

Naval Undersea Warfare Center, Division Keyport

***Providing
Test, Training
& Evaluation
Services to the
Warfighter and
Undersea Warfare
Programs***



Test, Training & Evaluation Capabilities Strategically Located with our Fleet in the Western Pacific Theater

Apra Harbor, Guam

- Guam NUWC Office
- Engineering
 - Direct Fleet Support
 - MK 30 Ops

Pearl Harbor, Hawaii

Hawaii Fleet Operational Readiness

- FTEC
- SESEF
- FORACS/USW T&E
- MK 30 Targets Maintenance
- Magnetic Silencing
- Engineering
- Pinger Maintenance

Keyport, WA

Undersea Warfare Annex

- Ordnance Handling/Storage
- USW T&E

San Diego, CA

Fleet Operational Readiness

- FTEC
- Engineering
- USW T&E
- SESEF
- Magnetic Silencing
- MK 30 Targets IMA/Pinger Maintenance

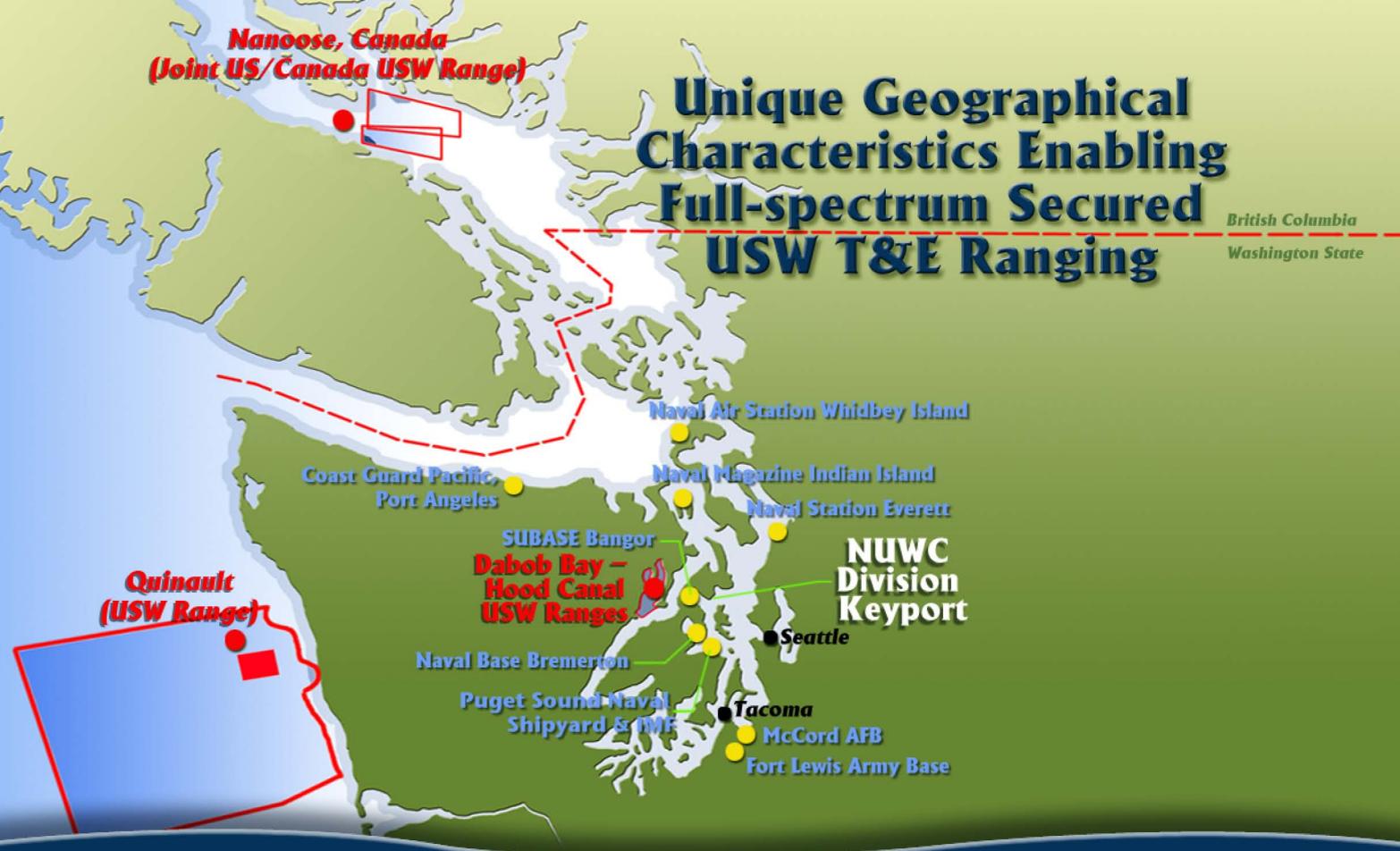
Unique Geographical Characteristics Enabling Full-spectrum Secured USW T&E Ranging

