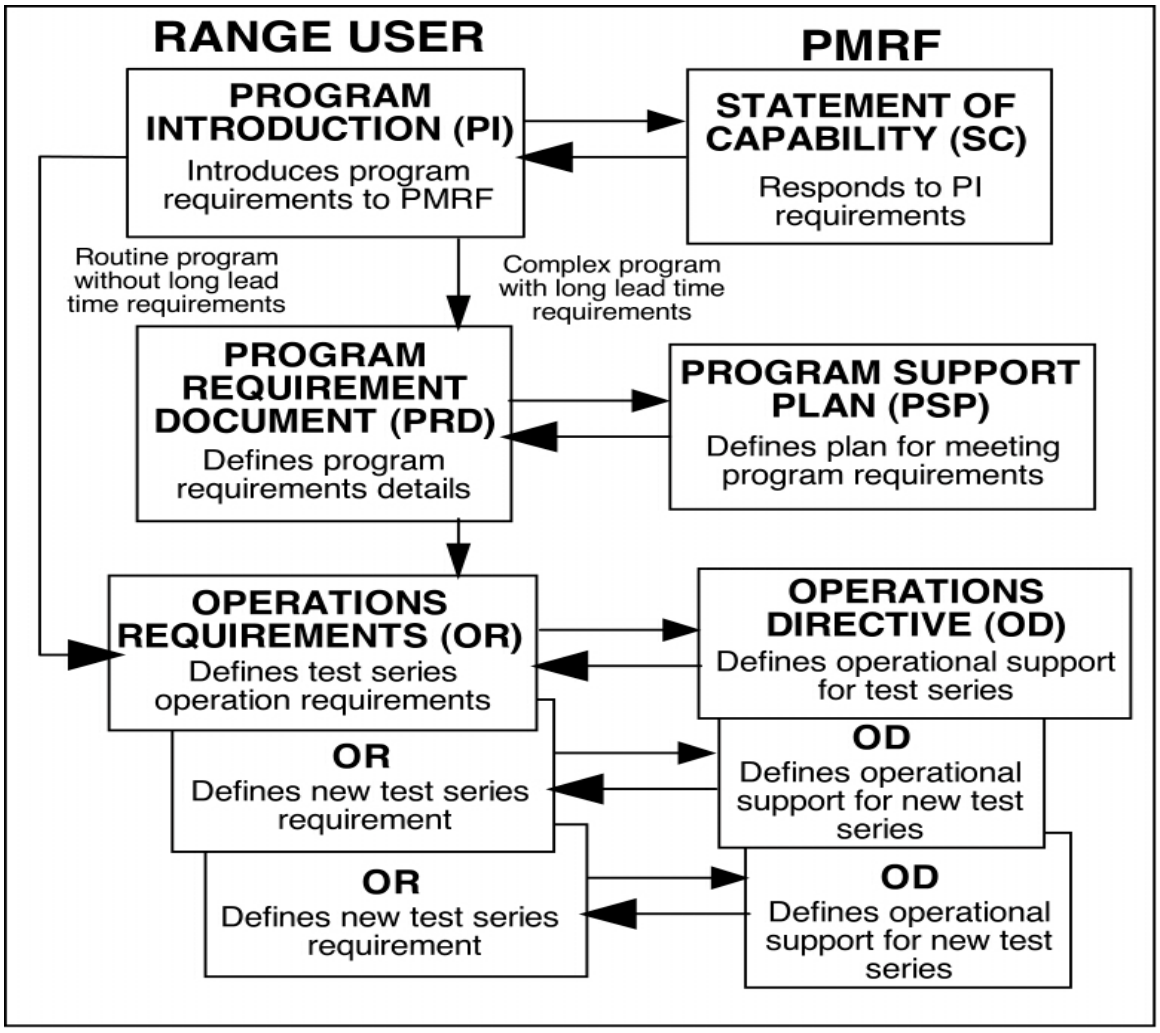

Figure 2-2 UDS Process

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3. RANGE OPERATIONS

The Pacific Missile Range Facility (PMRF) can provide a wide range of unique operational environment capabilities. Simultaneous operations can be conducted underwater, on the surface, in the air, and in space. This unique environment enables the range to track, display, record and provide data to enable customers to evaluate the performance of their specific operational events. PMRF has the facilities and areas to provide range support in virtually every related technological field. The heart of this vast network is the Range Operations Control Center (ROCC), Bldg 105 annex. Range operations at PMRF use tracking and display resources and follow range safety criteria to ensure operations are safe, and government and private property is protected. The Range Control Officer (RCO), acting for the COPMRF, is the authority that establishes the range firing status and the conditions under which an operation is allowed to proceed.

3.1 Operation Control Rooms

PMRF has three Tracking and Control rooms (T&C-Alpha, Bravo, and Charlie), a Range Facility Control (RFCO) room, and a Battle Management Interoperability Center (BMIC). Each control room has numerous work stations with graphic displays that exhibit real time tracking information and are capable of providing hard copy printouts of significant events. Control rooms also have access to voice, data, and video networks that provide communications between PMRF and range users and to the elements supporting range operations. There are operating console positions for the Operations Conductor (OC), the Missile Flight Safety Officer (MFSO), the Range User, and the Range Contractor in each T&C room. The OC is responsible for all activities in the control room. The OC has direct communication with the participants, Range Control, and the Range Contractor Controller (RCC) representing the range operations O&M contractor. The MFSO and range user console positions are used as required.

Also located in Bldg 105 are the VIP Viewing Room (Delta), and Conference Room (Echo). Delta is available to view an operation and contains two large screen displays, video monitors, and speakers for audio from the operation. Echo contains a conference table, speakerphone for conference calls, and overhead projector.

3.2 Range Data Products

PMRF provides a variety of real-time and post-op data products. NTADS, SIMDIS, and TSunami software programs are available for real-time and post-op display. Data products are available as hard copy or electronic media, (CD, 1.44 MB Disk, SIPRNET, 8MM or 4MM Tapes, STU III Data Transfers, or Unclassified E-mail). The preferred method of data distribution is via electronic media. In addition to the sample list of available products as shown in the table below, PMRF can provide video via classified VTC. For a complete list, contact the PMRF Program Manager.

Table 3-1 PMRF DATA PRODUCTS

POST OPERATIONAL DATA PACKAGES:		
TM Analog Tapes/Strip Chart Recorder	Tabulated Listings (Smooth or Un-Smoothed)	
Computer Listings	N Station	
X, Y, Z, Alt, Depth Plots		
REAL-TIME PRODUCTS, DATA BOOKS CONSISTING OF:		
X, Y, Z Plots	Operators Logs	VTACS (VHS VIDEO)
Radar Logs	Recovery Logs	Screen Hardcopy
Computer Printouts	Environmental Reports	Telemetry Strip Chart Recorder
Soundray Paths	Weapon Firing Reports	Visicorders
EORs		

ELECTRONIC FORMAT DATA PRODUCTS		
TIMS	Raw Data	RT Out
iNet (Smooth or Un-Smoothed)	SODIM 305.00 (TRAE)	Event Logs
ASCII (Similar to listings without headings)	SODIM 305.06	Plots
Tabulated Listings		
REAL-TIME DATA		
Closest Point Of Approach	Midcourse Tracking	N Station
Instantaneous Impact Predictions	Grid Positions	MINEX
Submarine Kilo Reports		

3.3 Display Systems

The Real Time Computer (RTC) generates control functions and computes parameters for control room displays. RTC interacts with the Navy Tactical Data System (NTDS) Computer and the Automatic Precision IFF Reporting System (APIS). Best track data is selected from tracking and surveillance radars, the underwater tracking system, the Navy Tactical Data System (NTDS) and the Integrated Target Control System (ITCS) to process real time display data. Ten Sun workstations provide all the information:

- 2 stations dedicated for Sensor Positioning And Readback System (SPARS)
- 2 stations dedicated for Data Display
- 2 stations dedicated for Instantaneous Impact Position (IIP)
- 2 stations dedicated for Inter-Range Vector (IRV)
- 2 stations dedicated for recording (STU III data transmission)

3.3.1 Range Navy Tactical Data System Upgrade System (RNUS)

The Navy Tactical Data System (NTDS) has been improved with several upgrades. With the upgrades the new Range Navy Tactical Data System Upgrade System (RNUS) is in operation. RNUS is an Advanced Combat Direction System (ACDS) Block 0 tactical computer system adapted specifically to upgrade and replace the NTDS system at PMRF. RNUS is composed of the following subsystems.

3.3.1.1 ACDS Computer Subsystem

The ACDS Computer Subsystem consists of two AN/UYK-43B computers, four Data Terminal Sets (AN/USQ-69 Emulators), a Universal Controller (RD-358 Emulator), and Personal Computer (PC) Emulators. The AN/UYK-43B computer hosts the ACDS Block 0 operational software. The computer subsystem receives Link messages, range tracks generated within APIS, and local tracks generated by ACDS operators. It performs the following functions:

- Local remote track correlation
- Generates track data for display and recording
- Interrogates RNDES consoles for operator inputs
- Generates messages for Links
- Communicates with the SGS/AC

3.3.1.2 Range NTDS Display Emulator Subsystem (RNDES)

The RNDES consists of one Radar Data Distribution Switchboard (RDDS), one Enhanced Central Data Buffer (ECDB), and several Display Emulators Consoles with CRT Read Out (CRO) Emulators. The units are distributed within the three T&C spaces, RFCO, BMIC, and the NTDS computer room. The RDDS receives, conditions, and distributes radar data and IFF data from the Radar Video Simulator (RVS) and live radars to the display consoles. The ECDB provides bi-directional communications between the display consoles and the ACDS Computer Subsystems via the HSDS. The display consoles process and display tactical data, radar track data, IFF data/symbology, and live/simulated radar video. RNDES also provides the interface for the operator to control display parameters and to enter display data.

3.3.1.3 Range ACDS Interface Translator (RAIT Subsystem)

The RAIT consists of up to three dedicated interface processors, one track file processor and one failover processor with interfaces to Link-11 (passive tap), the SGS/AC Subsystem, the ACDS Computer Subsystem, the iNet, and RNDES. The RAIT Subsystem receives, stores, correlates, translates, and transmits track and display data in providing the virtual interface between the ACDS Computer Subsystems and the iNet. The RAIT provides the interface for the exchange of graphic and textual display data between RNDES and the iNet.

3.3.1.4 Shipboard Gridlock System with Automatic Correlation (SGS/AC) Subsystem

The SGS/AC Subsystem consists of one AN/UYK-20 computer programmed to correlate and gridlock local and remote track data. The SGS/AC interfaces with the RAIT Subsystem, the ACDS Computer Subsystem, and Links.

3.3.1.5 High Speed Data Switch (HSDS) Subsystem

The HSDS is a programmable, computer-controlled, high-speed data switching system that inter-connects the ACDS Computer Subsystem, the RNDES, the RAIT, the NRI, and Links. The HSDS permits the rapid setup and automatic verification of switch configurations, which can be stored and recalled.

3.3.1.6 Radar Video Simulator (RVS) Subsystem

The RVS generates simulated radar video for RNUS operational verification and personnel training. A processor external to RNUS executes a test/training scenario in order to provide the track data required by RVS to precisely generate the radar video for personnel training exercises.

3.3.1.7 Identification Friend or Foe (IFF) Subsystem

The IFF Decoder Subsystem consists of up to eleven AN/UPA-59B automatic decoders that operate in conjunction with interrogating equipment at a radar to challenge aircraft and ships. Replies are translated for display on the RNDES console and on the AN/UPA-59B IFF data readout.

3.3.1.8 Link-11

The Link-11 subsystem consists of two Data Terminal Sets (DTS), KG-40/KG-40X cryptographic units and associated HF and UHF radios. The Data Terminals consist of a Magnavox AN/USQ-76 and a General Atronics model MX-512P. PMRF also has the capability to do Satellite Link-11.

3.3.1.9 Link-16 Joint Tactical Information Distribution System (JTIDS)

The JTIDS provides jam-resistant digital communication of data and voice for command and control, navigation, relative positioning, and identification capabilities in military tactical and air defense operations. The Link-16 subsystem consists of a AN/URC-107(V)7 JTIDS shipboard terminal that interfaces to one of the RNUS ACDS UYK-43 computers via a Gateway system, three similarly equipped PC's, the Gateway Virtual Terminal (GVT), the Tadil J Host Simulator (TJHS), and the Gateway Virtual Host (GVH). The terminal, GVH, and one KIV-7 are located in building 765, Kokee Park. Communications and the rest of the equipment are located in the main computer room.

3.3.2 Large Screen Displays

The large screen rear projection display system provides real time presentation for viewing. These units are located within the T&C rooms, and the VIP viewing room. The display system has two 6’ x 6’ screens in each of the T&C rooms, and uses multicolored symbology. The VIP viewing room has two 8’ x 8’ screens.

3.4 Range User Command Center

In Bldg 105, the Range User Command Center (RUCC) is located in room Delta. This room provides users with a segregated work area and is equipped with four speakers that provide operations communication data. Users are able to view, on two large-screen displays, the identical picture used by the Operations Conductor. VSAT Communications, phones and live video feeds are also available to the users.

3.5 Battle Management Interoperability Center (BMIC)

BMIC is a concept in battle management providing a capability to conduct Over-The-Horizon-Targeting (OTH-T), Battle Group Command and Control, and Strike/Mission/

Scenario Planning with operational units in a test and evaluation environment. These capabilities provide tools for investigating battle management strategies and interoperability architectures.

Located in room Delta, the BMIC system has access to various displays and communications systems that allow range user representatives to monitor and participate in range exercises. Some of the tools available in BMIC are:

- Secure voice and data circuits
- WSC-3 satellite communications
- Generic communications processors
- Tactical message processors
- Track simulation
- Regeneration equipment
- MDU tactical processor (MTP)
- Gale-lite
- Global Command and Control System-Maritime (GCCS-M)
- Naval Tactical Analysis Display System (NTADS)

An Officer in Tactical Command Information Exchange System (OTCIXS), V6 data and voice, and V5 voice satellite circuits are available in BMIC. Other secured HF/UHF and VHF radio circuits can be made available. Secured and uncovered voice communication circuits between the center and the T&C control rooms can be provided.

The BMIC is a resource that can be made available to a range user. Communication and display requirements, to adapt the facility to the needs of user, should be coordinated well in advance. Normally, PMRF will designate an individual from Range Programs to assist in the development of a plan for utilization of BMIC.

3.6 Range Safety

For operations at PMRF, the Range Control Officer (RCO) requires a safety plan. After working with the range user, a Range Safety Approval (RSA) or a Range Safety Operation Plan (RSOP) is generated by PMRF Range Safety personnel. PMRF RCO is the only authority that can approve deviations or modifications to the basic safety plan. PMRF Range Safety personnel can do modifications to an in-place RSA or RSOP. Although minor changes may be done via telephone or FAX machine, normally at least five working days must be allowed to change an RSA or RSOP. The RCO, representing the COPMRF, is responsible for all operations conducted and is charged with insuring the operations conform to range safety specifications. The RCO is also responsible for complete and thorough surveillance and for issuing proper range status and safe firing bearings. It is the goal of PMRF to conduct safe operations at all times.

3.7 Range Control

The Range Control Officer exercises real-time operational control over PMRF range operations for the Commanding Officer. The RCO is responsible for:

- Coordinating real time use of areas and airspace over which PMRF has scheduling authority
- Resolving real time conflicts in scheduled use of range facilities and areas
- Approving entry and departure of PMRF and participant aircraft, boats, and ships to and from the range
- Maintaining coordination with Barking Sands Airfield Tower whenever an operation borders or enters into tower controlled airspace
- Conducting surveillance and clearance of missile/ weapon/target hazard areas on the range
- Implementing provisions of the NAWCWD RSA or RSOP for weapon and target firings
- Controlling launching sequence for missiles and targets launched from the PMRF launch complex
- Initiating operational holds when conditions on the range warrant or any party involved in the launching sequence desires a "HOLD"
- Providing operation conductors with range clearance status "RED" or "GREEN" and "Safe Firing Bearings"
- Terminating the flight of a target if it is a threat to property or personal safety, when an MFSO is not available
- Coordinating and directing weapon, target and payload recoveries
- Providing information on hazardous operations and restrictions of transit to personnel desiring to transit range areas

3.7.1 Warning Area Air Space

The airspace above Warning Areas 186/188 is coordinated directly with Federal Aviation Administration (FAA) Diamond Head, Oahu, via a direct line. Normal scheduling coordination is done with a 24-hour lead-time.

Changes in airspace usage can be negotiated in real-time which requires time and may require waiting for FAA to clear an area. Range Control has direct lines to Honolulu combined Center Radar Approach Control (CERAP) and the Fleet Area Control Surveillance Facility (FACSFAC), Ford Island, Oahu to affect coordination with these agencies.

3.7.2 Range Facility Control

Range Facility Control (RFCO) is the control room for Range Control with dedicated displays for the Range Control Officer.

RFCO is equipped with eight Compunetix communication consoles, two SPA-25G surveillance radar remote indicators, three APIS displays, and three RNUS consoles. Wide band radar video data from the AN/SPS-67 and the AN/FPS-117 is displayed on the SPA-25G Remote PPI Radar Indicators and the RNUS consoles.

The APIS system displays tracking data selected from the metric systems, surveillance data from the AN/FPS-117 and AN/APS-134 radars, and IFF data from the AN/FPS-117 and ARSR-4 radars.

Figure 3-1 RFCO

The RNUS consoles, using data from APIS, wide band radar video data, and manually introduced data, generates target symbols for composite displays incorporating Link 11 and Link 16 data from participants.

PMRF radar provides surface surveillance of the Warning Areas out to 15 NM including the ocean area south of Kauai. Aircraft surveillance with these radars extends beyond 15 NM.

IFF Modes 2, 3, and Charlie responses from the ARSR-4 radar on Mt. Kaala, Oahu, and the AN/FPS-117 HIANG radar are displayed through APIS. IFF coverage increases aircraft surveillance coverage beyond 90 NM including the Kauai Channel between Kauai and Oahu. Surveillance coverage beyond the range of land based radars is provided by RC-26D and/or NAWCWD P-3 aircraft.

3.7.3 Range Surveillance and Clearance

Range SURVEILLANCE is the function of assuring surface and air traffic in or near the range is clear of the hazard area of an operation. The Range Control Officer (RCO), responsible for surveillance of the range, accomplishes this function by:

- Controlling range surveillance, target launch, and recovery activities
- Maintaining radar and/or visual coverage of the affected range area
- Verifying the conduct of the operation conforms to operational procedures and range safety criteria

Range CLEARANCE, normally accomplished by voice contact, is the process of clearing civilians and military non-participants from an area. Resources used to clear an area are:

- VHF Channel 16 for calls to and from transiting vessels
- Citizens band radio for local fishermen
- Direct contact using PMRF airborne or range boat assets

Range Control can request outside assistance, such as the Coast Guard, to establish proper surveillance and assure clearance of the area.

3.8 Firing Status

A weapon may have variable launch parameters that affect the size of the weapon footprint. It is very important for a Range User to advise Range Control of the launching parameters before an operation. When launching parameters are not available, the worst case

firing scenario is used to define the hazard area, which can be disadvantageous to a range user.

A range user must advise Range Control when a firing variable has been changed. Adjustment in real-time, when a variable has been changed by a range user, can be made; however, the adjustment may cause a change in the size of the footprint resulting in a change of the range status.

There are three range firing status conditions. These are:

- A RED RANGE
- A GREEN RANGE
- A GREEN RANGE with issued SAFE FIRING BEARINGS

3.8.1 Red Range

A RED RANGE statement declares that there is an unsafe condition due to a fouled firing area. An unsafe condition can be caused by a surface or air contact within the hazard area, surveillance incomplete, or confusion as to firing procedure. Once a RED RANGE has been called, the shooter may NOT LAUNCH OR ARM HIS WEAPON. Should the weapon already be armed, it should be returned to a safe condition.

In order to continue the operation, the person or organization declaring the red range must clear the problem and declare the range green. Range Control cannot override a RED RANGE declared by a shooter and vice-versa. Once a red range has been cleared, a check of all participants will be made prior to picking up the count and proceeding with the operation.

3.8.2 Green Range

A GREEN RANGE is the term used to inform a participant shooter the allowable weapons hazard area is clear, and it anticipates the shooter will be allowed to launch his weapon. A GREEN RANGE does ***not*** authorize the shooter to:

- Launch his weapon
- Launch a different weapon
- Change a launch variable

3.8.3 Safe Firing Bearings

Safe firing bearings are the range of authorized firing azimuths for a shooter to use when launching his weapon. Shooters are reminded that issuance of the safe firing bearings only authorizes the shooter to launch his weapon at an azimuth within the stated range of the safe firing bearings.

Safe firing bearings are only issued when the range is GREEN. The bearings are issued by Range Control to the OC. They are stated in three digits using clockwise rotation, i.e.:

"Safe firing bearings are 270 degrees True, clockwise to 360 degrees True."

3.9 Summary

The goal of PMRF is to conduct safe operations at all times. The Range Control Officer, as the CO's representative, is responsible for all operations conducted, and is charged with insuring the operations conform to range safety specifications. Range personnel, trained in the proper use of range equipment help to ensure safe operations. Range Users should contact the PMRF Program Manager for all aspects of their program.

4. RADAR SYSTEMS

PMRF radar systems are comprised of tracking, surveillance, and special purpose radars. External radar systems, not operated or maintained by PMRF, feed additional track data into PMRF.

4.1 Tracking Radar Systems

There are eight operational C-band automatic tracking radars that provide precision tracking data. Two of these radars (AN/MPS-25's) are located at Barking Sands (BS). Four radars are located at Makaha Ridge (MR) at an elevation of 1,500-1,700 feet (one AN/FPQ-10, one AN/MPS-25, and two wide band coherent signal processing [COSIP] radars). The remaining two radars, an AN/FPS-16, and an AN/FPQ-10, are located at the PMRF Kokee Park (KP) site at an elevation of 3,800 feet.

Tracking data from Makaha Ridge and Kokee radars are transmitted, via microwave, to the Real-time Computer Center for processing, display, and recording along with the tracking data from the Barking Sands radars.

Figure 4-1 Makaha Ridge Radars

4.1.1 AN/MPS-25

The AN/MPS-25 radar set is a high-accuracy, long-range, monopulse tracking radar. The AN/MPS-25 transmitter is equipped with a tunable, 1-megawatt magnetron. The modulator is triggered by the range sub-system and, when operator selected, can be coded to interrogate coded beacons.

The antenna consists of a 16-foot parabolic dish with a 4-horn monopulse comparator mounted at the focal point. The RF signals are amplified by three preamps and fed to solid state IF amplifiers, all located in the RF compartment of the antenna. These signals are fed via slip rings to a three-channel video detector/ processor.

Figure 4-2 Barking Sands MPS-25

The video detector/processor extracts the video from the IF, processes it and distributes it to various subsystems in order to control receiver gain, phase, and frequency. This video is also sent to the console for display, to the range tracking subsystem, and via the angle-gating unit to the angle servo subsystem.

There are two basically similar range tracking subsystems: Integrated Digital Ranger (IDRAN) in the MPS-25 radars at Barking Sands and Integrated Circuit Digital Range Machine (ICDRAM) in the Makaha Ridge MPS-25. These subsystems are high-resolution rangers, and depending on configuration, can track to a range of over 32,000 nautical miles with a qualified accuracy of plus or minus three yards RMS.

4.1.2 FPS-16

The FPS-16, a fixed station version of the AN/MPS-25, is located at the PMRF Kokee Park Facility, at an elevation of 3700 feet. The radar instrumentation is permanently installed within Bldg 781, the Radar/Telemetry building. The FPS-16 pedestal is located on the antenna tower, an integral part of Bldg 781. This radar is configured similarly to the Makaha Ridge AN/MPS-25s and features the same equipment characteristics. The elevation of the radar provides a tracking horizon of approximately 90 NM, an additional 30 NM over the Makaha Ridge radar tracking horizon.