British Columbia
Washington State

Nanoose, Canada (Joint US/Canada USW Range)

Quinault (USW Range)

Dabob Bay – Hood Canal USW Ranges



Centrally Located In Major Fleet/DoD Concentration Area

Pacific Northwest Range Sites



Trident Submarine on Dabob Bay

Winchelsea Island, Nanoose Test Site

Keyport Test Site UUV Operating Area

Dabob Site

Dabob Site near Submarine Base Bangor provides a compact local CONUS operational test area in an isolated branch of Puget Sound adjacent to the Olympic National Forest. The Dabob Site uses orthogonal short-baseline hydrophone arrays and precisely timed PSK (Phase Shift Keyed) coded acoustic signals to provide a high-accuracy, high-frequency tracking system. High accuracy tracking covers 9 nmi with depths ranging from 500-600 ft.

Nanoose Site

The Nanoose Site is a joint Canadian-US test facility located in the Straights of Georgia between Vancouver Island and the Province of British Columbia. It provides the largest modest-depth active tracking area of the Pacific Northwest Range Complex. The Nanoose Site shares the same basic tracking technology as the Dabob Bay Site, with highly accurate track covering a 50-nmi area provided by 29 short-baseline arrays. The Nanoose site water depth is 700-1300 ft.

Quinault Site

The Quinault Site is located off the west coast of Washington State near Destruction Island. It provides a unique shallow-water littoral test area where the tracking range to depth ratio can easily exceed 50:1. The development of this site pioneered the introduction of the reverberation-tolerant SFSK (Spaced [pulse] Frequency Shift Keying) tracking technology that has not been surpassed for tracking in such critical environments.

Keyport Site

The original torpedo range was located in the shallow waters adjacent to NUWC Division Keyport. Requirements for deeper water moved torpedo ranging out of these waters. Keyport is experiencing a resurgence in activity in these shallow water areas, as it is found to be ideal for UUV (Unmanned Underwater Vehicle) testing. With depths of 200 ft and less, this area continues to be an important part of the Pacific Northwest Range Complex.

3-D Tracking

3D Underwater track is the heart of the PNW Range capability. Both Dabob & Nanoose sites utilize a short base-line system that allows for extremely high tracking accuracy. This unique type of tracking allows for higher tracking frequencies, minimizing impact to systems under test.

Targets & Countermeasures

NUWC Division Keyport offers a full spectrum of artificial/real, active/passive, stationary/mobile targets which are operated & maintained by Keyport personnel.

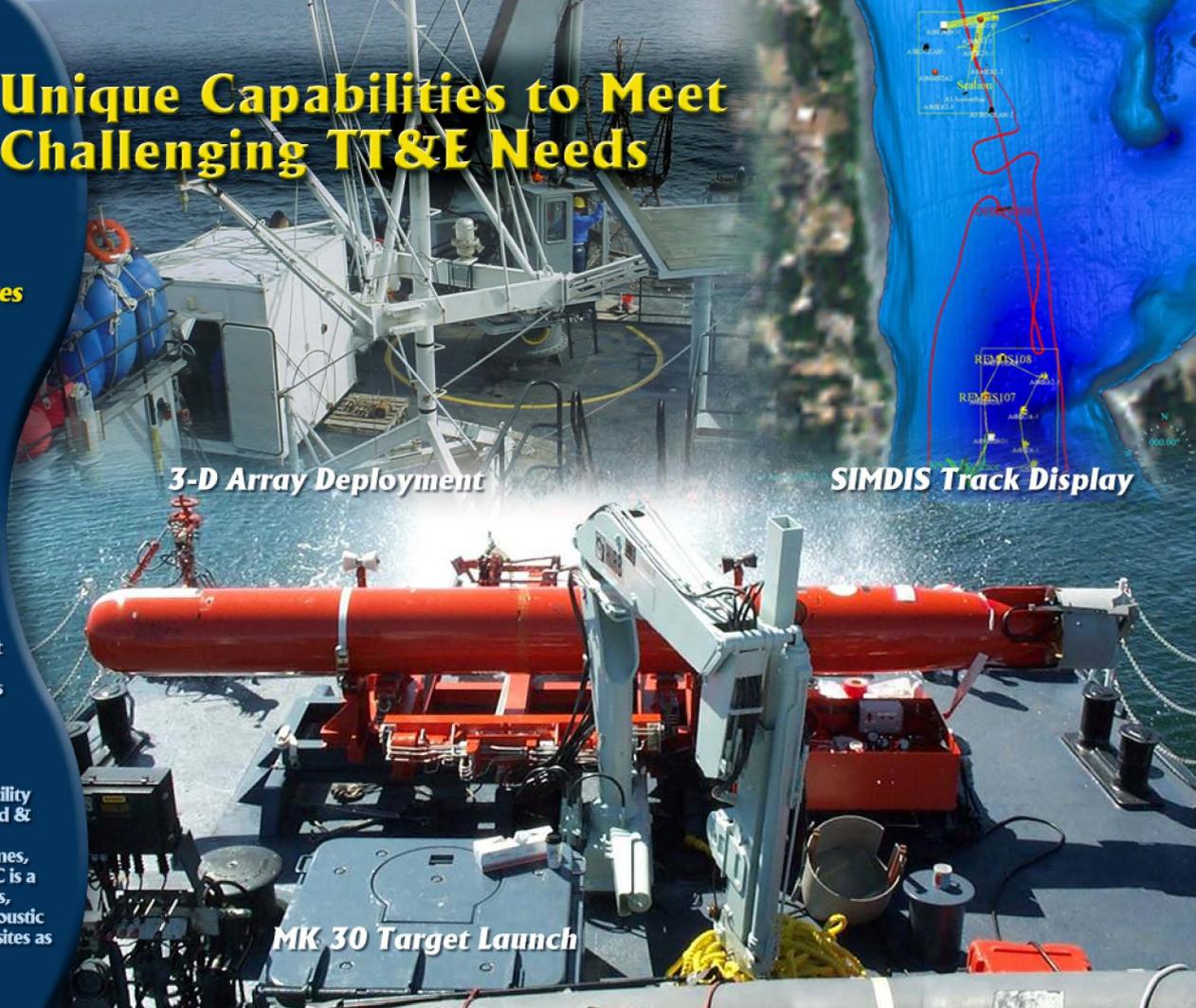
Acoustic Measurement

NUWC Keyport provides extensive capability for measurement & analysis of radiated noise, structure-borne noise, self-noise, and ambient noise in support of range operations. They include features for high speed & ultra quiet vehicle measurements. The Northwest Range sites are fully instrumented for acoustic measurement & monitoring with data processing & analysis performed at NUWC Keyport's Underwater Noise Analysis Facility (UNAFAC).

UNAFAC

The UNAFAC is the Navy's principal facility for the processing & analysis of radiated & structureborn noise from underwater weapons, targets, countermeasures, mines, UUVs & other special vehicles. UNAFAC is a secure computer facility used to process, interactively analyze & report on all acoustic data acquired at the Northwest Range sites as well as outside sources.