Figure 4-3 FPS 16 Kokee Park

4.1.3 AN/FPQ-10

Two AN/FPQ-10 radar systems are part of the PMRF Instrumentation Measurement system. One system is located in the Instrumentation complex at Makaha Ridge. The second system is in the Radar/Telemetry building at the PMRF Kokee facility.

The Makaha Ridge site, at an average elevation of 1,550 feet above sea level looks down on the BARSTUR and BSURE Underwater Tracking Ranges and the PMRF Barking Sands area, 7.3 miles away.

The AN/FPQ-10 radar is a high accuracy, monopulse C-band tracking radar. The system can acquire and automatically track beacon returns or skin echoes. Target present-position range, azimuth, and elevation data are provided as outputs.

The AN/FPQ-10 transmitter provides pulsed RF energy at an output of 1 megawatt, with a pulse width (selectable) of 0.25, 0.5, and 1.0 μs, covering a frequency range of 5450 to 5825 Megahertz. The transmitter PRF is selectable at 160 or 640 pulses per second. The ranger automatically tracks beacon or echo target returns and provides accurate range data of the tracked target to ±5 yards. The ranger also generates triggers and gates that provide synchronization for the radar system.

The console contains the controls and indicators necessary for operation of the radar. The console also contains the receiver local oscillators for the echo and beacon channels.

The digital angle data is produced by two 17-bit binary encoders; one driven by Azimuth and the other by Elevation. The binary data is stored in a register until shifted out by SPARS.

Figure 4-4 FPQ-10 Radar at Makaha Ridge

The AN/FPQ-10 radar is also capable of receiving range and angle data from a remote source. Target position data, in digital form, is received on the data link from the computer system at Barking Sands. It is processed in the SPARS sensor buffer located in the Radar Building at Makaha Ridge and is reformatted and transmitted to the range and angle servo systems of the radar. The AN/FPQ-10 is configured to receive three coordinate acquisition data in range, azimuth, and elevation.

4.2 Surveillance Radar Systems

There are seven surveillance radars supporting the range. Their primary function is to provide the "eyes" for range safety. There are two AN/SPS-67 radars, one AN/SPS-48 (Track-While-Scan) radar, two AN/APS-134(V) radars, and two AN/APS-140 mounted on the RC-26D aircraft.

4.2.1 AN/SPS-67

This surface search surveillance radar is located in the Operations Control Center with its antenna installed atop the microwave tower alongside the building. It is used for detection, ranging, and tracking of surface targets and, to a limited extent, of air targets. All radar data is fed into the Range Facilities Control room, and the information is used primarily for range safety. The radar transmitter is synchronized to the timing system to prevent interference with other PMRF C-Band radars. Surface coverage is

limited to 25 NM. Clear horizon visibility is from 115° True clockwise to 025° True with some obscuring from Niihau Island to the southwest.

Figure 4-5 SPS-67 Radar

4.2.2 AN/SPS-48E

The AN/SPS-48E is an S-Band, 3-D, Track-While-Scan (TWS) Radar located at Makaha Ridge. The system uses an electronically stabilized, ultra low sidelobe antenna consisting of a serpentine waveguide feeding a number of vertically stacked slotted waveguides. The antenna is a 17' x 18' planar array rotating at 15 rpm. The antenna scans nine multiple, simultaneous pencil beams in elevation as a function of the transmitted frequency to achieve a total volumetric coverage of 360° in azimuth, up to 69° in elevation, and out to a range of 220 nautical miles. The nine overlapping pencil beams comprise one elevation beam group.

Up to eight elevation beam groups are positioned at each azimuth location to form the elevation scan. The resulting pattern of beams hits a typical target many times to provide precision accuracy data determining target range, elevation, and azimuth during the radar's comprehensive coverage of the search volume.

Auxiliary Detection Processor (ADP) performs post-detection processing for verification, correlation, and ranking of targets. The ADP also performs data processing including target controlling operations, three-dimensional target tracking, and the generation of track and radar status reports for various users. Video and processed data are forwarded to the Range Operations Control Center via microwave.

Figure 4-6 Makaha Ridge SPS-48E Radar

4.2.3 AN/APS-134 (V)

The AN/APS-134 succeeded the AN/APS-116 ASW airborne surveillance radar specifically designed to detect periscope-type targets under high sea-state conditions. The AN/APS-134 systems used at PMRF have been modified and are employed as general purpose surface search radars to detect vessels operating within the vicinity of the Underwater Tracking Ranges. Each system uses a pedestal with a cosecant squared high gain, narrow beamwidth antenna. Additionally, the receiver subsystem has been equipped with a Retrospective Processor that reduces the effect of sea clutter and increases target resolution.

Figure 4-7 Makaha Ridge APS-134 (External View)

Figure 4-8 AN/APS-134 Unit (Internal View)

There are two AN/APS-134 (V) Surface Search Radars supporting the Range Surveillance function at PMRF. Digitized video surveillance radar data from both AN/APS-134 radars are processed by the Automatic Precision IFF Reporting System (APIS) and are presented to recording and display systems within the Operations Control areas.

One APS-134 is located within the AN/SPS-48E building at Makaha Ridge at an elevation of 1500 feet. The other AN/APS-134 radar site is located on the island of Niihau at Paniau Ridge, at an elevation of 1235 feet MSL. The Navy leases this site from Niihau Ranch. All equipment at the unmanned site is operated remotely from Barking Sands. Niihau personnel provide facility maintenance and supply fuel to the site via existing service contract. Data from this radar is transmitted back to PMRF by a dedicated microwave link.

Figure 4-9 Niihau APS-134

4.2.4 AN/APS-140 Airborne Radar System (C-26)

The two APS-140 (Litton 504(v)5) radars provide airborne surface search. They are installed in two of the three C-26D aircraft permanently assigned to PMRF. This X-band, pulse compression frequency agile system with digital signal processing and scan conversion operates between 8.9 GHz to 9.4GHz.

The radar can be operated on any one of 16 frequency steps, 30MHz apart, within the band in the fixed mode. In a frequency agile mode the radar randomly selects its frequency from 13 or 16 of the available steps. The radar can be operated in search, beacon, or weather modes, and furnishes the operator with radar video up to 200 NM in range and 360° in azimuth. Radar operation in the compressed narrow pulse mode with scan to scan integration and frequency agility reduces sea clutter and optimizes detection of small targets. Surveillance information observed from the aircraft is relayed to Barking Sands via radio.

4.3 Special Purpose Radar System

4.3.1 MK-74 MOD15 Guided Missile Fire Control System (GMFCS) Radar

A modified MK-74 MOD 15 GMFCS is located at Kokee Park site A. The system has both a C-Band Pulse Tracking Radar and an X-Band Continuous Wave Acquisition and Track (CWAT) Radar. The MK–74 MOD 15 system can be used to track targets using either the C-

Band Pulse Tracking Radar or the CWAT or both. The PMRF installation includes a new X-Band Data Acquisition System (XDAS). The XDAS improves the data collection capabilities of the CWAT. X-Band Imaging Data Products can be obtained with the XDAS. The different subsystems within the MK-74 MOD 15 system are the data processor, antenna/director, pulse transmitter, and Continuous Wave Illuminator (CWI).

Figure 4-10 MK-74 Radar

4.4 Other Radars

Additional radars complement PMRF's sensor suite. These external systems are not operated or maintained by PMRF contractor personnel, but radar data from these systems feed into PMRF as additional track data.

4.4.1 AN/FPQ-14 (USAF 30RANS Vandenberg AFB)

The AN/FPQ-14 Radar System is a high accuracy, long range, monopulse tracking system capable of tracking in both skin and beacon modes. It is a collateral sensor in the U.S. Space Command Space Surveillance Network and provides the Air Force 30th Space Wing with accurate trajectory data in support of weapons system testing, space surveillance, and new foreign launches. The AN/FPQ-14 is located at the northwestern most tip of the Island of Oahu, at the Kaena Point Satellite Tracking Station. A main building houses the radar equipment, administrative, and support areas. The antenna is located just outside of the main building. COSIP modification is scheduled for this radar. The radar is operated and maintained by 30RANS Vandenberg AFB.

Figure 4-11 AN/FPQ-14 Radar

4.4.2 AN/TPS-75 (154th HIANG ACW SQ)

The Hawaii Air Guard Mobile Ground Radar is operated by the 154th Air Control Squadron. This tenant unit is located in buildings 1115 and 1116 on North Sidewinder Road. The facility and equipment are used to train air guardsmen for wartime tasking. The squadron is a subordinate unit of the 154th Operations Group (154th OG) under the 154th Wing of the Hawaii Air National Guard (HIANG) located at Hickam AFB. Headquarters of the HIANG is located at Fort Ruger, Honolulu, HI.

The AN/TPS-75 Ultra Low Sideband Antenna (ULSA) is an integral part of the Combat Air Force (CAF) Ground Theater Air Control System (GTACS) Control and Reporting Center (CRC), and the Control and Reporting Element (CRE). It is the radar sensor used to support the CRC/CRE functions of force allocation, surveillance, early warning, weapons control, identification, air traffic regulation, and Theater Missile Defense (TMD). A modification is being developed to provide tracking, classification, and launch/impact point prediction for TBMs detected within its surveillance range. Additionally, a stand-alone Expert Missile Tracker (EMT) Correlator will accept and display TBM tracks from up to 4 EMT modified TPS-75s. The EMT Correlator will also forward relevant TBM data via TADIL B/J TMD message sets.

Figure 4-12 HIANG TPS-75 Radar

The Enhanced ULSA reduces the antenna side lobe levels of the radar set, making the radar more resistant to enemy jamming. When fielded with the AN/TLQ-32 Anti-Radiation Missile Decoy Set, the radar operational capability/survivability is greatly enhanced in an Anti-Radiation Missile (ARM) environment. The receiver signal processor and frequency generator adds 3-D performance and Electronic Protection (EP) features. The AN/TPS-75, by either fiber optic cable or TRI-TAC communications, interfaces with the AN/TYQ-23 Modular Control Equipment (MCE) Operations Modules (OM) via the MCE Interface Group (MIG) installed in the radar shelter. The AN/TPS-75, with its two operator consoles and/or its interface with the MCE OM, supports the GTACS CRC/CRE operational roles in OCA, DCA, strategic attack, interdiction, air refueling, and TMD.

The 154th Air Control Squadron supports USN operations with Radar Services and Data Link. Communications Data Link, commonly referred to as Link 11 or Link 16, has been used in the past in various other operations. The TPS-75 radar has also been used in various operations in a surveillance capacity.

4.4.3 AN/FPS-117 (150th ACW Flight)

The HIANG FPS-117 surveillance radar located at Kokee Air Force Station is operated and maintained by the 150th Aircraft Control and Warning Flight. As part of the early warning system for the state and nation, it functions to identify airborne objects in the Hawaiian Air Defense Identification Zone. Control of the F-15 interceptors that defend the air space is through the Hawaii Regional Operations Center (HIROC) located at Wheeler Army Air Field (AAF) on Oahu. PMRF shares the surveillance radar data through a microwave link from Kokee AFS to Barking Sands.

Figure 4-13 FPS-117 Radar

4.4.4 WF-100 (Kauai Test Facility)

Dual WF-100 X-band radar systems, which are directly interfaced to the wind-weighting computer, track weather balloons above one hundred feet. The balloons gather upper elevation wind information. Wind profile data are gathered with pole mounted anemometers for low elevation winds within the launch field. The primary physical components at KTF are the launch field, the rocket assembly areas, the wind radar, a 16-inch mobile tracking telescope, a power station, and support complex. Most of the electronic systems are housed in the launch operations building which is located in the support complex.

The Kauai Test Facility (KTF) is a Department of Energy rocket launch facility operated by the Sandia National Laboratories. The facility is intended to be utilized in support of development programs at the DOE weapons laboratories; however, other organizations may make use of the facility on a non-interference basis. KTF is a tenant of the PMRF base.

Figure 4-14 KTF Weather Radar

4.4.5 ARSR-4 (FAA)

The ARSR-4 radar is a surveillance radar located at Mt. Kaala on Oahu. The radar provides IFF (Identification Friend or Foe) data to Barking Sands via microwave circuits to Kokee. The former HIANG radar is now operated and controlled by the Federal Aviation Administration (FAA). The surveillance and altitude information provided is used in the control of all air traffic in and out of the Hawaiian Islands. The FAA radar control center is located in the Diamond Head crater.

4.5 Radar Upgrades

Improvements currently in process or recently completed on several radar systems call for the units to incorporate the Digital Receiver (DR) Coherent Signal Processor (COSIP) system. These improved wide band radars will replace several units, two at Makaha Ridge and one at Kokee Park. Another COSIP radar will be a mobile unit with wide band capability situated at Makaha Ridge or located on the new MATSS Platform, supporting operations from the sea.

Currently, PMRF can acquire a 1 square meter (M^2) target out to approximately 300nm and track it to more than 400nm; however, the data will be of limited quality beyond 180nm due to reduced Signal to Noise Ratio (SNR).

Figure 4-15 COSIP Radar

The upgrade will improve the radar system coherency and sensitivity enhancement through coherent integration, multi-gate data recording, and real-time processing and display capabilities. The new capabilities include:

1. Doubling the skin coverage range through real-time coherent integration on most targets
2. Providing 30km of coherent multi-gate data recording
3. Providing interleaved beacon and skin waveforms to support coherent skin multi-gate signature data collection while beacon tracking
4. Providing on-site real-time and/or playback of fully-calibrated engineering unit metric and signature displays including:
   a) trajectory motion-compensated coherent A-Scopes
   b) range-doppler-images (RDI's), RTI's, DTI's
   c) windowed/peak RCS
   d) track residuals
   e) TSPI data

The Wide Band COSIP systems, with the advantage of a large aperture and increased transmitter power, will have a single pulse loop gain sufficient to acquire a target at approximately 1,350nm and track to more than 1,500nm. Once acquired, the system can incorporate coherent integration to provide additional gain, thereby increasing the maximum tracking range to greater than 3,000nm. (If

pointing or cueing data is of sufficient accuracy, coherent integration can be enabled during the acquisition process thereby increasing the acquisition range accordingly.)

Table 4-1 C-BAND RADAR UPGRADE PARAMETERS

PARAMETER	FPQ-10	MPS-25	WB DR COSIP	UPGRADED COSIP MPS-25	KAENA PT FPQ-14
Sensitivity (RFLG) * Single pulse	232 dB(m)	236 dB(m)	258 dB(m)	236 dB(m)	263 dB(m)
Sensitivity (RFLG) .1 sec. Coherent Integration on a Sphere	N/A	N/A	273 dB(m)	254 dB(m)	275 dB(m)
Track Modes	Skin Beacon	Skin Beacon	WB Skin NB Skin Beacon	Skin Beacon	WB Skin NB Skin Beacon
Range-20dB tgt @ 15dB SNR (single pulse)	80 km	105 km	375 km	105 km	480 km
Range-20dB tgt @ 15dB SNR (.1 sec Coh. Int)	N/A	N/A	975 km	300 km	1100 km
Range Resolution	150 m	150 m	.5m(500MHz WB) 37m(8 MHz NB)	150 m	.5m (WB) 37m (NB)
Doppler Resolution	N/A	N/A	.26 m/sec	.26 m/sec	.26 m/sec
Recording Windows	none	none	2 1024 Samples Per window	2 1024 Samples Per window	1 1024 Samples Per window

* RFLG = Signal-to-noise ratio on a 0dBsm target at 1 meter range

Table 4-2 MK74 RADAR PARAMETERS

PARAMETER	C-BAND	X-BAND	XDAS MOD Note 1
Freq. Range (MHz)	5450-5825	10250-10500	N/A
Duty Cycle (µsec)	3.4	CW	N/A
Pulse Width (µsec)	1.8-3.5	CW	N/A
Peak Power Output (kW)	165.0	5.0	N/A
Average Power (dBw)	37.5	38.1	N/A
RANGE Km (instrumented)	468.17	468.17	N/A
Tracking Accuracy	50 Yards (45.7 m) (Tracking)	100 Yards (91.1 m) (Tracking)	N/A
RANGE 20dB tgt @ 15dB SNR (.1 sec Coh. Int)	69183 yds (63 km)	134542 yds (123 km)	134542 yds (123 km)
RANGE RESOLUTION	500 yds (457.2 m)	NA (CW)	
DOPPLER RESOLUTION (.034 sec int)	.4 m/sec	.78 m/sec	.14 m/sec (.1 sec int)
RECORDING WINDOWS	20 min	20 min	

Note 1: The MK-74 XDAS System is an add-on system digital processor and coherent data recording system that works in tandem with the existing MK-74 CW signal processor both operating in the X-Band frequency range. The XDAS allows post event reconstruction, which increases detection of high-speed small targets by coherently integrating longer intervals than the integration period of the embedded MK-74 signal processor.

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5. TELEMETRY SYSTEMS

The PMRF telemetry facilities are located at Makaha Ridge, in Bldg 725 and at Kokee Park, in Bldg 781. At Makaha Ridge, the telemetry site is situated at 1,700-foot elevation, which enables line of sight reception of surface units to ranges in excess of 60 nautical miles. The telemetry systems consist of antennas, receivers, recorders, scoring processor (miss-distance analyzer), and display and decommutation equipment. The Kokee telemetry building, at 3,800-foot elevation, has a direct line of sight up to 90 nautical miles. The systems include antennas, receivers, and digital recorder equipment. Connectivity to Makaha Ridge exists through fiber optic lines, which enables the data acquired from Kokee Park antennas to be displayed at Makaha. Received signals and processed data from both Makaha and Kokee antennas can also be extended down to Barking Sands T&C Rooms via microwave, for range safety monitoring purposes.

Figure 5-1 Makaha Ridge Telemetry

The telemetry antennas consist of three 30-foot and four 14-foot Parabolic Telemetry Tracking Antennas. The GKR-8A 30-foot antennas employ Monopulse feeds; all the other systems use Conical Scan feeds. Either Left-hand or Right-hand Circularly Polarized RF signals in the High S, S, High L, or Low L bands can be selected. All antenna systems are designed to down convert all acquired RF frequencies in all four bands to the P band, 215-315 MHz. Table 5-2 tabulates the characteristics of each antenna.

PMRF Telemetry Site's geographical location contributes to its uniqueness. In comparison with other ranges, the PMRF Telemetry Site is the only site with telemetry tracking antenna systems located at elevations between 1,700 and 3,800 feet above sea level. Because of this prime location and elevation, the tracking capability of these antennas can cover approximately 220° of open-ocean surface and air operations with a line of sight (LOS) tracking range up to 90 nautical miles. All telemetry antenna systems were designed to support U.S. Government approved aeronautical telemetry frequency bands (low L, high L, S, and high S).

PMRF Telemetry Site is one of the few facilities that can fulfill the Department of Defense (DOD) Theater Ballistic Missile Defense (TBMD) telemetry and range safety requirements. In real-time, the systems can receive, record, process, and display up to 18 telemetry data streams and distribute the required data to different range users simultaneously. The collected data can also be routed to multiple locations around the country for real-time data display and monitoring.

PMRF telemetry systems were designed to support both existing Fleet Weapons Training and new Test and Evaluation (T&E) high data rate missile testing. There are more than 80 telemetry receivers capable of receiving a signal up to 20 MHz. To record the received data, there are seven digital recorders with the bandwidth of 64 MHz along with eight 4 MHz analog instrumentation recorders. Three processing systems were incorporated to process and display all current known and projected complex telemetry data formats on the 72 thermal chart recorders.

5.1 Telemetry Equipment

5.1.1 Antenna & Receiver Subsystems

The PMRF antenna and receiver subsystems are capable of tracking seven objects independently and simultaneously. Up to 18 different data sources can be received with backup and redundant capability. These parabolic-dish tracking systems are capable of receiving four separate sources in their respective spectrums. Additional signals can be received when more than one carrier emanates from the same source.

Table 5-1 Antenna & Receiver Equipment

SYSTEM	CONFIGURATION	MAKAHA RIDGE	KOKEE PARK
Antenna Subsystem	GKR-8A (30’ Antenna) (9.14 m)	3	0
	150-14 (14’ Antenna) (4.28 m)	2	2
Receiver Subsystem	Narrow Band	40	4
	Wide Band	24	4

Table 5-2 Antenna Characteristics

ANTENNA TYPE (LOCATION)	ELEVATION	BEAM WIDTH	G/T	GAIN
GKR-8A-#1 (Makaha Ridge) Lat 22°07'46.2535" Long 159°43'25.7169"	1,750' (533.4 m)	1.5° (L-Band) 1.0° (S-Band)	19.3	43.5
GKR-8A-#2 (Makaha Ridge) Lat 22°07'47.6904" Long 159°43'25.3043"	1,765' (538 m)	1.5° (L-Band) 1.0° (S-Band)	19.5	43.5
GKR-8A-#3 (Makaha Ridge) Lat 22°07'46.2535" Long 159°43'5.7169"	1,776' (541.32 m)	1.5° (L-Band) 1.0° (S-Band)	19.6	43.5
150-14 #1 (Makaha Ridge) Lat 22°07'48.945" Long 159°43'26.598"	1,750' (533.4 m)	3.2° (L-Band) 2.0° (S-Band)	14.7	36.5
150-14 #2 (Makaha Ridge) Lat 22°07'49.056" Long 159°43'27.436"	1,750' (533.4 m)	3.2° (L-Band) 2.0° (S-Band)	15.2	36.5
150-14 #3 (Kokee Park) Lat 22°07'24.4737” Long 159°39'55.6384"	3,805' (1160 m)	3.2° (L-Band) 2.0° (S-Band)	14.6	36.5
150-14 #4 (Kokee Park) Lat 22°07'24.933" Long 159°39'55.303"	3,805' (1160 m)	3.2° (L-Band) 2.0° (S-Band)	14.8	36.5

Figure 5-2 Four 150-14 TM Antennas (Left-Kokee Park & Right-Makaha Ridge)

Table 5-3 Recording Equipment

SYSTEM	CONFIGURATION	MR	KP
Recorder Subsystem	Analog Recorder 97 Metrum	8	0
	Digital, BVLDS 64 Metrum	5	1
	Digital, BVLDS 32 Metrum	1	0

5.1.2 Recorder Subsystem

The tape recording subsystem is capable of recording all received data in either analog or digital formats. The bandwidth of the recorders is sufficient to support high data rate telemetry data.

5.1.3 Processing and Display Subsystems

The Telemetry Processing Subsystem or TPS consists of three real-time telemetry units. Each unit processes four PCM streams, two PAM streams, and one Video Doppler simultaneously. A total of six SUN (Ultra-60) workstations and four Bay network hubs located at Makaha Ridge and Barking Sands, Bldg. 105, allow the workstations to communicate over a local area network and exchange processed data via DataViews display package. The DataViews display package provides range users with a graphical display on the workstation and allows the software developer to provide a multitude of graphs including strip charts, bar charts, digital readouts, and a variety of dynamically updated objects

The Telemetry Processing Subsystem is based upon Acroamatics Model 2224V Telemetry Data Processor (TDP) which serves as the heart of the TPS. It is controlled by software running under Sun Microsystems Solaris 2.6 operating system on a Force Computer Sparc Processor. Measurement data, raw or processed, can be outputted to any of the 72 Thermal Chart Recorders or in any combination. The data can also be distributed over the network to display stations.

5.1.4 PMRF Telemetry Improvements

Future plans call for the addition of 12 more wide and narrow band receivers and two more digital recorders.