Unique Capabilities to Meet Challenging TT&E Needs



3-D Array Deployment

SIMDIS Track Display

MK 30 Target Launch



YTT Craft

Torpedo Recovery

Canadian Target & Sound Craft

Torpedo Retriever

Range Control at Winhelsea Island

Remotly Operated Vehicle

Range Craft

The PNW Range is supported with a number of special purpose vessels specifically to support test and training events. The special built YTT craft combine a number of unique features found on no other craft. They have the ability to launch torpedoes both above & below water, as well as to support Remotely Operated Vehicles (ROVs) & heavy lifting capability for range maintenance. In addition to the YTT craft, the PNW Range maintains three special torpedo retrieval craft & two target & sound craft.

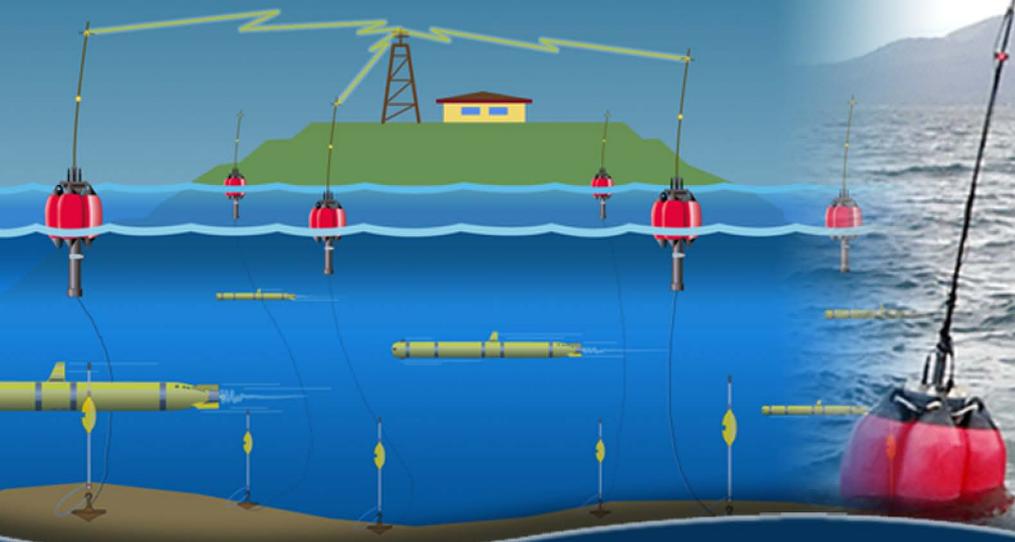
Range Control

Both the Nanoose & Dabob sites have dedicated range control facilities. These facilities combine all aspects of range control from 3-D track, special systems operations & range safety.

Recovery

The combination of extremely soft bottoms on Pacific Northwest Range sites along with an extremely capable recovery team results in a truly unique capability, virtually ensuring damage free recovery of test items. In addition to surface retrieval, NUWC Keyport maintains a recovery group that relies on ROVs (Remotely Operated Vehicles) recovering test items off and even under the seabed.