Table 5-4 Processing and Display Equipment

SYSTEM	CONFIGURATION	MR	KP
Telemetry Data Processor	TDP 2224 V Acroamatics (12 PCM/6 PAM/3 Doppler total)	3	0
Display Subsystem	Thermal Chart Recorder TA 5000 Gould	12	0
	Thermal Chart Recorder TA 6000 Gould	64	0

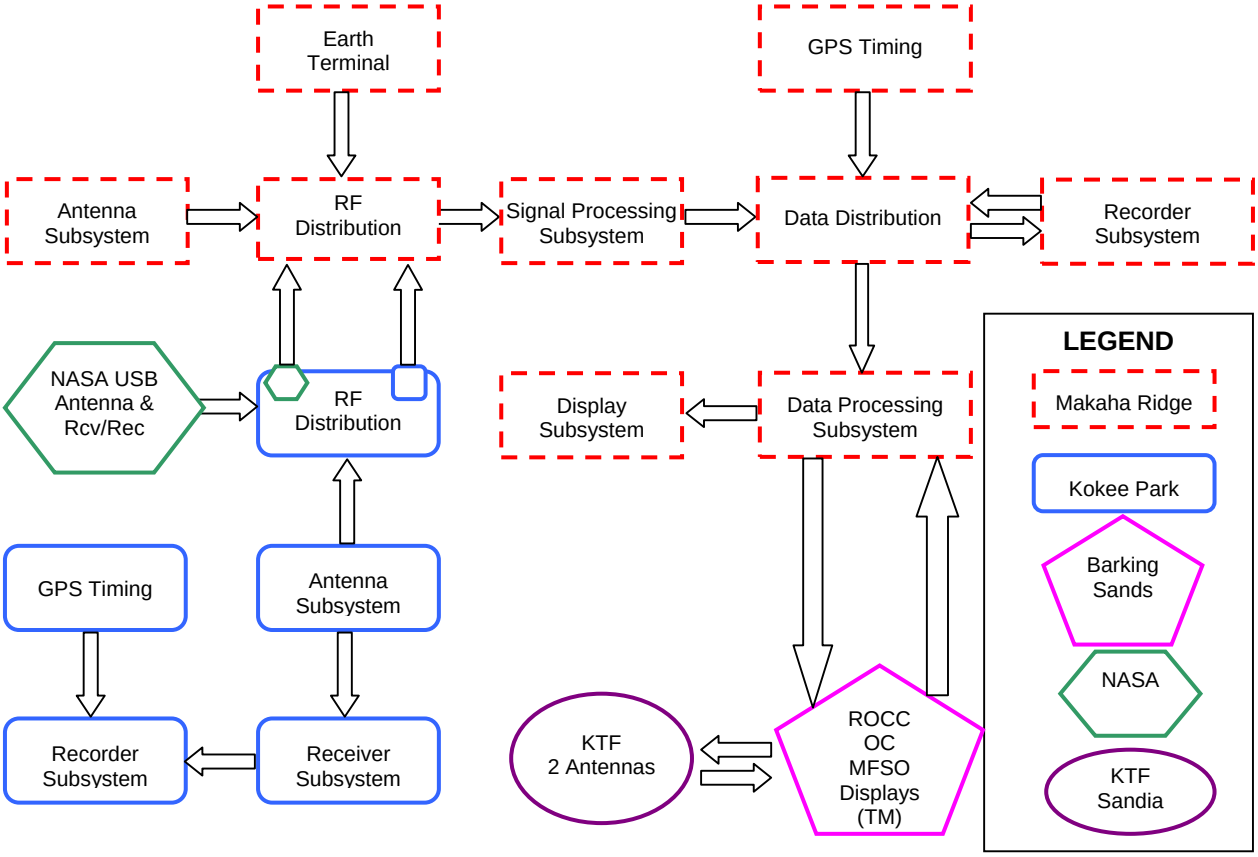

Figure 5-3 PMRF Telemetry Architecture

5.1.5 Modular Telemetry Receiving System MK 77 Mod 0

The Modular Telemetry Receiving System (MTRS) MK 77 Mod 0 is a stand-alone system intended for temporary installation aboard various range platforms requiring only primary power from the platform for operations. The PMRF version of the MTRS is designed as a versatile telemetry receiving/recording system that is capable of accommodating telemeters that conform to IRIG Standard 106-99. It is designed to operate at S-band frequencies of 2200 to 2400 MHz, using Commercial-Off-The-Shelf (COTS) equipment. The MTRS receives the modulated carrier and records the information for subsequent processing. Recording is accomplished by means of optical disk and a magnetic hard disk technology. The disk of the telemetry data recording can later be taken to a land-based analysis center for more detailed analysis.

Figure 5-4 Modular Telemetry Receiving System

5.1.6 Miss-Distance Analyzer (Scoring)

The AN/GSQ-228 is a miss distance analyzer consisting of a computer processor, enhanced graphics adapter and display, keyboard, and printer. A multi-channel recorder is also used for each mission to record the baseband video from the DSQ-50 prior to bit synchronization.

The AN/GSQ-228 processes telemetry data transmitted from the DSQ-50 (an airborne scoring system installed on aerial targets) and provides scoring as an expression of the closest approach from the attacking missile to the target. The system is an active system using the radiating source in the DSQ-50 to obtain ranging information from the attacking missile, and the PCM Telemetry downlink transmitting the Doppler data.

The AN/GSQ-228 receives data from the telemetry receiver through a bit synchronizer, stores it on hard disk, processes the weapon/target intercepts, and provides a time-based output for use in determining miss distance. The AN/GSQ-228 calculates and displays the following data:

- Miss distance
- Time of closest approach
- Closing velocity
- Range and time of warhead detonation
- Indication of confidence for each of the preceding data items
- Raw frequency versus time data
- Computed doppler roll-off curve including correlation coefficient

5.2 KTF Telemetry

Primary recording of telemetry data is carried out at the KTF ground station within the control center. Facilities exist for receiving, decrypting, decoding, and recording P- and S-band telemetry including PCM, PAM, and FM data. A playback and real time capability exists for making real time range safety decisions and for performing limited quick-look data analysis. The telemetry data recorders are wide-band instrumentation devices with electronics for recording and reproducing direct, wide-band group II FM, and digital data. Telemetry reception antennas include a 20-foot S-band auto tracker, a 15-foot S-band computer driven slave, and quad-helix P-band array. Pointing angles are derived from the auto tracker, from propagated state vectors, from radar tracking data or from nominal trajectory predictions.

Figure 5-5 KTF TM Antennas

5.3 NASA Kokee Telemetry

The NASA Kokee Park Geophysical Observatory is part of a network of sites which perform Space Geodesy. The facility is operated by Allied Signal Technical Services Corporation for NASA. The prime system for VLBI (Very Long Baseline Interferometer) is a 20 Meter Radio Telescope which is provided by the Naval Observatory. The frequency band of the telescope is 2.2-2.4 GHz and 8.1-8.9 GHz. The 9 meter diameter USB antenna at the NASA Kokee site will continue to receive improvements. Currently, it only supports frequencies within the 2200-2400 MHz range.

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6. COMMUNICATION SYSTEMS

PMRF Communication Systems support mission requirements for dedicated, switched, and packetized data, voice, video, teleconferencing, and alarm systems.

Communication systems at PMRF are categorized as Base Communication Systems and Range Communication Systems. The two systems, although distinct from one another, are interconnected and interoperable.

The Base Communication systems provide communications with government agencies and commercial businesses. The equipment is principally commercial and subject to deregulation and competition.

The Range Communication Systems use specialized telecommunications, radio, microwave, and underwater equipment to fulfill range operational requirements.

6.1 Communications Backbone

The communication systems transmit voice and data electromagnetic signals between range sites and areas. Transmission media includes wire, radio, microwave and light. Microwave and satellite circuits are linked to the Wheeler Network Segment Center (WNSC) at Wheeler Army Air Field (AAF), Oahu. Voice and data circuits through WNSC access mainland and Western Pacific ranges.

6.1.1 Digital Microwave Systems

Multiple DS3 Microwave systems at PMRF provide voice and data communications between Barking Sands, Makaha Ridge, Kokee Park, and the Hawaii Air National Guard (HIANG) facility at Kokee. Operational circuits and networks can be extended throughout the Hawaiian Islands, Pacific area and CONUS.

The Kokee site is linked to the HIANG microwave system at the DS3 rate, which provides multiple T1 connectivity to Mt. Kaala, WNSC, and HIANG at Wheeler AAF on Oahu. The Mt. Kaala node is connected to the PMRF/Mt. Kaala to Kaena Point DS3 microwave system. There are two circuits dedicated to PMRF in the Air Force link to Wheeler AAF. The Western Test Range (WTR) radar at Kaena Point on Oahu is linked into this microwave system to time phase the WTR radar with the PMRF radars and to transfer radar data between sites.

A microwave link, via a DS2 system between the Range Operations Center and Niihau Island, provides the path for remote control of the AN/APS-134 surveillance radar on Niihau and returns radar data to Barking Sands.

Circuits are integrated in the communication centers into networks, bridging circuits or single line terminations. Comm Centers are located in the Range Operations Center at Barking Sands known as Facility Control (FACCON), Makaha Ridge Communications Bldg 708, and Kokee Park Communications Bldg 765.

Digital switching of multi-channel Compunetix panels in control rooms are used for telecommunication, telephone, and radio circuits.

Figure 6-1 Communications Tower

6.1.2 Analog Microwave Systems

The Makaha Ridge site is linked to Barking Sands via a Hughes AML system for transport of multiple National Television Standards Committee (NTSC) video downlinks.

6.1.3 Fiber Optics

PMRF has a 48/48 multimode(mm)/single mode(sm) fiber optic cable backbone from Range Operations Bldg 105 to the north of the base and a 12/24 mm/sm system to the south. Extensive duct systems at Makaha Ridge and the Kokee sites provide paths for single and multimode fibers.

A 24sm direct buried cable connects the Kokee and Makaha Ridge sites.

The normal minimum complement of fiber to most buildings is 12/12 with larger counts to major communications and operations buildings. Dark fiber is available at all sites to support specialized customer requirements, except on the Makaha Ridge – Kokee fiber.

6.1.4 Copper Cables

PMRF has extensive copper cable plants at Barking Sands, Kokee, and Makaha Ridge. The Makaha Ridge, Kokee sites, Barking Sands Administrative to Range Operations areas, and Bldg 1115 to Bldg 802 areas have cabling placed in duct systems with spare pairs and ducts available. The remaining portions of Barking Sands have direct buried cables.

The Makaha Ridge cable plant was recently modernized. The modern copper cables consist of 22 or 24 awg copper terminated on fused blocks. Most of the long haul direct buried cables consist of pressurized 19 awg cables on non-protected blocks.

6.2 Commercial Service Providers

FTS2001 MCIWCOM/SPRINT, DSN, GST, and Verizon data services can be ordered on a reimbursable basis from Barking Sands Demarcation Bldg 287. Verizon Hawaii and GST have independent fiber optic networks to PMRF which are connected throughout Hawaii via undersea fiber cables. GST has an OC-12 Service Delivery Point (SDP) at PMRF and Verizon can provide a wide range of services including Asynchronous Transfer Mode (ATM), Frame Relay, and dedicated data on a reimbursable basis. Verizon delivers Integrated Services Digital Network (ISDN) Primary Rate Interface (PRI) service to Bldg. 287 but does not offer Basic Rate Interface (BRI). FTS2001 MCIWCOM utilizes Verizon to deliver service to PMRF.

Figure 6-2 GST OC-12 SDP

6.3 Dedicated Point-to-Point Data Transport

A dedicated T1 and T3 data network utilizing the Timeplex Link II and TX3 multiplexers connect Barking Sands with the remote sites at Makaha Ridge and Kokee Park on Kauai, Mt. Kaala, Space and Naval Warfare Systems Activity Pacific (SPAWARSYSACT PAC), and Commander in Chief Pacific Fleet (CINCPACFLT) on Oahu, and the Maui High Performance Computing Center (MHPCC). T1 channels are readily available among the Kauai nodes, with T1 connections off island on a more restrictive, case-by-case basis.

6.4 Switched Data

PMRF maintains an ISDN network with Madge switches at Barking Sands Bldg 105, Makaha Ridge Communications Bldg 708, Makaha Ridge Telemetry Bldg 725, Kokee Communications Bldg 765, and SPAWARSYSACT PAC. ISDN PRI or BRI service can be provided at these and other sites. BRI service can be provided up to 18K feet from these buildings.

PMRF has 3 commercial data/voice PRI trunks from the Madge switch on Oahu with FTS2001 as the long distance carrier. Access to the DSN

is provided at the multiple BRI rate. Range customers can utilize the ISDN to dial up multiple BRIs to provide a T1 connection to mainland sites. The KIV-7 HS can be used for encryption.

6.5 Packetized Data Transport

6.5.1 Unclassified Local Area Network (LAN)

PMRF maintains a 10/100Mbs switched Ethernet fiber LAN to each building with Gigabit connections between the Backbone Switches. Firewall protected LAN drops are available at all buildings throughout Barking Sands, Makaha Ridge, and Kokee. LAN drops to field locations are routinely installed on a reimbursable basis. LAN drops from outside the firewall can be arranged on a case by case basis for mission or tenant requirements.

6.5.2 Wide Area Network (WAN)

The Defense Research Engineering Network (DREN) maintains an ATM OC3 node at PMRF which connects PMRF to SPAWARSYSACT PAC and MHPCC. The MHPCC DREN node connects to the Nationwide DREN at an OC3 rate and provides PMRF access to supercomputers and RDT&E labs and universities across the nation.

PMRF connects, via the SPAWAR node, to CINCPACFLT, Naval Computer and Telecommunications Area Master Station Pacific (NCTAMSPAC), Joint Intelligence Center Pacific (JICPAC), and two University of Hawaii at Manoa sites. The DREN is a reliable asset that is utilized to pass mission data to/from PMRF.

6.5.3 NIPRNET

PMRF accesses the NIPRNET via the DREN.

6.5.4 SIPRNET

PMRF has a T1 SIPRNET node at Range Operations with a limited number of workstations.

6.6 Voice Communication Systems

6.6.1 Satellite

6.6.1.1 INMARSAT Magnaphone

PMRF maintains service for two portable Motorola MagnaPhones, primarily for disaster recovery but also available for operations support.

6.6.1.2 INMARSAT PLANET 1

Four compact portable PLANET-1 INMARSAT systems are available for Range users.

6.6.1.3 IRIDIUM (EMSS)

Two Motorola IRIDIUM handsets are available for range users and provide worldwide satellite communications with connection to DSN and the PSTN via the DISN Gateway at Wahiawa, Oahu.

The Motorola IRIDIUM network has been reorganized under a new company, Iridium, LLC with financial support from DOD.

6.6.2 Radio

6.6.2.1 Mobile Radios

PMRF maintains its own mobile radio network for operational, emergency services, and security purposes. Base stations provide mobile radio coverage throughout Barking Sands and Makaha Ridge. A limited number of mobile radios are available for the Range User, who should submit requests through the PMRF Program Manager. Mobile radio requirements should be included in UDS documentation.

A Range User operating mobile radio equipment on PMRF is cautioned that there are Hazardous Electromagnetic Radiation to Ordnance (HERO) areas within Barking Sands and compliance with PMRF electromagnetic radiation instructions is required. Questions should be referred to the Ordnance Officer.

6.6.3 Switched

6.6.3.1 Telephones

PMRF owns and maintains a NORTEL Meridian 1 Option 81 Release 25 Electronic Private Automatic Branch Exchange (EPABX) which provides telephone service at all PMRF sites.

The EPABX provides access to the DSN with 24 routine precedence tie trunks to Pearl Harbor. Access to the FTS2001 MCIWCOM network for commercial long distance is provided by 48 tie trunks. Verizon Hawaii provides 26 outgoing and 18 incoming commercial trunks. Only credit card toll calls via a 1-800 number may be placed on the commercial trunks.

International calls may be placed utilizing FTS2001 calling cards which can be obtained on a temporary basis from the PMRF Program Managers. Upon request, the PMRF telephone

switch has integrated voice mail available for all telephones.

Figure 6-3 Telephone Key System

Meridian Key systems provide multi-line digital telephones for most users with three digit intercom dialing. External paging speakers can be added to key systems.

A Range User desiring telephone system information may request a copy of the Telephone Directory by sending a request to:

Commanding Officer
Pacific Missile Range Facility
P.O. Box 128
Kekaha, Hawaii 96752-0128

6.6.3.2 Cellular Telephones

Cellular phones are available for authorized customers on Kauai. Cingular is the only provider with adequate coverage at Barking Sands and island-wide. Verizon service is available for users frequenting Oahu or those who require a flat rate nationwide plan. Coverage at Barking Sands is poor to the north and at Kokee is very limited to non-existent. Cellular phones or mobile radios may not be used in ordnance red label areas or in Bldg 105/ ROCC.

6.7 Video

A video distribution system routes all security, launch area, and range video to a matrix switch located in Range Operations. The video switch is programmed to distribute video to customers at the ROCC, Bldg 105 Room Delta, the VTC Bldg 355, and Security Dispatch.

Cameras at the launch area and on the roof of Bldg 105 are utilized to monitor range control and surveillance. Cameras in the ROCC monitor operations and are used to produce documentary videotape records.

6.7.1 Launch and Beach Areas Video

Four video cameras are strategically located in the Launch Area Complex. Remote pan/tilt, zoom, and focus controls for these cameras are in the blockhouse. Monitors within the launch area blockhouse are used by the Launch Control Officer to assure personnel are clear of the pad and adjacent beach areas prior to a launch. One launch area camera can be remotely controlled by the Range Control Officer.

A video camera on the roof of Bldg 105, controllable from Range Control, provides beach and close-in surveillance monitoring. Video outputs from all the cameras are transmitted to Bldg 105 via microwave. The video can be displayed in the ROCC and Range Control.

6.7.2 Video Tactical Analysis and Critique System (VTACS)

VTACS is a video production system used to create color videotapes from operational displays in the tracking and control rooms. There are VTACS systems in ROCC. A video camera, controlled from the VTACS console, is in each control room. A special effects generator, editing monitors, a tape recorder, and provisions for inserting audio and time information are included in the consoles. Videotapes from the VTACS are used for documentary and debriefing purposes.

6.7.3 Extended Range Video System (ERVS)

ERVS, mounted on range helicopters, is used to provide real-time video coverage of events up to 90 miles from PMRF. NTSC video is transmitted back to PMRF over portable video transmitters to Makaha Ridge, then relayed to Bldg 105.

6.7.4 Video Distribution

A video switch and distribution panel is in FACCON for patching and distribution of video camera outputs to the monitors in the Operations Control Center. A numeric generator is available to superimpose time of day on the video. A tape recorder is connected to the patch panel for recording selected camera data.

6.7.5 Video Teleconferencing

PMRF maintains video teleconferencing studios at Bldg 355, Bldg 105 Room Delta, COMSUBPAC Pearl Harbor, and Bldg 216 Pearl Harbor. The VTC systems are DVSG approved for classified and unclassified ISDN connections, which are generally made at 384Kbs.

Figure 6-4 Bldg 355 VTC

The Bldg 105 Room Delta VTC is used for classified operations only.

A PictureTel Montage Multipoint Control Unit (MCU) installed in Bldg 105 Real-time Computer (RTC) allows users with KIV-7 HS encryption to dial in via ISDN at 384Kbs data rates to participate in video teleconferences with up to 12 other users. The MCU is used primarily for the ALI LEAP missions and conferences with the ship at sea via a Hughes VSAT system.

6.8 Alarm Systems

6.8.1 Intrusion Detection Systems (IDS)

PMRF maintains and operates a network based state of the art IDS, which provides continuous protection at all Kauai sites. More sensors or systems can be easily added to provide additional levels of protection or to alarm additional zones.

6.8.2 Fire Alarm Systems

PMRF buildings are protected with a centralized fire alarm system with continuous monitoring.

6.9 Range Conferencing

The unclassifed conference switch is capable of supporting over 300 conferences, which can host an unlimited number of conferees. A typical radio conference would include a radio and several conferees. All HF/VHF/UHF radios at PMRF are interfaced to the conference switch, meaning PMRF can support approximately 150 radio conferences.

The classified conference switch is similar, using KG58's and Analog Narrow Digital Voice Transmission (ANDVT).

Unclassified users are provided Type I keysets capable of monitoring up to 48 conferences simultaneously. Classified users are provided Type II keysets capable of monitoring up to 96 unclassified and 24 classified conferences simultaneously. Both Type I and II keysets provide transmit over one conference at a time. If a user on a Type II keyset selects talk on an unclassified conference, the monitor speakers are muted to assure the classified conferences are not compromised.

Additionally, a 4-part panel is available that monitors four conferences, and selectively will transmit on one conference.

6.10 Radio Communications

The primary radio communication equipment for operations is VHF/UHF radios at Kokee Park, Makaha Ridge, and Mt. Kaala. Line of sight surface coverage from Kokee Park is 90 nautical miles. Surface coverage from Makaha Ridge is 60 nautical miles. UHF radios on Mt. Kaala are operated remotely from Barking Sands via a microwave link. These radios provide coverage between the islands of Kauai and Oahu and supply a means of verifying radio circuit integrity with ships in Pearl Harbor.

HF radio equipment at Barking Sands is located at Kokole Point in Building 802 and in the Nohili area in Building 515. HF communications are used to meet Range Control, Range Navy Tactical Data System Upgrade System (RNUS), and long haul operational requirements.

A CB radio in Range Control is used for communication with local fishermen and surface craft. Range control and control room multi-channel units provide access to the radio equipment at Barking Sands, Makaha Ridge, Kokee Park, and Mt. Kaala.

6.11 Voice Recordings

A 64 channel digital tape recorder is located in the Message Center. This unit routinely records operational circuits used in Range Control and the Control Rooms with IRIG-B and IRIG-E

timing signals. Recorded information is retained for at least 60 days. A digital recorder is located in a secure area of the Message Center to record classified circuits when requested by the Program Manager or Operation Conductor.

A Range User with pre-operational knowledge of voice recording requirements should include this information in UDS Documentation.

6.12 Secure Communications

Secure voice radio communications are available in all control room centers for classified HF, UHF, and Fleet Satellite Communication (FLTSATCOM) voice communications with similarly equipped ships and aircraft. The range boats are equipped for secure voice communications on UHF radio.

Early establishment of range users secure circuit requirements is highly recommended to ensure secure operational circuits can be provided.

STU-III telephones are installed in most of the PMRF program managers' offices. A list of STU-III locations and numbers is included in the telephone directory. A loaner STU-III set can usually be made available in response to a Range User request.

The Battle Management Interoperability Center (BMIC) offers secure connections for surveillance data, Officer in Tactical Command Information Exchange System (OTCIXS), tactical radios, and satellite voice communications. Data and voice formats are derived from FLTSATCOM for Demand Assigned Multiple Access (DAMA) and Non-DAMA communications. Multiple UHF radios and antennas provide secure simultaneous voice and data FLTSATCOM communications. BMIC data elements include:

1. UHF SATCOM secure voice and data
   DAMA
      SATCOM Secure voice
      TADIXS
   Non-DAMA
      OTCIXS
      IRV transmission
2. Global Command and Control System-Maritime (GCCS-M)
   AFLOAT software load
3. Mission Display System Tactical Processor (MTP)
4. SIPRNET Connectivity
      Intelligence feeds from external sources for range surveillance
5. Range Secure Voice and Data
   STU III
   Compunetix intercommunications device
6. Satellite Link 11, RNUS

6.13 Message Center

Naval Telecommunication Center equivalent functions are provided at PMRF by the Network Operations Control Center (NOCC) Message Center in Range Operations, Bldg 105. The Message Center is open 16 hours a day, five days a week, except holidays. Program managers can schedule 24-hour service if operationally required. Full DMS support is provided with copy and local distribution routing for messages up to GENSER Secret. Communication guard shift can be accommodated.

Secure facsimile services are available in the Message Center. The telephone numbers for the secure facsimile are Commercial (808) 335-4442, DSN (315) 471-6442. Verification numbers are Commercial (808) 335-4425, DSN (315) 471-6425.