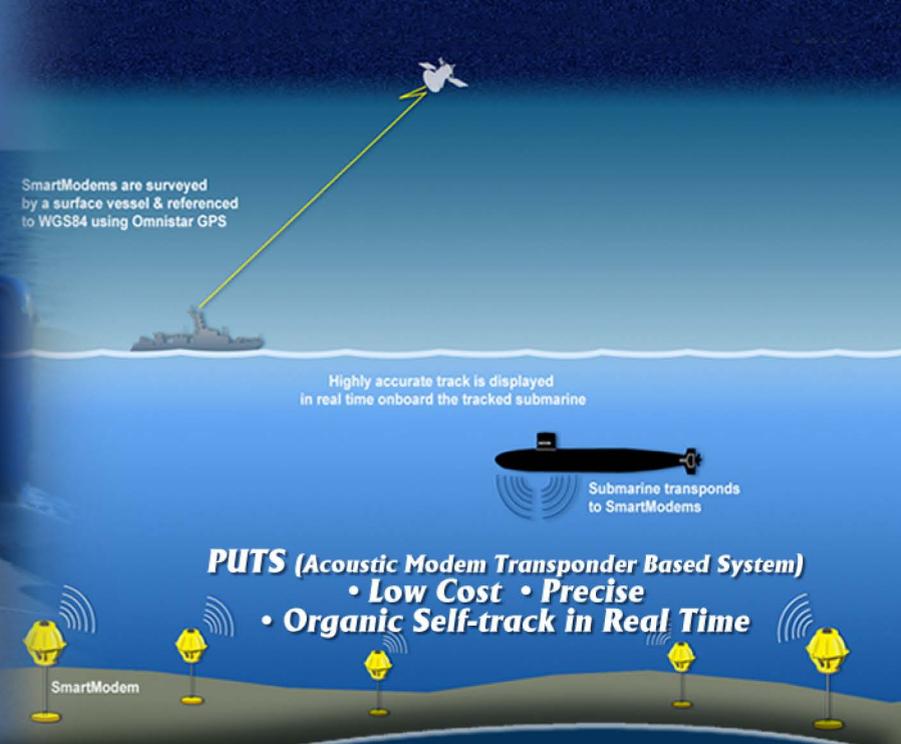
Portable Test & Evaluation... Anytime/Anywhere



SWIFT Range Buoy



PUTS Bottom Nodes



SmartModems are surveyed by a surface vessel & referenced to WGS84 using Omnistar GPS

Highly accurate track is displayed in real time onboard the tracked submarine

Submarine transponds to SmartModems

PUTS (Acoustic Modem Transponder Based System)
• Low Cost • Precise
• Organic Self-track in Real Time

SmartModem

PUTS

PUTS is an organic portable underwater acoustic tracking system for temporary deployment in unusual shallow-water environments. It uses an acoustic modem-based tracking system & takes advantage of the transponder feature of the modem to determine the range between the modem on an underwater vehicle & a selected bottom-moored modem or PUTS transponder. Each bottom-moored modem has a unique identifier number that allows any given test vehicle to select the bottom moored modem it will interrogate. By interrogating three different PUTS transponders, the test vehicle can locate its position in real time with a high degree of accuracy.

Portable Systems

The Pacific Northwest Range Team provides several tracking systems that may be transported to any suitable location in the world. This allows testing in threat-representative environments & with forward-deployed fleet assets. To accommodate the wide variety of test requirements, Keyport has developed three basic portable systems for underwater tracking. These include the Shallow Water Integrated Flexible Tracking (SWIFT) system, the Target Centered Tracking (TCT) system & the Portable Underwater Tracking System (PUTS).

SWIFT Range

Increased emphasis on operations in shallow/littoral water environments led to the SWIFT Range architecture that relies on proven technologies & many COTS components. SWIFT Ranges are fully developed & available to serve shallow or deep tracking requirements. SWIFT Ranges provide integrated, real-time tracking of multiple undersea, surface & above-water participants. SWIFT is easily adaptable to different configurations & system components can be tailored to individual range sites & test requirements. SWIFT continues to be highly effective & has successfully provided tracking on over 45 operations since its original deployment in 1989.

TCT

The TCT system provides high-accuracy, real-time tracking data relative to a single fixed or mobile reference point or target. This system is ideal when extremely accurate track is required in the vicinity of the target. TCT is an Ultra-Short Baseline (USB) tracking system that can be mounted on suitable submarine targets. The USB array is installed on the exterior of the submarine & real-time track is provided on the submarine itself. A pinger (synchronized noise generator) installed on the underwater weapon under test provides the tracking signal, allowing TCT to precisely track the weapon as it intercepts the target.

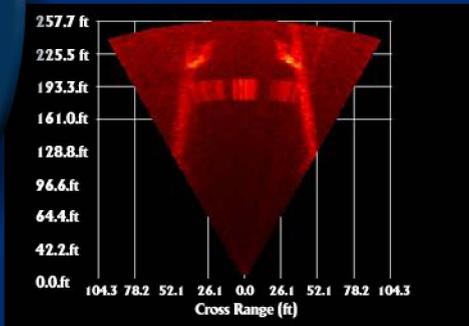
Collaborative Test Events

Visualization via SIMDIS

SIMDIS, a 3-D visualization tool developed by the Naval Research Laboratory, is rapidly becoming the standard for displaying range operations data. SIMDIS is being used extensively by CTEC to support Test & Evaluation Events.