A Range User requesting Message Center support should include their requirements in UDS Documentation. Requests for Communication Guard Shifts should include release authorization for message pickup.

6.14 Underwater Communications

Submarines operating on the PMRF underwater tracking ranges can communicate with the PMRF control rooms using their WQC high band or low band system. PMRF uses any of the bottom-mounted underwater hydrophones to receive the transmissions. The hydrophone signals are demodulated, and the voice is routed to the control room. PMRF voice transmissions are modulated, amplified, and routed to underwater projectors on the tracking range. There are 13 WQC High Band projectors - 8 for the Shallow Water Training Range (SWTR), 3 for BARSTUR, and 2 for BSURE. These provide high band coverage (8-11kHz) over the entire 1100 square mile tracking area. WQC Low Band coverage is only available on the BSURE range, which contains 2 low band projectors.

Underwater communication can be expanded beyond the range of the fixed, bottom-mounted projectors using PMRF range boat hull-mounted transducers. Communications from the PMRF control rooms can be relayed to and from a submarine by a radio operator on the range boat using the boat's UQC system (WQC High Band).

The SWTR range also has a Low Frequency Alarm capability for submarine safety in shallow water. In the event that an unsafe condition exists and WQC communications are unsuccessful, a beeping 2kHz tone can be activated using 2 bottom-mounted projectors. The submarine sonar room will detect this alarm signal, and the submarine should then surface immediately.

6.15 Timing

There are three functionally identical timing generation and distribution systems at PMRF. One is located in FACCON in Bldg 105. The second system is located at Makaha Ridge Bldg 708 and the third is located at Kokee Park Bldg 765. Standard IRIG time code formats available are A, B, E, G, and H. Sinusoidal and pulse reference frequency outputs are also available.

Each timing system includes two Time Code Generators, two GPS Time/Frequency Systems, and an Alarm and Transfer Unit. There are two Cesium frequency standards in the Barking Sands timing system for the time code generator time base. Makaha Ridge and Kokee timing systems are provided with a Cesium frequency standard.

6.15.1 Timing Signals

Timing signals generated by the timing systems are:

IRIG-A: Basic element rate of 1,000 pulses per second with a time frame of 0.1 second and a binary coded decimal (BCD) time of year code in seconds, minutes, hours, and days.

IRIG-B: Basic element rate of 100 pulses per second with a time frame of 1.0 second and a BCD time of year code in seconds, minutes, hours, and days.

IRIG-E: Basic element rate of 10 pulses per second with a time frame of 10 seconds and a BCD time of year code in seconds, minutes, hours, and days.

IRIG-G: Basic element rate of 10,000 pulses per second with a time frame of 0.01 seconds and a BCD time of year code in seconds, minutes, hours, and days.

IRIG-H: Basic element rate of 1 per second with a time frame of 1.0 minute and a BCD time of year code in minutes, hour, and days.

Sinusoidal Outputs of 1 MHz, 100 kHz, 81.964270 kHz, and 1 kHz.

Pulse Rate Outputs of 1 kPPS, 100 PPS, 10 PPS and 1 PPS.

6.15.2 Distribution

There are five distribution amplifier units at Barking Sands and three each at Makaha Ridge and Kokee Park. Each unit can accommodate 10 dual channel amplifiers. IRIG time signals are distributed in the carrier format via the cable system to instrumentation sites. Time signals can be transmitted via VHF radio upon request.

6.15.3 Visual Countdown and Status Indicators

There are time of day display units and countdown and status display units throughout PMRF. Countdown displays are located in the control rooms and at primary tracking stations. The more common time of day display units are located throughout the technical areas. Both countdown and status display units use IRIG-B as the signal source.

6.16 Frequency Management

PMRF Frequency Manager verifies frequency compliance of PMRF emissions and responds to requests from the Joint Frequency Management Office (JFMO) at Camp H. M. Smith and the Naval Computer and Telecommunications Area Master Station Pacific (NCTAMS PAC) in Wahiawa. Range Users may request frequency monitoring support to protect project frequencies through the PMRF Program Manager or UDS Documentation.

Frequency monitoring is performed on Oahu and Makaha Ridge to protect range and Range Users frequencies during operations. Monitoring facilities on Oahu are at Mauna Kapu and a mobile van staged from Barbers Point. Monitoring equipment is capable of measuring frequency, bandwidth, pulse width, pulse repetition frequency, percent modulation, FM deviation, and a direction finding to an interfering source.

6.17 Command Control/Command Destruct Transmitter (CCT/CDT)

Four UHF Command Transmitter Systems (CTS) are located at PMRF. The systems provide command and control for targets, and command destruct capabilities for targets and missiles. Universal Destruct Panels allow the system to work up to 20 targets and missiles simultaneously. By sequencing with a similar system located on Maui, CTS has the capability of off-axis presentation to the target/missile.

The CTS are controlled from WorkStations located in the Bldg 105 control rooms. In case of relay failure between Bldg 105 and Kokee Park, tone selection can be made at Kokee Park. CTS generates IRIG tones 1-20 in the frequency band from 7.5 kHz to 73.95 kHz. One or more tones, to a maximum of six, can be combined into a single composite signal to modulate the carrier frequency.

Transmitter systems are located in Kokee Park Bldg 765. Each system has two identical FM transmitters whose outputs are connected through switch over control circuitry with the primary transmitter connected to an antenna and the secondary unit connected to a dummy load. Both transmitters are active with code signals applied to each transmitter when the system is in use. The primary transmitter is designed to automatically change over to its secondary transmitter, within 50 milliseconds, if its output power drops more than 3 dB. The form, fit, and function of the PMRF CTS is to Range Commanders Council Standard RCC 319.

Transmitter carrier frequencies are in the 406 to 450 MHz range and can be set in 100 kHz steps. The modulated carrier can be transmitted in linear or compressed form with output power variable from 100 to 1,000 watts. Ten frequencies between 420-450 MHz are authorized for use at PMRF for CTS.

Eight antennas are installed atop a 200-foot tower adjacent to Kokee Park Bldg 765. Four of these antennas are omni-directional and four are directional. The directional antennas have a gain of 12 dB with a beam width of 40°. Pointing of the directional antennas is slaved to TSPI data derived from Range radar returns. One of the directional antennas has an upward tilt of 15° to increase altitude coverage. Surface coverage is provided from a bearing of 140° True, clockwise to 015°True at ranges up to 90 NM with some obscuring from Niihau and Kaula islands to the southwest. Line of sight operating range is at least 200 NM with a directional antenna and at least 60 NM with an omni-directional antenna. PMRF's C-26 aircraft provides a Flight Termination System (FTS) relay extension for OTH Command Destruct.

Four command control receivers, located in Bldg 765, receive transmitted signals, separate the tones, and display each channel on a panel. Output can be sent to Bldg 105 T&C Rooms and to the Bldg 105 Facility Control for recording. Four more receivers, located in Bldg 105, use a rooftop antenna to receive transmissions from the omni-directional antennas at Kokee Park. Directional antenna signals can only be received when the rooftop antenna is pointing south. In addition to receiving the signals, the receivers at Bldg 105 also have record and time stamp functions.

Table 6-1 CCT/CDT Equipment Summary

EQUIPMENT	BS	KP
Command Transmitters		4
Directional Antennas		4
Omni-directional Antennas		4
Receivers	4	4

6.18 Range Users Responsibilities

Range Users operating on the range are in communications with Range Control and the Operations Conductor via RF or underwater communications. PMRF will provide a Communications Plan and/or pre-operation briefing instructions for using range communication systems during operations. A Range User is responsible for complying with these instructions.

Range Users operating their own radiating systems on the range or base are responsible for complying with PMRF frequency management procedures. Typically, an EMI/RFI study will be required prior to radiating a system on the range. Special emphasis shall be placed on procedures affecting hazards to personnel. A description of a Range User's radiating systems characteristics should be included in the UDS Program Introduction.

Range Users in multi-range programs will become involved with inter-island transmission of unclassified and classified, voice and/or data communications. Requirements should be included in the UDS Program Introduction.

IRIG timing signals are generated and distributed by PMRF resources. Range Users with timing requirements for project systems should incorporate these requirements in the UDS Program Introduction.

Operational communications and telephone requirements should be included in the UDS planning documentation. Range Users requesting temporary or permanent occupancy of base facilities should include telephone and telecommunication requirements.

6.18.1 Automated Information Systems (AIS) Security Procedures

Users desiring to connect AIS equipment to the PMRF network must have either an Interim Authority to Operate (IATO) or a complete and fully executed Certification and Accreditation (C&A) package. The IATO or C&A will be addressed by a Memorandum of Agreement (MOA) signed by cognizant authority for PMRF and range user. Contractors or vendors must have Defense Security Service (DSS) signatory approval.

6.19 Summary

Range Users desiring additional communication systems information should address their inquiry to:

Pacific Missile Range Facility
Hawaiian Area, Barking Sands
P.O. Box 128
Kekaha, Hawaii 96752-0128

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7. ELECTRONIC WARFARE

PMRF Electronic Warfare (EW) assets are available to conduct training exercises on the Barking Sands ocean ranges, land areas on Kauai, Pearl Harbor, Kaneohe Marine Corps Base Hawaii, Barbers Point, and in Special Training Areas on the islands of Hawaii and Niihau.

On Kauai, the EW instrumented site is located on Makaha Ridge at an elevation of 1500 feet Mean Sea Level (MSL). The island of Niihau has an EW instrumented site located at the Perch Site at an elevation of 1083 feet MSL. Both sites cover the entire underwater range.

Mauna Kapu, in the Waianae Mountain Range, is the major EW instrumentation site on Oahu. Mauna Kapu is eight nautical miles northwest of Pearl Harbor at an elevation of 2539 feet MSL. The site covers the Pearl Harbor area and its seaward approaches with a near unobstructed 190-degree view of Pearl Harbor, Barbers Point, and the ocean area to the south and west.

EW portable systems can be operated at various locations throughout the state of Hawaii and can also be installed on PMRF's Weapon Recovery Boats (WRB's), unmanned aerial targets, and Seaborne Powered Target (SEPTAR) boats.

7.1 Electronic Warfare Terminology

Electronic Warfare is the military action involving: (1) the use of electromagnetic and directed energy to determine, exploit, reduce, or prevent hostile use of the electromagnetic spectrum and (2) the actions which retain the friendly use of the electromagnetic spectrum. There are three major subdivisions within Electronic Warfare. These are:

Electronic Warfare Support (ES) is the action to search for, intercept, locate and immediately identify radiated electromagnetic energy for the purpose of immediate threat recognition.

Electronic Attack (EA) is the action taken to prevent or reduce an enemy's effective use of the electromagnetic spectrum.

Electronic Protect (EP) is the action taken to ensure friendly effective use of the electro-magnetic spectrum despite the enemy's use of EA.

7.2 PMRF, Makaha Ridge, Kauai

The Makaha Ridge EW site is located at 22°8'4.1"N, 159°43'42.3"W, at an elevation of 1500' MSL. The site has coverage from 220° True clockwise to 340° True and has a line of site out to approximately 50 nautical miles (NM). During Range operations, the Makaha Ridge EW call sign is "Best Bet" and communication with the site can be made on 383.6 Megahertz (MHz) (uncovered).

Figure 7-1 Makaha Ridge EW BLDG

The EW resources on Makaha Ridge are located in the EW Bldg 770. The capabilities of the threat emitters and jammers include simultaneous transmissions, as well as dynamic parametric changes during operations. All of the equipment and capabilities are described in the following sub-paragraphs. Table 7-1 in the back of this section summarizes the Makaha Ridge site capabilities.

7.2.1 Combat Electromagnetic Environment Simulator (CEESIM)

The CEESIM system at Makaha Ridge is a computer-controlled threat radar system capable of simulating a variety of signals from 2-18 Gigahertz (GHz). The simulated radar threats are computer generated and transmitted through two 1-kilowatt Traveling Wave Tube (TWT) systems, one for 2-8 GHz and the other for 8-18 GHz signals. The CEESIM is capable of simulating a dense radar threat environment with as many as 128 simultaneous transmissions.

Figure 7-2 CEESIM Antennas

Two dish antennas, one for each band, are mounted on a single pedestal and are capable of tracking air and surface platforms on the PMRF Range. The 0.5-8 GHz dish antenna has a beam width of 35° with a gain of 11 dBi at 0.5 GHz, and a beam width of 2.6° with a gain of 36 dBi at 8 GHz. The 8-18 GHz dish antenna has a beam width of 6° with a gain of 28 dBi at 8 GHz, and a beam width of 2.4° with a gain of 34 dBi at 18 GHz.

The system controller is a computer which is capable of simulating individual threats or complex threat scenarios involving steady, conical, sector, circular, raster, palmer, helical, spiral, track–while-scan, multi-beam, electronic, lobe switching, orthogonal, and synchronized scans.

New and revised threats can be programmed into computer scenarios to support unique range user requirements prior to the exercise.

7.2.2 I/J-Threat Emitter Simulator (I/J TES)

The I/J-TES simulator at the Makaha Ridge EW site uses two AN/DPT-1(V) Radar Transmitter Sets. One transmitter has an I-Band magnetron operating in the 8.5-9.6 GHz frequency range and the other transmitter has a J-Band magnetron operating in the 14.0-15.2 GHz range. The I-Band and J-Band simulators share a high gain, narrow beam parabolic antenna for long range uses and also have horn antennas for lower gain, wide beam close in uses. The maximum ERP for the system is 108 dBm.

Independent pulse and scan generators provide circular, steady, unidirectional and bi-directional scan patterns. The I/J-TES system is computer controlled with program provisions to change magnetron tuning between threat transmissions and to change output power level attenuation up to 20 dB during a threat to simulate an approaching weapon. The antennas are installed on a pan tilt pedestal and are capable of tracking air and surface platforms.

7.2.3 H, I, and J-Band Threat Emitter Simulators (TES)

Figure 7-3 H, I, and J Threat Emitter Simulator (TES)

Three manually controlled threat emitter simulators, based on the AN/DPT-1(V) radar transmitter sets, are housed in domes on the platform atop the EW building. The H-Band system is capable of operating from 7.8-8.5 GHz, the I-Band from 8.5-9.6 GHz and the J-Band from 14.0-15.2 GHz. Horn antennas are mounted on each of the TES systems. The H and I-Band horns have a beam width of 12° and a gain of 22 dBi, giving an overall system ERP of 100.5 dBm. The J-Band horn has a beam width of 12° and a gain of 24 dBi, giving an overall system ERP of 102.5 dBm. Tuning of the magnetrons is accomplished manually, while scan and pulse generators such as the Silver Box II (SBII) and the Portable Automatic Radar Simulator-2 (PARS-2) are fed into the transmitters to simulate radar signals. Both scan and pulse generators simulate circular,

direct, unidirectional and bi-directional scan patterns.

7.2.4 Response Monitor/Frequency Interference Control System

The Response Monitor/Frequency Interference Control system consists of two independent receiver systems, both located on Makaha Ridge. The first system, located at the FIC Trailer Site, is the SENSYS Low-Band system with frequency coverage of 120 MHz to 500 MHz. The second system is the ST Research system, located in the EW Building, with frequency coverage of 500 MHz to 18 GHz. Both systems are capable of Direction Finding (DF) signals on the PMRF Range with rotating antennas, as well as monitoring voice and data transmissions via omni-directional antennas. Relative signal strengths of signals can be measured, however, neither system is calibrated to take precise and accurate field strength measurements. The two systems are primarily used for Frequency Interference Control (FIC) work, as well as monitoring jamming responses from participants on the Range.

Figure 7-4 SENSYS DF and OMNI Antenna

The SENSYS Low-Band FIC System is located in the trailer situated on the top portion of the Makaha Ridge Instrumentation Site, but is capable of being remote-controlled from the Range Operations Bldg 105 at Barking Sands or the Makaha Ridge EW Bldg 770. The system is able to monitor communication signals on-site from 10 kHz to 1.3 GHz with its omni-directional antenna and radio receiver. For remote-control direction finding (DF) purposes, the sensitivity of the system is minus 107 dBm at the 50 kHz bandwidth, and has a DF accuracy of $\pm 3^{o}$ throughout the band from 120 MHz to 500 MHz.

The ST Research System is co-located in the Makaha Ridge EW Bldg 770 along with all of the EW threat emitter systems. The ST System covers a wide frequency range with audio outputs and polar displays but is capable of only local manual control. The sensitivity of the system is minus 100 dBm, with a DF accuracy of $\pm 3^{o}$ and covers the frequency range from 500 MHz to 18 GHz. The spectrum analyzer portion of the system is capable of printing real-time plots of signals for later analysis.

7.2.5 Countermeasures Systems

7.2.5.1 ALT-41/42 (B/C-Band) Jammer

Countermeasure systems in the B- and C-Band are provided with the ALT-41 and ALT-42 systems. The land-based version of the ALT-41/42 systems are combined into a single white enclosure box and is transportable to various locations on Kauai and Niihau. The transmitter power in each of the systems is 100 Watts. The beam width of the ALT-41 is 70^{o} and its antenna gain is 8 dBi, while the beam width of the ALT-42 is 50^{o} and its antenna gain is 10 dBi.

The frequency coverage is as follows:

ALT-41 B-Band:	425 - 445 MHz
ALT-42 C-Band:	902 - 928 MHz

The jamming modes for each of the systems are as follows:

1. SPT Continuous Spot Noise
2. NCDB Spot Noise Countdown Blink
3. NSAM Noise Swept Amplitude Modulation
4. BAR Continuous Barrage Noise
5. BCDB Barrage Countdown Blink
6. BSAM Barrage Swept Amplitude Modulation
7. SWPT Swept Noise

7.2.5.2 AN/DLQ-3 (D, J-Band) Jammer

The AN/DLQ-3 Jammer systems provide countermeasure systems in the D- and J-Bands. The land-based version of the AN/DLQ-3 systems are fitted into individual white enclosure boxes and are transportable to various locations on Kauai and Niihau. The transmitter power in each of the systems comes from a 100-Watt Traveling Wave Tube (TWT). The beam width

of the D Band jammer is 30° and its antenna gain is 9 dBi. ERP is from 57-62 dBm.

The frequency coverage is as follows:

D Band: 1.0 GHz to 2.0 GHz

J Band: 11.0 GHz to 18.0 GHz

The jamming modes for each of the systems are as follows:

1. SPT Continuous Spot Noise
2. NCDB Spot Noise Countdown Blink
3. NSAM Noise Swept Amplitude Modulation
4. BAR Continuous Barrage Noise
5. BCDB Barrage Countdown Blink
6. BSAM Barrage Swept Amplitude Modulation

The AN/DLQ-3 is a manually operated system, which is most effective against radar systems operating at a specified frequency and mode. To maximize noise jamming and deceptive EA effectiveness, pre-operational adjustments of the modulation parameters are made with knowledge of the radar frequency that the EA system is to work against.

7.2.5.3 AN/ULQ-21(V) (I-Band) Jammer

The AN/ULQ-21(V) Jammers are all capable of providing radar jamming in the I-Band from 9.0-10.5 GHz and are available in two variants at PMRF. Variant 27, capable of jamming on three individual frequencies simultaneously, is enclosed in a white environmental enclosure and is transportable to various sites on Kauai and Niihau. Variant 29 is also contained in an enclosure and is transportable to various sites; however, it is presently located at the Makaha Ridge EW site. Variant 29 is capable of jamming on a single specific frequency with various modes and is also capable of dynamic changes to match a victim's radar frequency with the use of its receiving antenna.

Each variant of the AN/ULQ-21(V) consists of the same type of 100-Watt TWTs as the AN/DLQ-3 jammers and is capable of being programmed against certain specific shipboard radar. Jamming modes include Wide Band Tone, Swept, Multiple Swept, Random Jump, Multiple Random Jump, Blink, Spot, and Barrage Noise.

7.2.5.4 AN/ULQ-26(V) Jammer

The AN/ULQ-26(V) system is capable of providing jamming in the E/F-Band from 2.0-4.0 GHz from land-based sites or seaborne platforms.

Figure 7-5 ULQ-21(V29), ULQ-26(V) and the ALT 41/42 Jammers

The primary use of the AN/ULQ-26(V) jammer is to provide effective SPY-1 jamming against AEGIS ships. There are a total of three systems available on the Kauai Range. One system is currently located at the Makaha Ridge EW Site, one at the Perch Site on Niihau, and one system on the TWR Range Boat. The transmitter of the AN/ULQ-26(V) is the same type of 100-Watt TWTs, which are used in other PMRF countermeasures systems. All AN/ULQ-26(V) systems are identical and are able to transmit on up to three frequencies simultaneously. The beam width of the AN/ULQ-26(V) is 10° and the antenna gain is 10 dBi.

7.3 Niihau Perch Site

The Niihau Perch Site is located at an elevation of 1083 feet MSL with coordinates of 21°57'22.5"N, 160°05'1.8"W. The site has coverage from 0° True clockwise to 90° True and line of site out to 40 NM.

On this site are three 20-foot diameter domes, antenna poles, and a 40-kW generator. Two domes, closer to the ocean, are designated as emitter/jammer domes. The emitter/jammer domes are equipped with pedestals, which are able to direct as many as eight directional transmitters and antennas in Azimuth and Elevation. The center dome, which is located behind the emitter/jammer domes, is used for storage and communications equipment. It contains spare parts, the remote-control generator starting system, and the future equipment racks for a microwave system which

will link the Perch Site to the Makaha Ridge EW site on Kauai in FY 02. A battery bank located in one of the domes is trickle-charged by solar panels to maintain limited power for the on-site equipment.

A variety of emitters and jammers are capable of being transported to the site via helicopter and manned during an operation. In FY 02, a new emitter system and jammers on the site will be remote-controlled.

Figure 7-6 EW Perch Site on Niihau

The current configuration for the site includes a remote-controlled I-Band Surface Threat Emitter (STE) located in one of the emitter domes. The STE is capable of simulating several different types of coastal surveillance radar. The remote-control function for the STE is in the EW Building on Makaha Ridge and is used in conjunction with EW scenarios being transmitted on the Range.

7.4 PMRF Oahu EW Support Facilities and Systems

7.4.1 Mauna Kapu EW Site

The Mauna Kapu EW Site is located at 21°23'55.1"N, 158°06'17.5"W and is at an elevation of 2,570 feet MSL. The site is located in the Waianae Mountain Range and is equipped with an 80-foot antenna platform tower and a 20-foot diameter dome, on the top level, which houses all of its emitter equipment. The Mauna Kapu EW Facility covers all of the Pearl Harbor Naval Station as well as the Southern Operating Areas (SOA) south of Oahu out to a range of 65 NM. The bearing coverage from Mauna Kapu is 120° True, clockwise to 310° True and supports Electronic Warfare Training, Frequency Interference Control (FIC), Naval Gunfire Support (NGFS) beacon checks, and Outboard Stimulator Exercises. During all operations, the Mauna Kapu EW call sign is "Fly Trap" and communication with the site can be made on 383.6 MHz (clear voice). At the base of the tower is the Electrical/Maintenance Building where all the equipment racks are kept as well as a repair facility for on-site equipment.

Figure 7-7 Mauna Kapu Facility

All of the Mauna Kapu equipment and its capabilities are described in the sub-paragraphs which follow. Table 7-1 summarizes the Mauna Kapu EW equipment capabilities, as well as information on the rest of Oahu's EW capabilities.

7.4.1.1 Threat Emitter Simulators

Three manually controlled threat emitter simulators based on the AN/DPT-1(V) radar transmitter set are housed in the environmental dome on the platform atop the Wooden Antenna Tower. The H-Band system is capable of operating from 7.8-8.5 GHz, the I-Band from 8.5-9.6 GHz and the J-Band from 14.0-15.2 GHz. Horn antennas are mounted on each of the TES systems. The H- and I-Band horns have a beam width of 12° and a gain of 22 dB, giving an overall system ERP of 100.5 dBm. The J-Band horn has a beam width of 12° and a gain of 24 dB, giving an overall system ERP of 102.5 dBm. Tuning of the magnetrons is accomplished manually, while scan and pulse generators such as the Silver Box II (SBII) and the Portable Automatic Radar Simulator-2 (PARS-2) are fed into the transmitters to simulate radar signals.

Both scan and pulse generators simulate circular, direct, unidirectional and bi-directional scan patterns.

Figure 7-8 AN/DPT-1(V) Radar Transmitter Set

7.4.1.2 Frequency Interference Control (FIC)

The Mauna Kapu EW Site has several receiver systems that can monitor DF signals during operations and when the Joint Frequency Management Office Pacific (JFMOPAC) requests assistance during Radio Frequency Interference (RFI) investigations. Because all of the equipment does not have a remote control capability, the equipment is manned only when required for EW operations or RFI investigations. Upon receipt of a request for RFI support, the Mauna Kapu FIC systems can be in operation within 45 minutes.

The equipment used for FIC support at the Mauna Kapu EW Site is as follows:

- ICR-9000 Wide Band Receiver (100 kHz - 1999.8 MHz)
- T-1200 Scanning Receiver (100 kHz - 999.99 MHz)
- TC-5120 DF Antenna (Used with T-1200)
- AN/WLR-1 High Resolution Receiver (50 MHz - 10.75 GHz)
- AN/WLR-11 ESM Analysis Receiver (7.0-18.0 GHz)
- MX 9414 Digital Pulse Train Sorter/Analyzer (measures signal parameters received by WLR-1 and WLR-11)

7.4.1.3 Naval Gunfire Support (NGFS)

The AN/PPN-19(V) Transponder Set is a marker beacon used for directing NGFS from surface ships. The unit is fully self-contained or may be powered by an external source. In operation, the unit receives radar signals from ships or aircraft and transmits coded reply signals that are displayed back to the interrogator, thus indicating the position of the target.

The AN/PPN-19(V) transponder has the following capabilities:

1. Seven different coded response signals
2. Two transmit frequencies (I- and J-Band)
3. Three receive frequencies (I-, J-, and K-band)
4. Remote control
5. Omni-directional and directional antenna
6. Waveguide switch
7. All-weather operation
8. Built-in self-test circuits
9. External power capability
10. Transmit pulse repetition rate from 1 pulse-per-second (pps) to 4,000 pps
11. Power output of 200 watts
12. Directional antennas are 15^{o} above horizontal and 50^{o} wide

Support for NGFS beacon checks is available from the Mauna Kapu EW Site with ships either in-port at Pearl Harbor or while operating in the Southern Operating Area (SOA) south of Oahu and is used only for system check outs, not actual firings.

7.4.1.4 Outboard Stimulator System (OSS)

Outboard Stimulator operations are conducted periodically by personnel from the Naval Security Group Activity (NSGA) in Pearl Harbor. With prior coordination for certain HF frequencies, NSGA personnel conduct Outboard training from the Mauna Kapu EW Site with ships underway and also with ships in-port Pearl Harbor. HF Radios located in the Equipment/ Maintenance Building at Mauna Kapu are integrated with NSGA coding equipment, transmitting several different formats of data such as ASCII, RTTY, Morse, and Baudot via the HF antenna system on the wooden antenna tower.

The on-site HF radio equipment is available for any Fleet User who requests Outboard Stimulator training and provides the necessary software and coding equipment.

7.4.2 Barbers Point Maintenance Facility

Figure 7-9 PMRF Contractor Facility at Barbers Point

A contractor operated systems maintenance facility is located on the former Barbers Point Naval Air Station in Building 1769 and in part of Building 1767, on land still under U.S. Navy jurisdiction. All portable emitters, generators, radar tracking beacons, Large Area Tracking Range (LATR) packages, and a low power ULQ-26(V) jammer are stored, maintained, and serviced from this location. The EW Mobile Van and FIC Chase Van are both staged from this facility and are the primary vehicles used for supporting all PMRF EW operations on Oahu.

7.4.3 EW Mobile Van

The EW Mobile Van is equipped with the Lightweight Electronic Warfare Trainer (LEWT) threat emitter system and is capable of being driven to almost any location on Oahu to support operations. The LEWT system is composed of two Traveling Wave Tube (TWT) based systems with one operating from 2-8 GHz and the other from 8-18 GHz. The LEWT system can transmit in the two bands simultaneously and can simulate many modern day complex-scanning radar. Because the LEWT transmits through TWT systems, support is limited to in-port Pearl Harbor and near-shore (less than 10 NM) operations. For operations requiring less complex radar simulations, up to three higher power AN/DPT-1(V) Radar Transmitter Sets can be transported and used with the EW Mobile Van.

Figure 7-10 Mobile EW Van on Oahu

7.4.4 Frequency Interference Control (FIC) Chase Van

The FIC Chase Van is used primarily to support RFI investigations that require mobility in order to track down a frequency interference problem. It is capable of being driven to almost any location on Oahu and has portable equipment that can be set up in only a few minutes to DF signals. The Frequency Monitoring and Direction Finding Equipment in the FIC Chase Van is as follows:

- T-1200 Scanning Receiver (100 kHz and 999.99 MHz)
- TC-5120 DF Antenna (used with T-1200 receiver)
- EMC-60 Superhet Analyzer (0.5-18 GHz range, has limited DF capability with horn antenna)

Figure 7-11 FIC Chase Van on Oahu

7.5 Portable EW Equipment

PMRF Portable Simulators are used in remote field operations where no existing support facilities exist. The portable systems have been used throughout the State of Hawaii to support Fleet training exercises, including large-scale operations such as JTFX and RIMPAC. The systems are small enough to allow transport via truck or aircraft and can be set-up in a relatively short time, depending upon the number of frequency bands that are required. Radar simulations include Surface-to-Air Missile (SAM) threats, coastal surveillance, surface platforms, missile homers, and airborne platforms.

PMRF operates three types of portable EW simulators in the field. The first type is the portable AN/DPT-1(V) simulator system, the second is the AN/UPT-2A(V) simulator system, and the third type is the Portable Threat Emitter Simulator (PTES) system. Portable 5-kW generators provide the power source for remote EW systems.

7.5.1 Portable AN/DPT-1(V) Threat Simulator

The portable AN/DPT-1(V) simulator system consists of the AN/DPT-1(V) transmitter and a scan and pulse generator, either the PARS-2 or the Silver Box II.

The portable AN/DPT-1(V) simulator system is a manually controlled system tailored for land-based applications at remote field sites or seaborne platforms. The portable system is available in the H-Band from 7.8-8.5 GHz, I-Band from 8.5-9.6 GHz, or J-Band from 14.0-15.2 GHz. In field operations, up to two RF bands may be operated off of a single 5 kW generator and as many as four bands may be set-up at a single site. One EW technician operates the scan and pulse generator along with the frequency adjustment, while another EW technician controls the direction of the horn antenna. The H- and I-Band horns have a beam width of 12^{o} and a gain of 22 dB, giving an overall system ERP of 100.5 dBm. The J-Band horn has a beam width of 12^{o} and a gain of 24 dB, giving an overall system ERP of 102.5 dBm. A crew of two EW technicians is able to set-up a portable AN/DPT-1(V) system with two RF bands in less than 30 minutes in an area approximately 500 square feet.

Figure 7-12 Portable AN/DPT-1(V) Threat Simulator

7.5.2 Portable AN/UPT-2A (V) Threat Simulator

The AN/UPT-2A(V) system is similar to the AN/DPT-1(V) system but is capable of providing an improved range of signal parameters. This system gives the added capability of selectable pulsewidths between 0.2 to 1.2 microseconds, and higher pulse repetition frequencies (PRF) than its predecessor. The H-, I-, and J-Band horns have a beam width of 20^{o} and a gain of 21 dB, giving an overall system ERP of 99.5 dBm. The system is composed of two transportable fiberglass boxes mounted on a lightweight aluminum tripod.

Figure 7-13 Portable AN/UPT-2A(V) Threat Simulation System

One of the boxes contains the transmitter unit and the other contains the power supply and signal generator. The portable systems are available in the H-Band, which covers 7.8-8.5 GHz, I-Band, which covers 8.5-9.6 GHz, or J-Band, which covers 14.0-15.2 GHz. The systems are highly portable with a pick-up truck or helicopter and can be set up anywhere with a portable 5-kW generator. A clear area of approximately 500 square feet is required and set-up time is under 30 minutes for two systems used simultaneously from the same site.

7.5.3 Portable Threat Emitter Simulator (PTES)

The PTES system is a computer-controlled simulator system based around the AN/UPT-2A(V) transmitter. It is available in the E/F-Band which covers 2.9-3.1 GHz, H-Band which covers 7.8-8.5 GHz, I-Band which covers 8.5-9.6 GHz, Low J-Band which covers 14.0-15.2 GHz, and the High J-Band which covers from 16.0-17.5 GHz. The E- and F-Band horns have a beam width of 9.5^{o} and a gain of 21.7 dB, giving an overall system ERP of 104.7 dBm. The H- and I-Band horns have a beam width of 10^{o} and a gain of 21.5 dB, giving an overall system ERP of 103.3 dBm. The J-Band horn has a beam width of 10^{o} and a gain of 22.5 dB, giving an overall system ERP of 104.3 dBm. Based on a DOS 486 computer, the PTES can store thousands of different radar signatures and hundreds of scenarios, depending on the complexity of each signal and scenario. Scenarios can be executed automatically based on a pre-scripted timetable or manually, allowing real-time adjustments to be made during operations. The PTES is capable of producing high fidelity signals and can simulate complex scans involving jitters and staggers. It also integrates a Ferrite Attenuator, which is used to simulate platform closures against ships. The system utilizes a computer waveform board and ferrite attenuator to simulate realistic scan patterns, including variable sidelobe levels, and can also simulate range closures at different speeds.

The PTES system consists of six cases and a tripod. The cases contain the power distribution assembly, interface assembly, computer system, RF assembly, antenna assembly, and the modulation section. Depending on the RF band to be deployed, and the amount of available space at the emitter site, the PTES system may consist of as little as four cases or all six cases plus the tripod. A 5-kW generator or 110 VAC with a 30-Amp breaker can supply power to one PTES system. A crew of two EW technicians is able to set-up two PTES systems in approximately one hour in a clear area of 500 square feet.

Figure 7-14 PTES at Remote Site

Each PTES system consists of one control system and one RF transmitter box. PMRF has a total of four PTES control systems and five RF transmitter boxes that can be utilized in the field in support of remote EW operations or be used to augment existing EW sites on Oahu, Niihau, and Kauai.

7.5.4 Portable AN/ULQ-26(V) Jammer (low power)

The AN/ULQ-26(V) Jammer is similar to the system on Kauai. Because it is used only for Pearl Harbor in-port training, and because of restrictions for frequency interference on Oahu, it has been configured for low power transmissions only. Though the output of the jammer is less than 1 watt, the system is still highly effective for SPY-1 training purposes because of the close proximity of the system to the ships. The AN/ULQ-26(V) is transported as required to Pearl Harbor and set-up in the Harbor Control Tower which overlooks the AEGIS ships at pier side.

7.5.5 Surface Threat Emitter (STE)

Three STE simulators are available for operations while on the Kauai Range at PMRF or in-transit operations. STEs are typically installed on QST-35 Seaborne Powered Target (SEPTAR) boats, hulks, the Weapon Recovery Boat (WRB), or Torpedo Weapon Retriever (TWR) Boats when required for operations to simulate a hostile surface search radar from surface platforms.

The STE consists of an AN/DPT-1(V) transmitter, a rotating antenna, antenna pedestal, and antenna drive motor with provisions for local and remote control. A six or eight foot antenna is used with the STE systems. The antenna has four angled elevation settings, which consist of 0^o, 12.5^o, 15^o and 20^o. The H- and I-band magnetrons can be exchanged in the STE system to provide an operating frequency range, limited by the antenna at the low end, to 8.4 GHz. The upper frequency of the system is 9.6 GHz. Scan rates of the STE system can be set from 1.5 to 12 seconds per revolution and the azimuth beam width is 1.2^o while the elevation beam width is 20^o.

7.5.6 High Frequency (HF) Beacons

HF Beacons are used on both QST-35 SEPTARS and Range Recovery Boats for Over-The-Horizon Targeting (OTHT) exercises. The HF Beacons are capable of transmitting between 2-30 MHz and are equipped with an omni-directional whip antenna. Signals are transmitted in Morse Code and have the following messages: "I AM TARGET A," "I AM TARGET B," "I AM TARGET C" etc. Transmission ON/OFF times can be varied from one to nine minutes ON and one to nine minutes OFF then repeated until completion of the exercise. HF radio frequencies must be coordinated and obtained by Range Users and then passed to PMRF for beacon programming prior to operations.

7.5.7 Portable Air Defense System (PADS)

The Portable Air Defense System (PADS) is a man-portable, shoulder-mounted, infrared, surface-to-air missile simulator derived from a real world missile system and is capable of locking-on to heat sources on various aircraft. The PADS, when used in conjunction with Smokey SAMS, becomes an effective visual tool in training aircrews against man-portable infrared (IR) heat seeking missiles.

The PADS consists of a shoulder-mounted launcher and a portable instrumentation case. The shoulder-mounted launcher consists of the launch tube, missile seeker head, color video camera, microphone for recording audible cues from the seeker head, electronic compass, and a removable aluminum bottle of nitrogen gas for cooling the seeker head. The portable electronics case houses the engagement scoring system, a video monitor which displays a target recticle from the seeker head, VHS recorder, extra bottles of nitrogen gas, and a battery power supply.

Figure 7-15 Locking up a heat source with PADS

With the color video camera and monitor, real time feedback is available during the engagement sequence and is recorded for post operational data on the VHS recorder for later analysis.

7.6 Unmanned Airborne Target Simulators

For electronic warfare purposes, the BQM-34S and BQM-74 Unmanned Airborne Targets are capable of being equipped with radar transmitters which can simulate a variety of air-to-surface or surface-to-surface Anti-Ship Cruise Missiles (ASCM). The AN/DPT-1(V) units are installed in the BQM-34S targets and the AN/DPT-2(V) units are installed in BQM-74 targets. In place of a threat emitter, a radar jammer from NAWCWD Pt Mugu can be installed on the BQM-34S.

7.7 Seaborne Radar Target Simulation

The WRB and TWR Range Boats are all equipped with the Raytheon Model R73 Raster Scan Radar System. The radar system is used primarily for Surface Search and Navigation but can also be used during operations to simulate hostile or friendly radar in electronic warfare scenarios. Specifications of the radar are as follows:

Frequency:	9410 MHz (+/- 30 MHz)
Pulse Width:	0.08 µs at 2000 pulses per second (PPS)

	0.4 µs at 1500 PPS
	0.8 µs at 750 PPS
	1.2 µs at 500 PPS
Beam Width:	1.9^{o} AZ, 25^{o} EL
Power Out:	8 kW
ScanType:	Circular at 2.5 seconds per revolution

7.8 Summary

The current PMRF Electronic Warfare Capabilities Manual is dated January 2001. A complete description and detailed characteristics are defined within this latest edition. Technical data concerning power conversions, electro-magnetic path loss, duty cycle, and earth curvature nomographs are depicted.

Table 7-1 PMRF EW EQUIPMENT SUMMARY

DESCRIPTION		QUANTITY		
Category	**System/Equipment**	**B/S**	**M/R**	**Oahu**
EA Shore Based	ALT-41/42 (B, C Bands)	1	1	---
	DLQ-3 (D, J Bands)			
	AN/ULQ-26 (E/F Band)	1	---	---
	AN/ULQ-21 (I Band)	1	1	---
Simulators Shore Based	CEESIM (2-18 GHz)	---	1	---
	LEWT – EW Mobile Van (2-18 GHz)	---	---	1
	I/J TES (I, J Bands)	---	1	
	Portable AN/DPT-1 (V) or AN/UPT-2A (V)	3	3	3
	(H, I, J Bands)			
	PTES (E/F, H, I, J Bands)	3	2	---
Simulators Seaborne	STE (I Band)	3	---	---
Simulators Airborne	AN/DPT-1 – BQM-34 Drone (H, I, J Bands)	NAWC WD	---	---
	AN/DPT-2 – BQM-74 Drone (I Band)			
Simulators IR	PADS	1	---	---
NGSS Support	PPN-19	1	---	1

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8. OPERATIONAL SUPPORT SYSTEMS

8.1 Air Operations

PMRF operates three C-26D aircraft and five UH-3H helicopters for range surveillance, MK-30 underwater target launch and recovery, torpedo recovery, aerial target recovery, search and rescue, and utility logistics missions. When the airfield is in operation, aircraft on the ground and flying within the class delta airspace will be under control of the control tower. The class delta airspace extends from the surface up to and including 2,500 feet mean sea level within a 5.1-mile radius of the airport, excluding airspace east of a line 1.8 miles east of and parallel to runway 34/16. Air traffic on the range and outside the class delta airspace is the responsibility of Range Control.

Rules must be adhered to when conducting flights over and around the Island of Kauai in order to conform to Local Regulations and FAA Noise Abatement Programs. Operations requiring overland flights must be made at altitudes above 1,000 feet. Flights over populated and resort areas should be avoided.

The northern shoreline of Kauai is a sensitive area and shall be avoided by at least 5 NM, especially by high performance tactical jet aircraft. There is a high volume of tour helicopter and fixed wing aircraft on Kauai, and VHF equipped aircraft should monitor 122.7 for traffic information. The Island of Niihau is privately owned and, with the exception of aircraft having specific authority, military aircraft should not fly over Niihau Island.

Warning Areas W186 and W188 are controlled by Range Control. Aircraft shall not enter these areas without clearance from "Outrider Control" (Range Control) on 322.0 or 345.0 MHz. During normal work hours, clearance may be expected only for flights supporting range operations or those with prior arrangements.

When a range operation overlaps into the class delta airspace, PMRF Range Control will retain control of any participating aircraft within the class delta airspace. When this occurs the airfield will be closed and all nonparticipating aircraft will be directed by the tower to remain clear of the class delta airspace.

The airfield is equipped with a Tactical Air Navigation (TACAN) facility, operating on Channel 73 with identification "NBS," which is located approximately a half-mile north of the Control Tower at 22°02'26.7"N, 159°47'16.7"W. There is an approved TACAN high-altitude and low-altitude instrument approach to Runway 34.

The minimum safe altitude within 25 NM of Barking Sands is 6,300 feet MSL. Aircraft operating at low altitudes at night in W188 shall not fly east of Barking Sands, NBS CH 73, 360° radial below the minimum safe altitude. Such flights are extremely hazardous with rugged mountainous terrain rising abruptly within 2 NM east of Barking Sands to 5 NM north of Barking Sands and then extending northeast along the Na Pali coastline of Kauai.

8.1.1 Airfield

PMRF has a 6,000-foot long by 150-foot wide asphalt runway. The runway, designated 16/34, is 14 feet above mean sea level with a 100 foot overrun at each end. The magnetic runway headings are 158° and 338°. Normal airfield operating hours are from 7:00 AM to 6:00 PM, Monday through Friday, except holidays. Requests to open the airfield at other times must be approved by the COPMRF, XOPMRF, Air Operations Officer, or Base Operations Officer.

Distance remaining markers are located on the west side of the runway at 1,000 foot intervals. Runway lights are normally turned off during the hours of darkness, except as necessary to accommodate arriving, departing, or taxiing aircraft. The runway is outlined by high intensity runway lights, normally set at a low intensity setting. Intensity changes should be requested through the Control Tower. Taxiways are lined with blue reflectors. A standard military, single green and split white, rotating beacon is located NE of the control tower. The beacon is on when the tower is manned during night ops, before sunrise, and after sunset, or during Instrument Flight Rules (IFR) conditions.

There are two E-28, bi-directional, arresting gears, 1,500 feet from each end of Runway 16/34. Large amber circles illuminate locations of the E-28 arresting gear. Allowable gross aircraft loads in pounds for Runway 16/34 is governed by the T1 826-01/AFMAN 32-1121V1 (1) NAVFAC DM 21.7 dated 31 Aug 1999.

All taxiways, aircraft parking, ramp areas, and immediate surrounding area are limited vehicle access areas. Operation of vehicles in these

areas is controlled by the Control Tower to ensure safety of aircraft, vehicles and personnel. Clearance for the movement of personnel or vehicles on the limited access areas must be obtained from the Control Tower. Personal vehicles are not allowed on the flight line without approval of the Air Operations Officer.

There is a 37,000 square foot hangar/ maintenance/Air Operations Center building on the east side of the North taxiway between the runway and Red Label Area. A separate smaller metal hanger, 60 by 90 feet, is available for temporary use by transient aircraft. The temporary hanger has electrical power.

Jet A fuel is available from 0700 to 1800, Monday through Friday, and at other times by prior arrangement.

Crash/Fire, located within the Control Tower, Bldg 300, is operated 24 hours a day, 7 days a week.

The PMRF airfield is a Category II field and maintains an 800 GPM Aqueous Film Forming Foam (AFFF) capacity provided by two MB-5's. Runway foaming capability is not available at PMRF and crash/rescue lifting equipment is limited.

Military aircraft arrivals and departures (including helicopters) require the field, including the tower, be manned. All transit aircraft require a PPR (Prior Permission Required). Under the general prudential rule, the airfield may be used in an emergency whether the tower is manned or not. Crash/Fire can be alerted via 126.2 (receive only) or via the Lihue Tower.

For other specific information pilots should refer to the current PMRF Air Operations Manual and Enroute Supplement. Additional information may be obtained by calling the Air Operations Officer, Comm: (808) 335-4310 or Autovon: (315) 471-6310

8.1.2 Support Equipment

The Support Equipment Division at PMRF Barking Sands provides support for five UH-3H aircraft with the following equipment:

AS32A-30 tow tractor, also known as the JG-40, has a drawbar towing capacity of 40,000 lbs.

AS32A-30A tow tractor is similar to the JG-40 with the exception of its diesel engine and an enclosed cab. It too is capable of towing aircraft up to 40,000 lbs.

A/M42M-2A mobile light carts, used during night operations when maintenance is being performed outside the hangar. These are diesel engine powered, self-contained units.

NC8A/-1 Mobile Electric Power Plants (MEPPS) are powered by a 353 Detroit diesel engine, and provide 28vdc, 120vac.

A/M26U-4 Nitrogen Servicing Carts (NAN-4) are used to service aircraft systems requiring nitrogen charges of up to 3000 psig. Targets personnel also use them to service aerial targets for testing and launching.

ALBAR15, which is a universal A/C towbar, is 20 feet long and is made of 4”x4” square aluminum tubing.

MMG-1A, Mobile Motor Generator, is used to check and test aircraft electrical systems, and provides an external source of power for maintenance troubleshooting procedures. It requires an external power source of 440vac to operate.

A/M27T-5 Hydraulic Servicing Unit, also called the Jenny, is used to check and test Aircraft Hydraulic systems. It also provides pressures to operate servos and valves without starting the aircraft. It is powered by a 353 Detroit Diesel engine

A/M27T-7 Hydraulic Servicing Units, or Jenny. It is used in the same manner as the T-5, with the exception of its power source. It requires an external source of 440vac to operate an electric motor, which provides power to operate the unit.

B-4A Maintenance platforms are used for external maintenance on aircraft. This equipment has a load capacity of 500 lbs, and can be raised to a maximum height of 7 ft. Its minimum height is 3 ft.

B-5 Maintenance platforms have a minimum working height of 84 in, and a maximum working height of 144 in. A hydraulically actuated hand pump performs raising and lowering of this unit.

B-1 Maintenance platforms are used for external maintenance on aircraft and have a maximum lifting capacity of 500 lbs. It can be safely raised to a height of 120 in. Its minimum height is 36 in.