CTEC (Collaborative Test & Evaluation Capability)

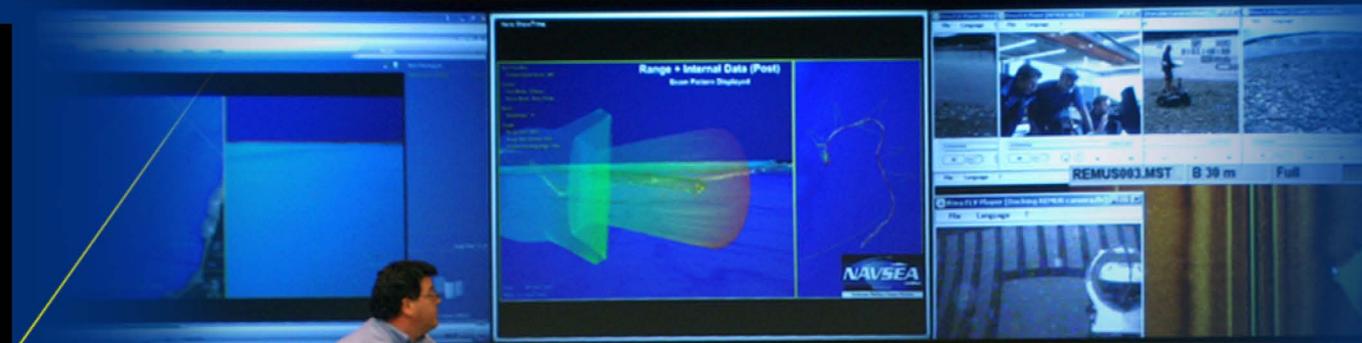
The US Departments of Defense & Homeland Security are transforming to prepare for maritime threats & environments of the 21st Century. To address this need, NUWC Division Keyport has evolved a core set of capabilities, collectively referred to as CTEC. CTEC advances the idea that Test, Training, Experimentation, & Evaluation activities should be inherently integrated to optimize the efficiency & effectiveness of maritime supported Joint operations & programs. No single organization or facility can be the center of the US Navy's transformational philosophy. However, each collaborating facility must possess a minimum level of capability to participate in distributed events. CTEC is a premier maritime T&E collaboration facility where users can plan event scenarios, control & monitor local & remote assets during events, present event information to local & remote viewers, & evaluate event data & provide rapid feedback.



Sonar Image

Sunken Barge

Time: Tue Jun 14 17:07:27.837 2005



Event Insight via ESMS

The Event Streaming Media System (ESMS) allows event participants to observe synchronized audio & video streams of instrumented ranges & event assets. ESMS is based on industry-standard Adobe Flash streaming media technologies. Streams are presented via a web browser interface on any network-enabled PC.

Environmental Test Lab

The Environmental Test Lab has developed a unique combination of experience & technology in test methodology, evaluation & program administration. The lab specializes in design verification & development, reliability assurance & lab simulation of environmental conditions. Many environments can be combined such as temperature, vibration & functional testing. Keyport has unique testing systems for size & extreme environments. Some capabilities are:

VIBRATION

3-axis simultaneous electrodynamic vibration.

HALT/HASS

SHOCK

Shock Response Spectra (SRS)
Replication of field data drop & shaker shock up to 4,000 lb.

CLIMATIC

Temperature extremes from -100° F to 300° F, 65,000 ft altitude, Humidity, fungus, solar radiation
Marine Environment: Salt Fog, emersion

UNIQUE EQUIPMENT

3-axis Rate table with temperature conditioning and ship sway simulation
Centrifuge for up to 1,000 lb payload.