T10-2FH hydraulic aircraft jacks are for lifting aircraft off the ground to remove tires, or test landing gear systems. It has a rated load capacity of 20,000 lbs.

T17-1FH hydraulic aircraft jacks are also used to lift the aircraft, and have a maximum rated load capacity of 34,000 lbs.

A10-1HC aircraft axle jacks lift the front nose wheel, or main landing gear wheels off the deck. It has a rated load capacity of 20,000 lbs.

A5-1HC aircraft axle jacks are also used for lifting the nose wheel or main landing gear wheels, but the rated load capacity is 10,000 lbs.

Blade handling units are used to support the main rotor blades during removal and installation from/to the main rotor head assembly.

Pivot slings are used in the removal and installation of the main rotor head and the transmission assemblies of the UH-3H aircraft.

Corrosion control carts are used for cleaning engines internally.

PMRF does not have equipment for Liquid Oxygen servicing (LOX), nor does it have Liquid Nitrogen servicing trailers. Nitrogen can be purchased commercially. Jet start units normally called NCPP105, or GTCP105 are also not available.

8.1.3 Red Label Area

There is a Red Label Area to the west of the north taxiway. This area is used for loading and unloading of aircraft carrying ordnance, MK-30 Underwater Targets, exercise torpedoes, and airborne target drones. A Targets Compound including ordnance and target shop facilities is located adjacent to the Red Label Area.

A Fuel Farm is located northwest of the end of the taxiway. Aircraft are not to approach the Red Label Area unless cleared by the Tower. Helicopters operating in and out of the Red Label Area are restricted from flying over the Targets Compound or Fuel Farm.

Figure 8-1 Recovered Target

Recovery cage spots in the Red Label Area are identified to allow adequate separation between ordnance personnel on the ground and helicopter operations. A canvas-covered water filled mattress, approximately 20 feet square, is available for recovery of MK-46/48 torpedoes, MK-30 targets and BQM targets.

8.2 PMRF Aircraft

8.2.1 C-26 Fixed Wing

PMRF operates three C-26D aircraft. Two are RC-26D versions and one is equipped as an EC-26D. The primary mission of the RC-26D is Radar Surveillance for Range Safety. Because of its electronic capability, it helps to ensure range clearance via visual and radar surface search.

The two APS-140 (Litton 504(v)5) radar systems provide this capability. This X-band, pulse compression frequency agile system with digital signal processing and scan conversion operates between 8.9 GHz to 9.4GHz. The radar can be operated on any one of 16 frequency steps, 30MHz apart, within the band in the fixed mode. In a frequency agile mode the radar randomly selects its frequency from 13 or 16 of the available steps. The radar can be operated in search, beacon, or weather modes and furnishes the operator with radar video up to 200NM in range and 360° in azimuth. Radar operation in the compressed narrow pulse mode with scan to scan integration and frequency agility reduces sea clutter and optimizes detection of small targets. Surveillance information observed from the aircraft is relayed to Barking Sands via radio. The radar systems are operated by PMRF Navy personnel and maintained by civilian contractor personnel.

Figure 8-2 C-26

Airborne Flight Termination System (FTS), Air Intercept Control (AIC), and Large Area Tracking Range (LATR) are other mission requirements for these aircraft. C-26 characteristics:

- Max Range 1,800 miles
- Max Speed 246 KIAS
- Max Alt 25K
- Max Pax (Clean) 18
- Max Pax (Rack in) 10

- Payload 5,169 #
- Fuel Capacity 4,342 #
- Station Time NM 300 500 700
  HRS 3.75 2.75 1.75

The single EC-26D has Electronic Warfare Capability. It also has some of the basic capabilities.

8.2.2 H-3 Helicopter

Five UH-3H Sikorsky Sea King helicopters are assigned to PMRF. They perform many varied functions, including: MK-30 underwater target launch and recovery, torpedo recovery, aerial target recovery, search and rescue, and utility logistics missions. PMRF helicopters have also been involved in Medevac missions, range clearance, and range surveillance. An excellent stable platform, the UH-3H has been used for still photography and video platform support.

UH-3H characteristics:

- Max Speed 120 knots
- Max Lift 6,000 #
- Service Ceiling 14,750 feet
- Max Range 625 NM

The operating area of PMRF helicopters is within 100 miles of land. On station time over the most distant part of the BSURE range is three hours.

Underwater and aerial targets are automatically configured for helicopter recovery at their end of run. This includes parachute detachment and lifting eye raised from aerial targets and torpedoes and underwater targets floating vertically. When the item does not properly configure for recovery, assistance and/or recovery by a WRB or TWR is required.

Figure 8-3 UH-3H

The time to "capture" an item normally does not exceed 15 minutes; however, recovery is influenced by sea state and may require longer. Each recovered item must be returned to the base before another item can be recovered.

8.3 Ordnance

8.3.1 Ready Service Magazines

There are three explosive ready service areas at Barking Sands. Magazine 2Y1 (Bunker 3992) is in the vicinity of the Aircraft Hangar. A limited service stock of explosive devices for the Flight Line and Paraloft is held in this magazine. The QD for this magazine is 75 feet.

Magazine 2Y2 (Bunker 442), in a berm west of the Underwater Targets Area, is used for temporary storage of "in transit" explosives which cannot be transported on the highway at night. The QD for this magazine is 400 feet.

Bldg 562 is a ready service locker to hold explosive devices that must be segregated from explosives in the Missile Assembly Building (MAB). It is located within the fenced compound surrounding the MAB.

A new missile assembly building is under construction and is expected to be completed by fall of 2001. The facility will provide additional space for rocket motor assembly.

8.3.2 Kamokala Ridge

There are ten cave magazines, in a controlled area, at the base of Kamokala Ridge, 2 miles east of Barking Sands.

The magazines are approved for Class 1.1 explosives. Range Users desiring explosive storage at PMRF must include their requirements in the UDS Documentation or submit their request through the Program Manager.

Figure 8-4 Kamokala Ridge Magazine

At the base of the Kamokala caves, two missile magazines/rockets storage areas are under construction. The bunkers will store target components for future testing.

8.3.3 Transportation

Shipment of explosives to PMRF can be via surface through the Naval Supply Center (NSC), Pearl Harbor, or by air landing on the PMRF Airfield. Surface shipments from Oahu are by barge into Nawiliwili Harbor. The barges carrying explosives are met by PMRF Ordnance personnel with vehicles for transit and delivery to PMRF. Explosives arriving on aircraft are off-loaded into Ordnance vehicles and delivered to their destination.

Figure 8-5 TALU

Ordnance vehicles and operating personnel are certified for handling and carrying explosives. Available Ordnance vehicles are:

- Three Tractor/Trailers - Two 40 foot and one 30 foot
- One 5 Ton Stake Truck
- One 3/4 Ton 4x4 Pickup
- One TALU ("K" Loader)

A range user planning to make shipments to or to transport explosives on PMRF must include such appropriate information in the UDS Documentation or coordinate these requirements through the Program Manager.

8.3.4 Ordnance Procedures

PMRF Ordnance program conforms to NAVSEA OP 5, Volume I, Ammunition and Explosives Ashore. The following instructions specifically document NAVSEA OP 5 applications at PMRF.

Non-Nuclear Ordnance Explosives Handling Qualification and Certification Program, PMRFINST 8020.1B. This instruction establishes a standard qualification and certification program within PMRF.

Safety Regulations for the Missile Assembly Building, PMRFINST 8020.2E. This instruction promulgates general safety regulations governing the conduct of operations and ordnance assembly within the PMRF Missile Assembly Building.

Ordnance Static Grounding Systems, PMRFINST 8020.3E. This instruction assigns responsibility for complying with the static grounding system requirements in NAVSEA OP:5.

Promulgation of Aircraft Ordnance Regulation, PMRFINST 8020.4A. This instruction promulgates regulations for arming, loading, and unloading of aircraft carrying ordnance items at PMRF.

Magazine Management, PMRFINST 8023.1G. This instruction promulgates procedures and regulations for management and security of magazines.

Handling & Transportation of Ammunition, Explosives, and Hazardous Materials, PMRFINST 8023.2G. This instruction establishes policy and procedures for handling and transporting subject materials.

Disposal of Unserviceable Ammunition and Explosives, PMRFINST 8027.1A. This instruction establishes policy and procedures for disposal of unserviceable ammunition and explosives.

Missile Accident Emergency Team (MAET), PMRFINST 5100.1E. This instruction establishes an MAET with the capability of performing emergency functions in the event a missile mishap occurs in the launch area, or when a missile inadvertently impacts on a land area.

8.3.5 Range User Responsibilities

Range users are requested to include descriptions of ordnance items and services required in the UDS Program Introduction (PI).

When approved safety specifications are not available, sufficient detailed information will be required to develop an Explosive Safety Approval (ESA). Assistance of NAWCWD explosive safety expertise may be requested by PMRF when an approved procedure is not available. Range users are cautioned that

ordnance items will not be allowed at PMRF unless an approved procedure or an ESA is available.

A Range User desiring additional information regarding launch and ordnance procedures at PMRF should address their inquiry to:

Commanding Officer
Pacific Missile Range Facility
P.O. Box 128
Kekaha, Hawaii 96752-0128

Attn: Launch/Ordnance Officer

8.4 Weather

8.4.1 Meteorology

The PMRF Weather Station is located in Building 331, east of the north taxiway between Air Operations and the Aircraft Maintenance Hangar. Radiosonde observations are made from the surface to 100,000 feet. Atmospheric weather conditions are monitored by radar to detect potential thunderstorms and local area adverse flight conditions. A thunderstorm potential exists in this area when cumulonimbus cloud heights reach 30,000 feet. Helicopter flight conditions can be dangerous at lower cloud heights. Both the Airfield Control Tower and Ordnance are advised of potentially dangerous conditions.

8.4.2 Meteorological Resources

Major meteorological equipment operated at Barking Sands includes a MARWIN Radiosonde Set MW-12, Meteorological Telemetry Tracking System, ASOS Semi-Automatic Meteorological Station, and two instrumented metro towers.

Figure 8-6 PMRF Weather Station

8.4.2.1 Radiosonde Observations

Surface launched balloons, tracked with the MW-12 system, provide wind direction, wind speed, temperature, dew point, relative humidity, index of refraction, and wind shear data at 1,000 foot intervals up to 100,000 feet during daylight hours. Balloon releases performed at night may not attain an altitude 100,000 feet due to a nighttime only phenomenon in the tropical latitudes known as "cold point burst." This can occur at altitudes above 60,000 feet when the air temperature drops rapidly below -75° C, causing the balloon to burst.

Routinely, a weather balloon is released every workday between 0730 and 0830. Additional balloons can be scheduled day or night for operational support observations. Balloon flights to 100,000 feet normally require at least 90 minutes. The minimum time between daytime launches is two hours to provide sufficient float time and time for prelaunch preparation and calibration. Releases at night, limited by cold point burst, may be possible with less than two hours between launches.

8.4.2.2 Weather Radar

A jointly owned, FAA and National Weather Service, Next Generation Radar (NEXRAD) System is located at Port Allen. Collected weather data is assimilated and presented by the University of Hawaii Meteorology Department and is available at http://lumahai.soest.hawaii.edu/cgi-bin/uhmetintro.cgi.

8.4.2.3 Semi-Automatic Weather Station

Sensors in front of Bldg 331 provide digital readouts of air temperature, dew point, maximum and minimum temperature, and rainfall through the ASOS Semi Automatic Weather Station. Wind speed and direction data from the meteorological tower west of the southern end of the runway are recorded on strip charts in the weather station.

Weather data is collected and recorded at three hour intervals every day. This synoptic data is retained at the PMRF Weather Station for at least three years. The data is sent to the National Weather Records Center in Asheville, North Carolina, for archived storage.

8.4.2.4 Wind Towers

The meteorological tower at the south end of the runway operates continuously. It is connected to wind direction and wind speed strip chart recorders in Bldg 331. The "Official" wind data for PMRF is obtained from the runway site. Another meteorological tower is located in the

launch area at the northern extremity of Barking Sands. It has three levels of instruments: 30, 60, and 90 feet. These instruments are active during launch operations. Wind speed and direction data is displayed in the Missile Assembly Building consoles. The wind data is also sent to Bldg 331 and to Range Facility Control (RFCO), where it is presented on a digital read out.

An interesting phenomenon at PMRF is a wind shear line passing diagonally across the northern area of Barking Sands with tradewinds from the northeast. The northern end of Barking Sands, including the launch area, can be exposed to the tradewinds while the balance of Barking Sands is sheltered by land terrain. It is not uncommon to observe two side by side wind speed recorders in Bldg 331, one from the runway tower indicating less than 10 knots while the launch area site is indicating winds in excess of 20 to 30 knots, and wind direction varying up to 180° between the two locations.

8.4.3 Meteorological Forecasts

Weather forecasts for the Hawaiian Area are provided by the Naval Oceanography Center at Pearl Harbor, Oahu. The PMRF weather station provides interpretive forecasts to all range users as requested. Requests for weather forecasts should be directed to the PMRF Weather Station, 335-4728. Long term forecast information (24 hour to 72 hour) originating from the Oceanography Center will be provided upon request. Short term forecasts (24 hours and less) will be based upon the Pearl Harbor forecast modified as appropriate by observations of the local conditions at PMRF.

8.4.4 Oceanography

Wave rider, bathythermograph, and observations from range boats are sources of oceanographic data at PMRF. Each of the three PMRF range boats, the 120 foot TWR Torpedo Weapon Retriever boat and the two WRB Weapon Recovery Boats, carry bathythermograph instrumentation. The system is the Sippican MK-12 Expendable Bathythermograph (XBT) Data Collection and Processing system. A probe launcher is mounted on deck with a computer/printer and modem in the wheelhouse. The system controls the probe launch and plots a temperature versus depth profile on board, which is then radio relayed to the range control room for processing and recording.

Temperature profiles are available to depths of 1,500 feet, 2,500 feet and 6,000 feet by selecting the appropriate probe for the depth desired. Data readout is in feet and Fahrenheit degrees. On shore, the XBT data can be printed in the control room in tabular form and/or processed into sound ray data in post operation data processing.

Datawell wave rider buoys are available for operations requiring wave height and period. Current profiles are obtained from expendable probes launched from a WRB, TWR, or helicopter.

8.4.5 UDS Documentation

A range user preparing a UDS Program Introduction is requested to include meteorological and oceanography requirements.

8.4.6 Summary

Meteorological activity at PMRF includes radiosonde observations from the surface to 100,000 feet, and weather radar observations to detect potential thunderstorms and local area adverse flight conditions. Bathythermograph, wave rider, and visual observations from range boats can be made to collect oceanographic data at PMRF.

8.5 Boats

PMRF is currently assigned three range boats. One is a 120 foot Torpedo Weapons Retriever (TWR-833), and the other two are 85 foot Weapons Recovery Boats (WRB-101 and -102). The larger TWR is configured with a single roller path torpedo retrieval ramp on the starboard side, an on-deck torpedo transfer carriage, and a telescopic target launcher that can launch up to nine MK-30 targets. A fully hydraulic storable articulated boom crane is also on deck. The winch is rated to 4,000 lbs, but loads are restricted to 3,260 lbs due to a wire rope safe workload standard.

The WRB is configured with a large central torpedo retrieval well, a hydraulically operated tailgate, and four roller paths on the retrieval ramp. A MK-30 target launcher with up to three underwater targets can be carried on the after deck. The range boats launch underwater targets and recover underwater targets and weapons. Other activities include: electronic warfare support, test vehicle launch and recovery, aerial target recovery, surface target control and towing, acoustic test support, range

surveillance and clearance, and search and rescue (SAR) operations.

Figure 8-7 Torpedo Weapons Retriever

The range boats can support range user project requirements such as, test vehicle in water implant and recovery, payload recovery, at sea transportation, data package recovery, and diver operations.

Figure 8-8 Weapons Recovery Boat

8.5.1 Berthing Facilities

Range boat operations are based at Port Allen, 17 miles from Barking Sands, adjacent to the communities of Eleele and Hanapepe on Kauai's south shore. Port Allen is a State of Hawaii Harbor Facility operating under the jurisdiction of the State Department of Transportation.

The channel on the pier side used by the Navy is maintained at a depth of at least 25 feet. Pier space available to the Navy is 600 feet. Shore power, fresh water, and compressed air are available at each range boat berth. Emergency berthing at the more protected pier in Nawiliwili Harbor is allowed during inclement weather.

Covered pier facilities include office space, shop facilities, and warehouse area and storage. The machine shop has the capabilities for Arc, Gas, TIG, and MIG welding and tools for pier side range boat equipment installations.

Security at the pier is provided by the O&M Contractor after hours, weekends, and holidays.

8.5.2 Range Boat Characteristics

Physical, navigational, communication, and instrumentation characteristics of the WRB and TWR range boats are included in Tables 8-1 and 8-2 at the conclusion of this section.

8.5.3 Operational Limitations

Sea State and deck space considerations can limit support capability of the range boats.

8.5.3.1 Sea State

Average sea states on the range are from 3.0 to 3.5. The sea state varies considerably from one day to the next in different parts of the range. Sea State descriptions are listed in Table 8-3.

Range boat target launch and recovery operations are avoided in sea states above 4.5; some activities, however, are only undertaken at sea states below 3.0. The go/no-go decision to conduct a boat operation rests solely upon the Boat Captain. He has the final decision, based upon safety for the crew and vessel.

8.5.3.2 Deck Space

The TWR has deck space for handling and storage of 15 large units or 20 small units. The WRB can accommodate 8 large units or 16 small units. Installation of the MK-30 launcher on the WRB does not reduce the number of units that can be handled; however, the launcher's presence usually precludes the use of other special deck rigging onboard the WRB. The TWR has a permanently affixed telescopic target launcher, which does not reduce the operational activities or capabilities of the boat.

8.5.4 Manifesting Passengers

PMRF Instruction 3170.1E establishes procedures for manifesting passengers on range boats. In summary, a passenger must:

- Have a valid security clearance on file at PMRF for classified operations.
- Have proper identification and verification of their requirement to board.
- Complete an Embarkation Request Form (PMRF 3170/1) for routing via the

appropriate PMRF Program Manager, Operations Conductor, or Marine Systems Engineer to the Range Operations Officer for approval.

8.6 Diving Support

Navy Divers are not assigned to PMRF, although there are several underwater operation and maintenance tasks performed in support of the range activities and facilities each year. The Port Hueneme Underwater Construction Team (UCT-2) is usually at PMRF for several weeks during the spring and summer. From time to time other groups will be at the range for diving activities.

PMRF does not maintain nor certify any diving support equipment. There is no decompression chamber on Kauai. The nearest chamber is on Oahu. It would be prudent for a Diving Unit to bring their own chamber to PMRF, whenever possible.

8.6.1 Support Activity Responsibility

A range user or a range support activity requiring diver support is responsible for the conduct of the diving operation at PMRF. This includes ensuring the safety of the personnel involved by:

- Defining the diving and support requirements
- Establishing availability of divers and support unit with Officer-in-Charge or Diving Supervisor
- Nominating or requesting an Operation Conductor to be in overall charge of the task force and to represent the activity at PMRF

8.6.2 Operation Conductor Responsibility

The Operation Conductor, as the task force representative to PMRF, is responsible for:

- Coordination of availability and pre-operational briefing of PMRF supporting activities
- Ensuring a Diving Supervisor is identified to all participating personnel
- Scheduling the diving operation

8.6.3 PMRF Program Manager (PM) Support Responsibility

The PMRF PM, as the single representative for the Commanding Officer, is responsible to review and approve the Diving Support Plan.

8.6.4 Diving Support Facility

There is a Diving Support Facility, Bldg 549, at PMRF with an adjoining fenced enclosure.

Figure 8-9 Dive Support Facility

This facility is used by UCT-2 for servicing and upgrading the PMRF underwater cable systems. Normally the UCT-2 team deploys to PMRF for two to four months in April, May, June, or July.

The Diving Support facility can be made available to other diving activities when not in use by UCT-2. The PMRF Underwater Systems Engineer schedules use of the facility.

Table 8-1 WRB Characteristics

PHYSICAL AND PERFORMANCE CHARACTERISTICS	
Length	85 feet
Beam	18 feet - 8 inches
Draft	5 feet - 9 inches
Displacement	52 Long Tons (Full Load)
Hull Construction	Aluminum
Main Propulsion Power Plant	Twin Detroit 16V71 Diesel Engines
Electrical Power Plant	Dual, 225/440 Volt, 60 Cycle, 3 Phase, 60 kW Generator Set driven by a Diesel 4-71 Diesel Engine. (Generators can not be operated in parallel.)
Normal Cruise Speed	14 knots
Maximum Speed	15 knots
Potable Water Capacity	350 Gallons
Fuel Capacity	Usable Capacity is 1,440 Gallons with 20% reserve. (Total capacity is 1,800 Gallons)
Fuel Consumption	Consumption: 50 GPH at 14 knots 31 GPH at 10 knots 5.2 GPH (Generators only)
Maximum distance from port and return	202 NM at 14 knots
Maximum time of station at 10 knots	23.4 Hrs at radius of 100 NM from port. Round trip transit time is an additional 14.3 Hrs at 14 knots. Total time at sea is 37.7 Hrs
Maximum range at 10 knots	480 NM
Habitability	There are only four bunks, a small galley and limited potable water. Habitability considerations will limit at sea endurance.

NAVIGATIONAL EQUIPMENT	
GPS	Trimble Nav/Trac Displays
Surface Search Radar	Raytheon Model 1273; Nominal effective ranges are: 72 miles - Land fall 6 to 8 miles - WRB size metal hull boat 2 miles - 16 foot fiberglass boat
Automatic Direction Finder	Raytheon Navimatic MKII: Three bands: Beacon: 0.19 - 0.42 MHz Broadcast: 0.55 - 1.6 MHz Marine: 1.6 - 4.5 MHz
Depth Indicator	SI-Tex Model CVS-109: Charts and displays keel to bottom depth. Maximum depth is 480 Fathoms.

INSTRUMENTATION EQUIPMENT	
Radar Tracking Beacon	C-Band transponder transmits reply when tracking radar coded pulse delay is same as beacon code.
IFF Beacon	Mode 3 response to interrogations from IFF equipped surveillance radars for identification and tracking.
Phase Coded Pinger	MK-84 underwater tracking pinger is extended through hull below keel for operations. WRB speed is limited to 10 knots when pinger is extended below hull. The pinger is retracted into a sea chest when not is use.
Expendable Bathythermograph (XBT)	Sippican MK-12 XBT System. Plots temperature verses depth profile onboard while radio relaying data to Control Space for processing and recording.
Anemometer	Monitors wind speed and direction up to 100 knots with remote outputs
TV/VCR	Television and video cassette recorder available for training and reviewing completed evolutions

COMMUNICATION EQUIPMENT	
HF Transceiver Radio Set	AN/URC-94, RT-1230 Transceiver, C-1026 Control Unit, H189GR Hand-set, and HF Antenna Coupler CU-2184, used for long range communications and WWVH time information.
VHF Transceiver	General Electric Model Orion, used for VHF communications with Range Control, small craft, and the Coast Guard.
Emergency VHF Transceiver	General Electric PCS Hand held, battery operated transceiver for communications with Range Control when the boats auxiliary power plant is shut down.
UHF Transceiver (Plain Voice)	AN/ARC-189, used for unclassified UHF communications with Range Control, ships, and aircraft.
Citizens Band Transceiver	Cobra Model 29NHST, used for range clearance and Search and Rescue communications with civilian vessels. The crew monitors Channel 22 while on station and during SAR operations.
Underwater Communication Relay	AN/UWQC-2A SONAR Communications Transceiver Set and Phoenix-SX dedicated VHF Transceiver, to provide an automatic relay and conversion between radio frequency and acoustic signals for two-way communications between range operating control rooms and sub-surface units. The AN/UQC-2A operates on the High Band from 8 to 11 kHz.

Table 8-2 TWR Characteristics

PHYSICAL AND PERFORMANCE CHARACTERISTICS	
Length	120 feet
Beam	25 feet
Draft	10 feet
Displacement	248 Long Tons (Full Load)
Hull Construction	Steel
Main Propulsion Power Plant	Twin Caterpillar, 3512 Diesel Engines
Electrical Power Plant	Two 450 Volt, 64 kW, 60 Cycle, 3 Phase Generator Sets each driven by a Caterpillar 3304NA Diesel Engine. Generator sets may be synchronized and operated in parallel.
Normal Cruise Speed	12.0 knots at 1,650 RPM
Maximum Speed	14.5 knots at 1,800 RPM
Potable Water Capacity	2,500 Gallons
Fuel Capacity	Usable Capacity is 7,148 Gallons with 20% reserve. (Total capacity is 8,935 Gallons)
Fuel Consumption	Consumption: 98 GPH at 13.5 knots 38 GPH at 10 knots 3.6 GPH (Generators only)
Maximum distance from port and return	492 NM at 14 Knots
Maximum time of station at 10 Knots	112 Hrs or 4.7 Days at radius of 200 NM from port. Round trip transit time is an additional 29.6 Hrs at 13.5 knots. Total time at sea is 141.6 Hrs or 5.9 Days.
Maximum range at 10 knots	1,880 NM
Habitability	Habitability considerations are not a factor limiting at sea endurance

NAVIGATIONAL EQUIPMENT	
Speed Log	Data Marine Model 3200
DGPS	Trimble NavTrac: Displays geodetic coordinates of presenting position, and course and distance to a selected position.
GPS	Trimble Nav Trac: Displays geodetic coordinates of presenting position, and course and distance to a selected position.
Surface Search Radar	Raytheon ModelR73 Interfaced with MK-27 Gyro Compass NCT-27Unit. Nominal effective ranges are: 622 miles - Land fall 8 miles - WRB size metal hull boat 2 miles - 16 foot fiberglass boat
Automatic Direction Finder	Furuno Model FD-171-ADF: Three bands: Beacon: 0.19 - 0.42 MHz Broadcast: 0.55 - 1.6 MHz Marine: 1.6 - 4.5 MHz
Depth Indicator	SI-Tex Model CVS-109DF: Charts and displays keel to bottom depth. Maximum depth is 480 Fathoms.

INSTRUMENTATION EQUIPMENT	
Radar Tracking Beacon	C-Band transponder transmits reply when tracking radar coded pulse delay is same as beacon code.
IFF Beacon	Mode 3 response to interrogations from IFF equipped surveillance radars for identification and tracking.
Expendable Bathythermograph (XBT)	Sippican MK-12 XBT System. Plots temperature verses depth profile onboard while radio relaying data to T&C Bravo for processing and recording.
Weather Fax	Furuno Model FAX-207 HF Receiver
TV/VCR	Television and video cassette recorder available for training and reviewing completed evolutions.

COMMUNICATION EQUIPMENT	
HF Transceiver Radio Set	AN/URC-94 Radio Set: RT-1230 Transceiver, C-1026 Control Unit, H189GR Hand-set, and HF Antenna Coupler CU-2184. Long range communications and WWVH time information.
VHF Transceiver	General Electric Orion: VHF communications with Range Control, small craft, and the Coast Guard.
Emergency VHF Transceiver	Three General Electric hand held, battery operated transceiver used for intra-boat communications and communications with Range Control when the boats auxiliary power plant is shut down.
UHF Transceiver (Plain or Secured Voice)	AN/ARC 159, with C-10206 Control Unit, and AS-390A antenna. Unclassified communications with Range Control, ships, and aircraft.
Citizens Band Transceiver	Cobra Model 29 NHST: Range clearance and Search and Rescue (SAR) communications with civilian vessels. Channel 22 is monitored while on station and during SAR operations.
Underwater Communication Relay	AN/UWQC-2A SONAR Communications Transceiver Set and Phoenix-SX VHF Transceiver: Automatic relay and conversion between radio frequency and acoustic signals for two-way communications between range operating control rooms and sub-surface units. The AN/UQC-2A operates on the High Band from 8 to 11 kHz.

Table 8-3 Sea State Description

DESCRIPTION	COMMENTS
SS1 SMOOTH SEAS	Average wave height less than two feet with ripples but no foam. Winds (1 - 4 knots); can not be felt on face.
SS2 SLIGHT SEAS	Average wave height 2 - 3 feet with small wavelets and no foam. Winds (4 - 10 knots); gentle breeze, can be felt on face, light flags will be waving.
SS3 MODERATE SEAS	Average wave height 3 - 4 feet, large wavelets with crests beginning to break. Winds (7 - 15 knots); gentle to moderate breeze, light flags extended.
SS4 ROUGH SEAS	Average wave height 4 - 8 feet, sea heaps up, spray from seas and foam streaks. Winds (14 - 27 knots); moderate to strong breeze, wind whistles in rigging.
SS5 VERY ROUGH SEAS	Average wave height 8 - 12 feet, sea heaps up, spray from seas and foam streaks. Winds (27 - 40 knots); strong to fresh gale, walking resistance high.
SS6 HIGH SEAS	Average wave height 12 - 20 feet, dense streaks of foam and much spray. Winds (40 - 48 knots); strong gale, loose gear and light canvas may part.
SS7 VERY HIGH SEAS	Average wave height 20 - 40 feet, very high waves with overhanging crests, sea appears white with rapidly blown spray and very dense foam. Winds whole gale, 48 - 55 knots.
SS8 MOUNTAINOUS SEAS	Average wave height 40 feet and above, very high rolling breaking waves. Sea covered with foam and visibility very poor. Winds storm force, 55 - 65 knots.

9. VISUAL IMAGING

Visual Imaging consists of photographic, optical, and video services. Equipment on hand allows for start to finish processing of photographic and video records covering specific range events, technical and administrative meetings, training and public affairs activities at PMRF. Additionally, video documentaries and news releases are produced and shared with Navy and local communities on a regular basis.

9.1 Photography

PMRF provides photographic services including on-site and studio photography, and photo lab processing, printing and copying. A contractor representative performs the photographic services and operates and maintains the PMRF Photo Lab. The Photo Lab is located in Building 305, north of the Control Tower. Processing support includes color slide, color negative, and black and white negative from 35mm to 120mm. Color prints up to 16x20 inches, as well as limited black and white printing are also available. Camera and processing equipment include:

- Bronica 6 x 4.5cm Format 40mm to 500mm lens FL
- Nikon 35mm Format 40mm to 500mm lens FL
- Canon F1, 35mm Kit 35mm, 50mm and 105mm lenses
- Canon EOS 10 frames per sec

There is also a digital photography capability. Exposures are recorded on disk and downloaded to a Windows System for printing and additional processing when required. Equipment supporting digital photography includes:

- Nikon N90 Camera with Kodak DCS 420 Disk
- Nikon 8008S Camera with Kodak DCS 200 Disk
- Kodak DCS 560 Camera
- Epson 3000 Printer (up to 44 inches wide)
- Fuji Digital Printer (up to tabloid size)
- Epson 9000 Large Format Printer

Long range plans call for photo lab capabilities to be discontinued with emphasis on the digital photographic capabilities.

9.1.1 Photographic Authorizations

Photography, including the use of any imaging device that stores or reproduces visual images, is prohibited inside all areas where classified material is stored, processed or viewed and within the boundaries of all restricted areas unless approved by the affected area manager and the PMRF Security Manager. Additional restrictions may be imposed on the use of photography equipment at PMRF geographically separated or remote sites. Photography in all other areas on PMRF is permitted unless temporary restrictions have been imposed due to mission requirements. Visitors should coordinate their official photography requirements through their respective PMRF Point of Contact and the PMRF Security Manager, (808) 335-4821. Photography authorization letters will be issued when warranted.

9.1.2 Video Services

A full-service video production facility is located in Bldg. 301, west of PMRF's parade ground. A video library is also maintained with file footage catalogued and used in various productions. Associated functions performed by video production personnel include concept development, scriptwriting, shooting, editing and duplication. The non-linear editing system is an Avid Media Composuer, version 6.01, digital non-linear editing suite. Specialized capabilities include the generation of graphics, animation, digital effects and titles. Video copies can be produced in VHS, S-VHS, 8mm, Hi8, and 3/4" U-matic formats.

Video equipment supporting this effort includes:

- Panasonic AG-180 VHS Camcorders (2)
- Panasonic AG-500R VHS Monitor/Player (2)
- JVC BR-S822U S-VHS Recorder (1)
- JVC GY-2BU S-VHS Camcorder (1)
- AVID Media Composer 900 V6.01(1)
- Computer, Apple Power MAC 8100/100 (2)
- Sony EVO-9700 Hi-8 Recorder/Player (1)
- Schewm FP-1 Gyrozoom Lens (2)
- Sony 3/4" U-matic A/B Roll Editing System
- Sony BVU-920 Players (1)
- Sony BVU-950 Recorder (1)

- Sony BVE-600 Editor Controller (1)
- Sony MXP-290 Audio

9.1.3 Optical Systems

Optical services include high quality instrumentation photography from mobile mounted equipment. All units are operated by civilian contractor and can support T&E and fleet operations. The optics facility is located in building 359. Two offices and two overhead hoists are situated within 5,600 square feet of floor space.

9.1.4 VTM

The Versatile Tracking Mount (VTM), a mobile trailer mounted system, is primarily used to track and record missile launches from PMRF.

Figure 9-1 Versatile Tracking Mount

The self-contained VTM unit can be trucked virtually anywhere in the vicinity of PMRF to provide remote video relay to the range user. VTM is a photo sonics cene sextant, rugged, mobile, self-contained, AC powered, GPS equipped, VME based electronics, 20 bit encoders, with an auto contrast TV tracker. VTM #1 is the current operational unit. VTM #2, a second unit, is expected to be operational soon.

9.2 Stabilized High-Accuracy Optical Tracking System (SHOTS)

Stabilized High-Accuracy Optical Tracking System (SHOTS) is a future asset. It is a mobile optical unit with high resolution, high frame-rate, visible and IR (mid-wave or long wave) camera and 20-30 inch diameter, long focal length telescope, and has a 1kHz frame rate. Its secondary imaging system has a wide field of view visible and MWIR cameras for coarse acquisition. SHOTS will be used on the MATSS vessel to support the TBMD programs. A second unit is also being built and can be used on other seaborne platforms or at various land locations.

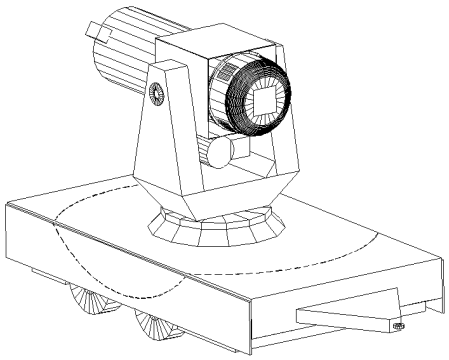

Figure 9-2 Proposed SHOTS Platform

Raytheon Radiance HS Camera Features:

- 2 - 1000 fps
- 256x256 pixels-Reduced format (64x64 pixels) for frame rates >352 fps
- 30 micron pixel size, 100% fill factor
- 0.95 percent quantum efficiency
- Snap shot read out (all pixels read simultaneously)
- Variable integration (2 microsec - 14 millisec)
- Integral closed cycle cooler (no LN_2)
- NTSC video output
- Real-time digital output
- Fixed internal spectral filter

DALSA CA-D6 Camera Features:

- 30 - 955 fps
- 260 x 260 pixels (at all frame rates)
- 10 micron pixel size (100% fill factor)
- Variable frame rate
- Variable exposure
- Snapshot operation
- Real time digital output

Table 9-1 VTM TECHNICAL DATA

CAMERA	VCR	FOCAL LENGTH	MEDIA
Panasonic CL350	AG7350	12 to 300 inches	SVHS
Panasonic CL350	AG7350	20 to 300 inches	SVHS
Panasonic CL350	AG7350	40 to 300 inches	SVHS
Panasonic CL350	AG7350	150 to 300 inches	SVHS
AGEMA MLW	AG7350	30 to 60 inches	SVHS

Table 9-2 VTM SPECIFICATIONS

Capacity	1,000 lbs equally distributed
Az/El Velocity	45°/sec
Az/El Acceleration	25°/sec
Az Travel	700° (almost 2 complete turns)
El Travel	-15° to 90°
Power	208 vac, 3 phase, 60 amp
Auto Tracking	Video Contrast TV Tracking
Slaved Tracking	Yes, if provided range TSPI data

Table 9-3 SHOTS Video Sensors

Camera	Aperture	F/number	FOV (deg)
Radiance HS MWIR	0.75 m	8.0	0.104
Radiance HS MWIR	0.30 m	2.6	0.56
Dalsa CA-D6	0.75 m	8.0	0.104 (Note 1)
Dalsa CA-D6	0.30 m	2.6	0.56 (Note 1)

Note 1. FOV of Dalsa cameras includes 3:1 image intensifier

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10. TARGETS

The Range Operation Department manages PMRF aerial and surface target services. Underwater target services are provided by the Naval Undersea Warfare Center, Detachment Hawaii (NUWCDH). The Operations and Maintenance (O&M) Contractor provides the BQM-74E, BQM-34S and AQM-37C aerial target services. The VANDAL Integrated Project Team (IPT) from NAWCWD Point Mugu provides MQM-8G Vandal missile target services for PMRF. Navy personnel at PMRF provide seaborne target services.

10.1 Targets Service Facilities

The PMRF aerial target facilities are located north of the Barking Sands Red Label Area in Bldgs 445 (main office), 413, 416, 429, 446, and 451.

Figure 10-1 Aerial Targets Compound

Seaborne target facilities are located at Port Allen in Building 77 above the pier parking area.

Figure 10-2 Port Allen Bldg 77

Under water targets are the responsibility of NUWCDH. Their facilities are located north of the Red Label Area in buildings 420, 422, and 447.

Surface launched targets are fired from the PMRF Launch Pad at Nohili Point, Barking Sands. PMRF UH-3H helicopters, WRB's and the TWR range boats perform many tasks to support target services. The tables at the end of this section summarize target characteristics.

Figure 10-3 NUWCDH

10.2 Aerial Targets

10.2.1 BQM-34S Missile Target

The BQM-34S is a surface or air launched, recoverable, remote-controlled, fixed–wing, subsonic aerial target capable of speeds up to Mach 0.95 and altitudes from 10 to 50,000 feet. This turbojet powered target is highly maneuverable and can withstand a 5G maneuver. The BQM-34S has full command control capability using the Integrated Target Control System (ITCS). The BQM-34S can be surface launched from the PMRF launch pad, where there are two launchers, one fixed and one portable. Air launch operations require a DC-130 aircraft.

The BQM-34S is 23 feet long, with a wing span of 13 feet, and weighs approximately 2,000 pounds at launch. It is surface launched using a single Rocket Assisted Take Off (RATO) bottle, employs a parachute recovery system, and is retrieved by helicopter or range boat. At PMRF the UH-3H helicopter is the primary method of retrieval and the range boats secondary.

The BQM-34S provides a realistic subsonic target for air-to-air and surface-to-air training exercises. Flight control is by the ITCS system with a target remote controller located in the Range Operations Control Center (ROCC). Recovery of the target is normally initiated by a command signal. Recovery is also initiated automatically when the command control carrier signal is lost, and when the engine runs down and internal electrical power is lost. When any of these events occur, a recovery parachute is

deployed to permit safe target descent into the ocean.

The BQM-34S can accommodate a large variety of Target Auxiliary/Augmentation Systems (TA/AS), as listed in Table 10-1.

Figure 10-4 BQM-34S

10.2.2 BQM-74E Missile Target

The BQM-74E is a surface or air launched, recoverable, remote-controlled, fixed-wing, turbojet powered subsonic aerial target capable of speeds up to Mach 0.86 and altitudes from 30 to 40,000 feet. The target is also capable of flying at a lower altitude with a special 5 meter low altitude kit. The BQM-74E has full command control capability using the Intergrated Target Control System (ITCS). The BQM-74E can be surface launched from the PMRF launch pad, where there are four launchers. Air launch operations require a specially modified DC-130, a G-1 Pegasus, or an Air Guard F-16. The BQM-74E is also capable of being surface launched from a launch platform at sea. Air launch or at-sea surface launch require a long lead time, and cost considerably more than surface launch from the PMRF launch pad.

The BQM-74E is 13 feet long, has a wingspan of almost 6 feet, and weighs approximately 550 pounds at launch. It is surface launched using two RATO bottles, employs a parachute recovery system, and is retrieved by helicopter or range boat. At PMRF, the UH-3H helicopter is the primary method of retrieval and the range boats secondary.

The prime uses of the BQM-74E at PMRF are to simulate surface-to-air or air-to-air missiles, or to simulate airborne incoming missiles for gunnery exercises. Flight control is by ITCS with the target remote controller located in the ROCC. Recovery of the target is initiated one of three ways: 1) by a command signal, 2) initiated automatically when the command control carrier signal is lost, or 3) automatically initiated when the engine runs down. When any of those events occur, a recovery parachute is deployed to permit safe target descent into the ocean.

Because of the limited payload space, the BQM-74E can accommodate only miniaturized TA/AS, as listed in Table 10-1. Luneberg lens type radar reflectors to enhance radar reflectivity and a smoke system are standard augmentation systems for the target. There are also kits available that can reduce the radar cross section of the target. Instrumentation includes a C-Band radar tracking beacon, an ITCS transponder, and a UHF locator beacon.

Figure 10-5 BQM-74E

10.2.3 MQM-8G VANDAL Missile Target

The MQM-8G, a family of VANDAL targets, are surface launched, expendable, ramjet powered TALOS missiles converted to aerial targets which simulate anti-ship threat missiles. The VANDALS are remote-controlled vehicles launched from the PMRF launch pad where a converted TALOS dual missile launcher is installed. Each VANDAL is launched by a solid propellant booster and propelled through flight by a ramjet engine. The VANDALS employ a computer controlled command guidance system utilizing real time radar data for azimuth control and radar altimeter data for altitude control. Target profiles are preprogrammed for low or high altitude flight trajectories. Overriding flight control commands from the Guidance Control Computer (GCC) in the ROCC can alter flight altitude, descent angle and terminal speeds. A Flight Termination System (FTS) is available for

the Missile Flight Safety Officer (MFSO) to terminate erratic flights. At the conclusion of a good presentation the target is permitted to dive into the water.

Figure 10-6 VANDAL Launch

MQM-8G(ER) and MQM-8G(EER) have a similar speed of Mach 2.13 at altitudes of 12 to 2,000 feet with flight ranges from launch point of 37.5 and 44 NM for the ER and EER, respectively. At launch, the target climbs to an altitude of approximately 700 feet and then begins its descent to presentation altitude, which it reaches approximately 15 NM downrange from the launch point. At PMRF a 45-degree right turn is usually programmed to accommodate missile hazard pattern considerations.

The MQM-8G(EER) is capable of performing nominal 8G (or 10G peak) S-turns transitioning into 4 to 5G jinking at the end of its flight path. The S-turns have nominal period of 7 seconds and amplitude of +/- 100 meters for 1 to 4 cycles. The MQM-8G, both ER and EER, are approximately 25 feet long (after booster separation) and 28 inches in diameter.

TA/AS available for use on the VANDALS include radar cross-section enhancement, emitters, electronic countermeasures, scoring, radar altimeter, command and control receiver (including the flight termination), and radar tracking beacon.

10.2.4 AQM-37C Missile Target

The AQM-37C is an air launched, expendable, hypergolic fueled, liquid rocket, aerial target, preprogrammed to fly selected trajectories between altitudes of 1,000 to 100,000 feet at speeds between Mach 0.7 to 3.0, the later depending on the flight altitude selected. The AQM-37C has limited command control capability (i.e., left and right turn capability for corridor control, a terminal dive initiation and flight termination). The AQM-37C can be launched from F-16 aircraft.

The capability of the AQM-37C is extended to Mach 4.0 at 100,000 feet altitude by the addition of an Extended Performance (EP) kit.

Figure 10-7 AQM-37C

The AQM-37C is also used for ballistic trajectory flights. AQM-37C flights conducted in support of the Ballistic Missile Target (BMT) program have added a new range of capabilities to the AQM-37C target. Ballistic flight profiles provide the high and low ends of the AQM-37C's ballistic performance spectrum. The lower profile is based on a subsonic launch at Mach 0.7 and 1,000 feet altitude and provides an apogee of 97K feet with the target climbing at an angle of 40 degrees. Two higher profiles are based on supersonic launches at Mach 1.5 at 50K feet altitude and provide apogees of 335K feet with a target climb angle of 65 degrees and 236K feet with a target climb angle of 40 degrees. Avionics software upgrades provide the AQM-37C the capabilities to perform other mission required ballistic profiles.

The AQM-37C is approximately 14 feet long and has a wingspan slightly in excess of 3 feet. It is capable of carrying TA/AS devices such as radar augmentation scoring, tracking beacons and the command receiver required for control and flight termination.

10.2.5 Aerial Tow Targets

Aerial tow targets, TDU-34A/A, or aerial tow banners, TDU-32A/B or –32/B, may be requested through Afloat Training Group, Mid-Pacific Fleet, Oahu.

10.2.6 MK-5 Launcher

The Terrier Target Launching System (TTLS) consists of a dual rail, Mk-5 Launcher and a launcher control system. This system is a modified Tactical Terrier Launcher System designed to launch the SM2 Terrier as a target. The TTLS is integrated into the PRMF Launch Control Firing System which provides for sequenced launches of other targets as well.