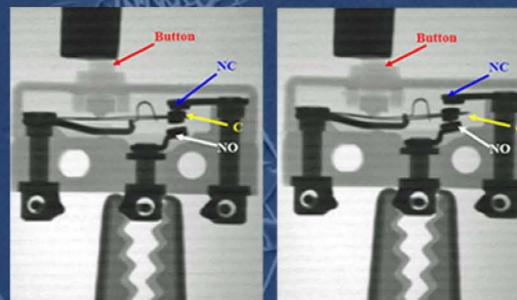
Environmental Test Facility

3-Axis Electrodynamic Vibration System

Drop Shock System

3-Axis Rate Table

HALT/HASS Chamber



Normally Closed

Normally Open



Failure Analysis

Failure Analysis Lab

The Failure Analysis Lab at NUWC Division Keyport supports the Fleet by providing independent root cause failure analysis & materials characterization services on-site. The lab's services are used to increase the reliability of weapon systems & improve combat readiness. Located near the Torpedo Intermediate Maintenance Activity (IMA) & Depot functions, the Failure Analysis Lab directly supports the In-Service Engineering Agent (ISEA) for the MK 46, MK 48 Mods 4-7, MK 50 & MK 54 Torpedo programs. We facilitate innovative solutions for the Fleet, including support for Custom Engineered Solutions (CES) & reverse engineering efforts. We have supported the Army, Navy & Air Force. We have assisted Foreign Military Sales (FMS), Judge Advocate General (JAG) & Naval Criminal Investigative Service (NCIS).

The Keyport Failure Analysis Lab offers:

- Light Microscopy & Electronic Photo-documentation
- Metallurgical Sample Preparation & Analysis
- Scanning Electron Microscope (SEM) for magnification up to 300,000 times
- Energy Dispersive Spectroscopy (EDS) for elemental determination
- Fourier Transform-Infrared Spectrometer (FT-IR) for organic analysis
- Real-time X-ray Inspection that can penetrate samples up to 0.650 in.-thick aluminum & 0.425 in.-thick steel with 2-micron detail detectability
- Tension & Compression Testing
- Hardness Testing
- Electrical Failure Isolation, including temperature dependent failures
- Integrated Circuit Decapsulation
- Die level electrical micro-probing
- Curve Tracer electrical characterization of discrete components, ICs & circuit boards, with up to 2,000 volt output & nanoamp current resolution
- Labview based rapid test set development



Our People: Experience to Meet Unique Needs

Range Management & Operations Division

Maintenance & operations on all Pacific Northwest Range sites is the responsibility of the professionals within this Division. This Division schedules all tests conducted on the range sites, ensuring customer schedules & test needs are met.

USW Weapons & Product Acceptance Division

Responsibilities within the Division include readiness assessment of operational USW ships, ship systems & weapons. They perform test data processing required for analysis & evaluation of T&E events. Responsibilities within this Division include land based test & failure analysis.

USW Systems Test & Operational Assessment Branch

This Division provides test planning coordination along with reliable test measurement systems. Division personnel are responsible for identifying, acquiring, sustaining & modernizing T&E systems, both fixed & portable, as well as R&D test vehicles & targets.

Hawaii Fleet Operational Assessment Division

Located near Honolulu, Hawaii, this Division provides the Fleet, acquisition community, Joint Forces & Allies with Test, Training & Evaluation products & services in Hawaii, Guam, WESTPAC, Pacific Rim, East Coast & Worldwide. The Division supports the Fleet & Allies with underwater mobile targets, underwater tracking range equipment & USW operational assessment for training & shipboard system testing for materiel readiness. Support to the acquisition community includes Trusted Agent & Shipboard T&E for USW systems. Interoperability & tactical link testing supports the Joint arena. The Division also provides engineering support to Hawaii-based S&T projects. The Division is NUWC's forward presence in the Pacific, strategically positioned at the "Tip of the Spear."

SOCAL Fleet Operational Readiness Division

Located in San Diego, this Division supports Fleet readiness by managing the air, surface, submarine, combat system test & analysis, weapon evaluation, mobile target, tactical exercise analysis, magnetic signature reduction & range support programs in the Southern California area. Operations include SCIUR, USWREF, FORACS 1, MSF, SSRNM & SESEF ship test ranges in the Southern California area.



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