Table 10-1 Aerial Target Characteristics

BQM-34S MISSILE TARGET	
Physical	Length: 23 feet Wing Span: 13 feet Weight: 2,500 pounds
Altitude	10 feet minimum with low altitude kit and 50,000 feet maximum without external stores
Speed	550 to 600 KTAS
Total Flight Time	86 minutes at 500 knots and 50,000 feet altitude. Typical flight will provide an hour on station time, depending on altitude.
Launch	Surface launched from PMRF Launch Pad. One fixed and two portable launchers are available. Airborne launches from DC-130 aircraft.
Control	ITCS radio command control
Recovery	Two-stage parachute: Recovered at sea by helicopter. As backup, can be towed to Port Allen behind WRB or TWR range boats. Normal flotation period with fuel expended is 24 hours.
Instrumentation	AN/DPN-90(V)1 Radar beacon AN/DkW-3B ITCS Command Control Transponder UHF Locator beacon
Augmentation (Optional)	AN/DPT-1 Radar H/I or J-Band simulator, or C/X-Band Radar augmentation system AN/DRQ-4 , AN/DSQ-37, or AN/DSQ-50 Scoring system transponder Radar altimeter low altitude control system (RALACS) AN/ULQ-21 Electronic countermeasure set AN/ALE-44 Chaff dispenser IR flares Smoke system Tow bodies

Aerial Target Characteristics (CONTINUED)

BQM-74E MISSILE TARGET	
Physical	Length: 13 feet Wing Span: 5.78 feet Weight: 435 pounds
Altitude	30 - 35,000 feet
Speed	435 KTAS at sea level; 455 KTAS at 20,000 feet; 435 KTAS at 30,000 feet.
Total Flight Time	30 Feet Altitude: 24 minutes at 435 KTAS 45 minutes at 300 KTAS 20,000 Feet Altitude: 75 minutes at 300 KTAS
Launch	Air launched from DC-130, F-16, or G-1 aircraft. Surface launched from PMRF Launch Pad.
Control	ITCS radio command control
Recovery	Parachute: Recovered at sea by helicopter. As backup, can be winched aboard WRB through well deck.
Instrumentation	AN/DPN-90(V)1 Radar beacon AN/DkW-3 ITCS Command control transponder Locator beacon
Augmentation (Optional)	AN/DPT-2 Radar I-Band simulator, or E-, F-Band/G-, I-, J-Band active radar augmentation system AN/DRQ-4 , AN/DSQ-37, or AN/DSQ-50 Scoring system transponder Radar altimeter low altitude control system (RALACS) Luneberg lens type radar reflectors (Standard) Smoke system (Standard) Tow bodies

Aerial Target Characteristics (CONTINUED)

MQM-8G VANDAL MISSILE TARGET	
Physical	Full scale TALOS missile converted to target
Altitude and Range	12 feet to 70,000 feet altitude. Nominal ranges are 37 to 167 NM. High altitude cruise maximum range is 167 NM.
Speed	Mach 2.1 to Mach 2.7
Time On Station	4 to 6 minutes
Launch	Dual TALOS Launcher at PMRF launch pad
Control	Preprogrammed flight with command override for cruise altitude, dive descent angles, and terminal speeds. The ER is capable of performing S-turns and jinking at the end of its flight path.
Recovery	Non-recoverable. At end of flight a flight termination system commands an explosive destruct system which alters the target aerodynamics causing the target to tumble and dive to water impact.
Instrumentation	AN/DPN-90(V)1 Radar beacon Telemetry transmitter UHF Command control receiver Flight Termination Receiver
Augmentation (Optional)	AN/DPT-1 Radar H/I or J-Band Threat Emitter AN/UQL-21 Electronic Countermeasure Set AN/DSQ-37 or AN/DSQ-50 Scoring system transponder

Aerial Target Characteristics (CONTINUED)

AQM-37C Missile Target	
Altitude and Range	1,000 feet to 100,000 feet altitude. Maximum range is 155 NM
Speed	Mach 0.7 to Mach 4.0
Time On Station	1 to 6 minutes, depending on flight profile
Launch	Air launched from TA-4J or F-4 aircraft
Control	Preprogrammed flight with command override for course correcting turns, dive angles of 15 - 65 degrees and dive pullout.
Recovery	Non-recoverable. At end of flight an aerodynamic destruct system causes target to spin out and dive to destruction.
Instrumentation	AN/DPN-90(V)1 Radar beacon Command control receiver Telemetry transmitter FTS Receiver
Augmentation (Optional)	Active C, E/F, or G/I/J Radar augmentation system AN/DRQ-4 or AN/DSQ-50 Scoring system transponder

10.3 Surface Targets

Surface targets are maintained and operated by PMRF Navy personnel at Port Allen assigned to the Seaborne Powered Target (SEPTAR) Division of the Threat Simulation Branch. These targets serve as relatively low-cost targets for gunfire and missile exercises. The SEPTAR targets are transited to the range area with onboard crews. The crew transfers to a range boat and the unmanned SEPTAR then proceeds into the exercise area under radio control. Other surface targets are deployed from manned SEPTAR or WRB and TWR range boats.

10.3.1 QST-35/-35A SEPTAR

The QST-35/-35A is a multi-purpose seaborne powered target designed to provide a remotely controlled target that can be augmented to present various threat scenarios. It can operate at approximately 30 knots in sea state 1 and in sea state 3 at approximately 15 knots. Both the QST-35 and the QST-35A are currently operational.

The QST-35 SEPTAR is a medium speed, gasoline engine-driven fiberglass-hulled target boat. It is 56 feet (17m) long with a 14-foot (4.5m) beam. The target can be wheelhouse or radio controlled. The target boat is equipped with a 34 foot high lattice framework tower mounted aft to support radar reflectors and side mounted radar enhancement screens.

Figure 10-8 QST-35 SEPTAR

Four mercury Marine V-8 (330 hp) engines currently power SEPTAR vessels. They have point to point round trip range of 150 NM at a maximum speed of 30 knots. The average operational speed of the QST-35 with Sea State 3.0 is 25 knots. When the radio command control carrier ceases, the engine throttles decrease to idle, and the target proceeds on the last received course command.

The QST-35 targets are equipped with a radar tracking beacon and either a UHF command control receiver or an ITCS command control

transponder. Camera pods (only available from NAWCWD Pt Mugu) can be installed on the target boats.

Passive augmentation includes reflectors and radar enhancement screens. Active radar threat simulators and rocket boosted chaff can be provided on the target. Other range project equipment may be installed to electronically simulate naval combatants for exercise and targeting purposes.

The QST-35 SEPTAR targets are staged from Port Allen, transiting to Point Tango in approximately an hour and a half. Tango is a buoy approximately 1.5 miles offshore of Barking Sands. It is used as a temporary mooring for target boats during operations. The QST-35 is only authorized for offset fire, unless specifically approved for direct fire.

10.3.2 High Speed Mobile Sea Target (HSMST)

The HSMST was developed to provide the user with a medium to high speed surface target with a high degree of maneuverability via remote control. The HSMST is 23 feet (7.25m) in length with a beam of 9 feet (2.75m). The HSMST has an aluminum hull and a foam-filled collar (or sponson) that surrounds the deck area. Because of this sponson the HSMST is considered a Rigid Hull Inflatable Boat (RHIB).

Figure 10-9 HSMST

The HSMST can exceed 40 kts in calm seas and approaches 40 kts in sea state 3. The HSMST propulsion system consists of two 150HP outboard engines.

The trailer mounted HSMST boats are maintained at Port Allen and are launched at the Kikiaola Small Boat Harbor in Kekaha. The transit time from the boat harbor to Point Tango is 30 minutes. The HSMST is authorized for offset or direct fire.

10.3.3 Improved Surface Tow Target (ISTT)

The ISTT was designed to provide the user with a tow target capable of simulating various threat scenarios. It is a 28 foot (8.5m) fiberglass-constructed target which is capable of supporting operations while being towed with a 1,200 foot towline. The target stability characteristics are excellent at all towing speeds behind a QST-35/-35A. Speeds up to 25 knots in sea state 1, and 10 knots in sea state 3. The ISTT allows the user to conduct direct fire and/or bomb drop operations. Additionally, the ISTT can be configured to accomplish Radar Cross Section (RCS) and IR signature enhancements. The ISTT is being considered to support various other augmentation such as RF Emissions and Miss Distance Information.

A 28 foot mast can accept a 16 inch corner reflector on top and/or stream a visual banner. It is used for surface gunnery training. The ISTT is authorized for direct fire.

10.3.4 Trimaran Tow Target

Figure 10-10 Trimaran

The Trimaran Tow Target is a low cost tow target used for bombing exercises and surface and aerial gunnery training. The central hull is 14 feet (4m) long and the overall beam of the trimaran is 8 feet (2.4m). The target can be towed by a QST-35 SEPTAR with a 1,200 foot towline. Maximum towing speed is 30 knots in calm seas. Sea state limited towing speeds are consistent with the operational speeds of the QST-35.

Standard augmentation consists of a 7 foot square banner attached to a 14 foot mast with the banner top supported by a rigid horizontal member. As an option, a radar corner reflector

can be installed on the target. The trimaran is authorized for direct fire.

10.3.5 Floating At Sea Target (FAST)

The MK-42 MOD 0 Floating-At-Sea-Target (FAST) serves as a bombing and strafing training target for air-to-surface and surface-to-surface weapons. The FAST is a six foot diameter, icosahedron, whose 20 plane surfaces are equilateral triangle panels. Fifteen of the twenty panels are radar reflectors to provide return characteristics comparable to a destroyer or frigate-type vessel. The hull of the FAST consists of reflector panels, which act as corner reflectors for radar signature augmentation and flotation panels.

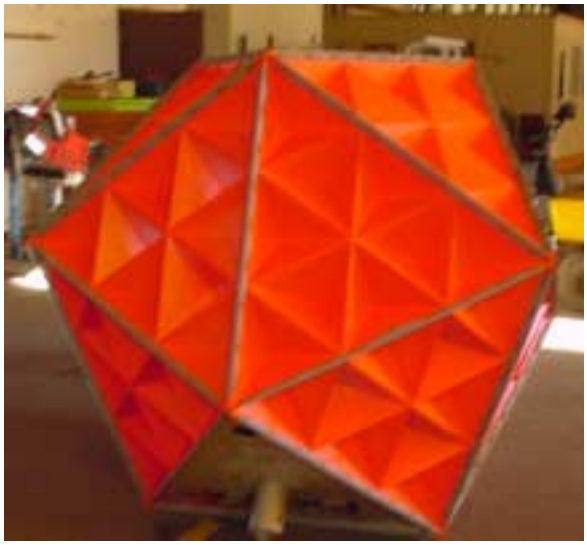

Figure 10-11 FAST

FAST, with the combination of the radar reflective panels, produces a cross-section measurement of approximately 2,000 square meters at 16 to 18 GHz. The FAST is a reusable shipboard-assembled target, which is deployable and recoverable from any Naval ship in weather conditions up to sea state 3. Once deployed, the FAST can be used as a target in weather conditions of sea state 4 or 5, when overflown by attack aircraft or the Armed Helicopter for gunnery training. The FAST can also be used as a floating target for surface-to-surface gunnery training, and is authorized for direct fire.

Ballast and flotation assemblies stabilize the FAST when afloat. At sea visibility from a surface vessel is approximately three and a half miles. The lightweight FAST units are hand-deployed and recovered by WRB or TWR range boats. The FAST is designed to remain afloat if damaged.

10.3.6 Full Scale Hulk

Instrumented and augmented inactive reserve hulks can be used as targets for Anti-Ship Cruise Missile (ASCM) exercises. The hulks are maintained in the Naval Inactive Ship Maintenance Facility (NISMF), Pearl Harbor.

Instrumentation and augmentation devices are installed at Pearl Harbor before the hulk is towed to the range by a Navy or commercial seagoing tug. Following the operation, the tug hulk is returned to NISMF, providing it is towable. When a hit has been scored, EOD personnel conduct a fire hazard inspection and remove or destroy on board explosive ordnance. Damaged hulks, unfit for towing, are stripped of usable equipment and sunk.

Hulk targets are allocated by COMTHIRDFLT. Upon allocation, equipment installation and deployment must be completed. At least two months advance notification is required to ensure readiness for an operation.

A C-Band radar beacon and power source is required on board a hulk before it can be taken on the range. The towing vessel must also carry a C-Band radar beacon and have UHF communications. The Operations Conductor, in direct communications with the towing vessel, coordinates hulk positioning and safe withdrawal of the towing vessel from the target area during the operation.

Augmentation devices to be installed for an operation should be agreed upon between PMRF and the Range User at least six weeks before the operation. Passive and active devices can include radar corner and screen reflectors, STE radar simulator, EW jammers, HF direction finder, and high speed cameras.

Camera instrumentation devices are provided from NAWCWD. The camera system incorporates provisions to activate camera filming. Active devices onboard the hulk are powered from a portable generator installed with the equipment.

All powered equipment, except cameras, is turned on before the hulk departs from Pearl Harbor. During the operation, targets are positioned within tracking range of shore based radar. A helicopter is positioned to provide visual surveillance of the target area and initial

damage assessment information. Video and photographic coverage of impact may possibly be provided from the helicopter.

Figure 10-12 Ex USS Ramsey

Outside supporting agencies involved when a hulk is scheduled as a target are:

- NAVSURFGRU MIDPAC - Towing and salvage services
- COMSUPPRON FIVE - Pretowing hulk evaluation
- EODGRU ONE - Fire hazard inspection and explosive ordnance disposal
- NISMF - Pre and post installation and equipment removal and hulk inspection and repair

A PMRF Program Manager coordinates with these agencies. A Range User must coordinate hulk target requirements in advance to ensure completion of the necessary arrangements for a hulk target presentation.

10.4 Underwater Targets

10.4.1 MK-30 Target

The MK-30 Mod 1 target, operated and maintained by NUWCDH personnel, is a fully programmable underwater vehicle capable of acoustically simulating the characteristics of all known submarines in the modern Navy. The target is 20 feet long, 21 inches in diameter and weighs 2,700 pounds. It is capable of speeds from 3 to 22 knots and can operate at depths from 50 to 2,000 feet.

The target can be programmed to run up to 7 hours, dependent on speed, i.e. 30 minutes at 22 kts, 7hrs at 7 kts. It is equipped with a MK-84 phase coded pulse pinger for acoustical tracking. MK-30 targets are launched and recovered by PMRF range boats and UH-3H helicopters.

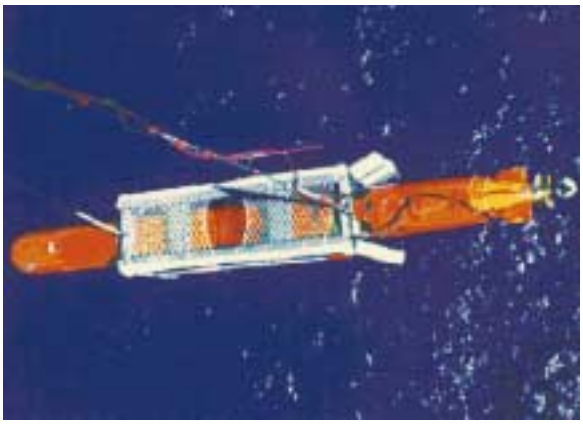

Figure 10-13 MK-30

The MK-30 can create a magnetic field similar to a submarine by trailing a current carrying wire. The magnetic anomaly created by the current induced magnetic field stimulates the Magnetic Anomaly Detection (MAD) equipment aboard ASW aircraft.

The target will respond to all active sonar and torpedo interrogations. Programmed responses are dependent on preset levels. The target can also stimulate shipboard and torpedo passive detection systems. An onboard solid state recorder records all incoming acoustic signals from sonar and/or torpedo systems involved in the exercise as well as some target functions to assist in post run exercise evaluation.

10.4.1.1 Target Launchers

A stern mounted rack launcher for the WRB range boats can accommodate up to three MK-30 targets. Launch is accomplished by dropping the target over the stern of the boat in a slightly nose down attitude. The launch order of the targets is set when the targets are loaded on the WRB at the Port Allen pier.

The TWR is equipped with a Telescoping Target Launcher (TTL). A target to be launched is positioned within reach of the TTL, which then picks it up and carries it over the stern of the boat. Launch is accomplished by dropping the target into the water. The TWR is capable of carrying twice as many MK-30 targets as the WRB and can launch them in any order.

MK-30 target launches from a UH-3H helicopter are accomplished using a MK146 Mod 0 helicopter launch cage suspended below the aircraft. The helicopter references target heading via Launch Control Box (LCB) and maneuvers into the wind, hovering over the

release point. LCB and mechanical release in the aircraft accomplish launching the target. The target is released in a nose down attitude with the target aligned fore and aft close to the aircraft heading. Upon water entry, the target will maneuver to referenced heading and the programmed run will begin.

10.4.1.2 Run Termination

At the end of the programmed run (EOR), the target's positive buoyancy causes it to rise to the surface for recovery. The target can also be acoustically commanded to EOR via range underwater projectors and range boats utilizing the Emergency Shutdown Pinger (ESP). The target will emit an acoustic EOR signal to aid recovery. The end of run signal and the tracking pinger will continue to run for several hours after the target has surfaced.

10.4.1.3 Recovery

The MK-30 Targets are recovered by helicopter (vertical recovery), the WRB and the TWR range boats. When recovery by boat is planned, the target is programmed to inflate a flotation balloon at EOR to raise the stern so the target floats horizontally for recovery. The balloon supports a strobe light, UHF radio beacon, and a dye marker to aid in locating the target. The WRB has a recovery capacity of eight MK-30 targets; the TWR capacity is fifteen.

When recovery by helicopter is planned, vertical EOR is selected and the MK-30 target floats vertically to allow a recovery cage suspended below the aircraft to capture the unit. If the unit is not recovered within one to three hours, the flotation balloon automatically inflates to aid recovery by the range boats.

10.4.1.4 Scheduling

Use of a MK-30 Target must be coordinated with COMTHIRDFLT and NUWCDH Lualualei, Oahu. PMRF coordinates with NUWCDH Lualualei for preprogrammed run geometries and acoustic simulations specific requirements.

10.4.2 MK-28 Target

The MK-28 is a floating, pinger equipped, target buoy system that acoustically simulates a large vessel. The systems array extends 350 feet below the buoy. The array includes sonar and a torpedo transponder with a MK-84 tracking pinger at the bottom of the array. Each device has a self-contained power supply. Normal operating time is 8 hours, which may be reduced by as much as 50% if the sonar transponder is interrogated continuously. The buoy is deployed and recovered manually from a WRB or TWR. Should it drift out of position it can be towed at reduced speed to return it into the target area.

The target is used to exercise weapon systems, including Warshot torpedoes. Use of this target must be coordinated with NUWCDH Lualualei, who obtains the target from Keyport, WA.

10.4.3 MK-17 Torpedo Target

The MK-17 is an acoustic array extending below the deploying boat. It is used to simulate an underwater target for MK-50 and other torpedo exercises. The system can be operated from a TWR, with the electronic control equipment mounted on deck in an 8 foot x 8 foot x 14 foot van with a stern-mounted winch and cable. The equipment requires four hours to install and remove. Technicians from NUWCDH deploy with the TWR to operate the MK-17 equipment.

The system generates and transmits acoustic noise data and responds to torpedo interrogations to simulate a submarine. This is a versatile system whose simulation parameters can be readily changed by the operator onboard the TWR.

10.4.4 Mk 39 Mod 1 Expendable Mobile ASW Training Target (EMATT)

The Mk 39 Mod 1 is a small, negatively buoyant, expendable, self-propelled underwater device that can be launched in flight from both fixed wing and rotary wing ASW aircraft, or from surface ships. This unit was developed to serve as a low cost, open ocean ASW training target for the US surface and air Navy. The EMATT weighs 25 pounds, is 36 inches long, is 4.88 inches in diameter. It can operate for 3 hours at a depth of 75-600 feet with speeds between 7-8 knots. The Mod 1 version available at PMRF has:

- Programmable tonal levels
- Autonomous evasion maneuver
- Integrated tracking pinger
- Improved safety circuit
- High reliability electronic processor
- Single ring tonal transducer

Figure 10-14 EMATT

This highly successful target has been employed in all oceans and in numerous multi-national exercises. The EMATT generally serves as backup to MK-30 targets when high sea states preclude recovery.

10.4.5 J-11 and J-15 PANS

The J-11 and J-15 Programmable Acoustic Noise System (PANS) units are hydro-acoustic projectors that are deployed from, and towed through the water by the WRB and TWR range boats. The QST-35 SEPTAR can tow the smaller J-11 PANS. They are programmable to simulate surface and sub-surface threat representative signature and noise hydro-acoustic signals. Maximum towing depth of the J-11 unit is 100 feet at speeds of 4 to 5 knots. The J-15 maximum depth is 500 feet at a towing speed of 5 to 6 knots. The PANS system, developed for AEGIS, can be used by other platforms.

10.4.6 Autonomous Mobile Periscope System (AMPS)

AMPS, developed jointly by the Pacific Missile Range Facility (PMRF) and the Carderock Division of the Naval Surface Warfare Center (NSWCCD), meets the requirement for an inexpensive readily available periscope detection target. The AMPS represents the above water portion of a submarine running at periscope depth. A simulated attack periscope and mast are mounted to a free running, underwater vehicle. The vehicle positions and propels the periscope over a prescribed path and has the capability to submerge the periscope at various intervals. The vehicle path can be radio controlled or preprogrammed. It also has the capability to be instructed to end its run through an acoustic link.

AMPS is designed to operate at a maximum of five knots for five hours. It is capable of operation in sea state three and recovery in sea state four. The nominal mast exposure is five feet and it submerges on command. Dynamically, the AMPS is designed to have a maximum heave amplitude of plus or minus one foot in short (less than eight seconds) period waves. It will follow long (greater than ten seconds) period waves. It is designed to pitch and roll less than ten degrees 90% of the time. Physically the AMPS has a cylindrical hull, is 25 feet long, 24 inches in diameter, and weighs 3,000 pounds in air. It has control surfaces forward in the form of differentially actuated bow planes. The rudder and stern planes are located aft and are non-differentially actuated. The mast is ten feet long and folds down for launch and recovery and to reduce drag while operating underwater. An external keel located just forward of the mast retracts into the AMPS hull for launch and recovery.

External commands to control vehicle motion are depth, heading, and speed. The bow planes control roll, pitch, and depth. The stern plane controls pitch and depth. The rudder controls heading and the propulsor speed. The model used to examine vehicle dynamic response was a non-linear, six-degree-of-freedom, time domain simulation. The model is based on the DTMB Standard Equations of Motion for Submarine Simulation. The vehicle dynamic

force and moment equations were written in a form utilizing non-dimensional coefficients of the various motion variables. A three-dimensional, surface-piercing mast model was added to the vehicle model to represent the AMPS with mast. The AMPS is designed to be capable of being tracked both on and off range. While operating on the PMRF underwater range the AMPS is tracked acoustically by its tracking pinger. During off range operations, or in lieu of acoustic tracking, the AMPS can be tracked using GPS data acquired by an onboard GPS receiver and transmitted via an RF link. Both the GPS and UHF antennas are embedded in the periscope in order to make the periscope as realistic as possible.

In a typical operation the AMPS is checked out pier side prior to going to sea. When on station, the vehicle is placed in the water by rolling it down the WRB deck rollers and over the tail gate. Once in the water the mast and keel deploy. The AMPS then waits in a power saving "sleep" mode until directed by an RF signal or an internal count down clock to begin the scenario. The vehicle proceeds to a way point submerging and resurfacing. It corrects its heading each time it resurfaces as it receives updated GPS data. After reaching the way point it proceeds to the next way point. Throughout the operation the scenario can be interrupted through the RF or acoustic link.

Figure 10-15 AMPS

At the end of the run, the AMPS deploys a recovery balloon. Upon command the mast folds down and the keel retracts into the AMPS body. The vehicle will then be winched onboard using a cable attached to the nose pin ring on the nose section of the AMPS.

The AMPS provides a low cost, low risk solution to the Navy's periscope detection requirement. PMRF is the world's largest instrumented multi-environment range capable of utilizing this unique training target.

10.5 Target Control Systems

Three independent types of command and control systems at PMRF are used to control targets, from slow moving boats to high-speed aerials.

Four UHF command control systems are available at PMRF with the UHF transmitters at Kokee Park. Aerial and surface target control signals and flight termination signals originating in the ROCC are transmitted to Kokee via microwave. More information on CCT/CDT Systems can be found in the Communication Systems chapter.

There are four G-Band ITCS remote trackers at Makaha Ridge with two operating consoles in each of the Alpha and Bravo tracking and control rooms.

The Multiple Aircraft GPS Integrated Command and Control (MAGICC) system capability is available at PMRF on a limited basis. It is generally used for T&E programs. This system is not fully sanctioned for use to support Fleet exercises. Future plans call for System for Naval Target Control (SNTC) to replace MAGICC.

All target operations are subject to compliance with range safety specifications; however, the aerial target safety requirements are the most stringent. The Range Safety Approval (RSA) for the MQM-8 VANDAL and AQM-37C target flights specify that an MFSO representative must be present during these target operations. Surface and airborne targets are operated and controlled by Targets personnel using ITCS and UHF command control systems. Operation and control of underwater targets are the responsibility of NUWCDH Kauai.

Underwater target control and run terminating signals originating in the control rooms are transmitted through the UQC underwater communication system to one of three projectors in the BARSTUR range or one of two projectors in the BSURE range. UQC radio relay through the range boats can extend these signals into areas not served by the bottom mounted range projectors.

Control and termination of weapon firings or launches are the responsibility of the participant.

PMRF may stipulate weapon run or flight termination to preserve range safety; however, the responsibility for accomplishing the termination function remains with the range user. PMRF assistance, if desired by the range user to supplement the user's function, should be requested in planning documentation.