Enabling Effective & Efficient Fleet UMV Operational Training through Distributed USW Test & Training Technology

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When a new Unmanned Undersea Vehicle system is ready to go to the Fleet, have we done all we can to assure the sailors will be ready to employ it?

- Typical acquisition cycles for "new" systems result in new products being delivered to the operational community, but leaving that community the responsibility to figure out how to employ it.

- The current Submarine Community approach, is to use "cadres" of specialized operators who take the new, specialized systems to sea and interface with the crew of the host ship in system deployment.

- Shipboard crew members need training because cadres are not expected to provide a long-term ConOps for UUV employment.

- Navy school houses don't have trainers for teaching operators how to use UUVs, and they probably won't have them in the near future.

Spiral Development

- More Challenge: Current military technology development cycle is shorter than traditional DoD acquisition cycle. *However …*

- This also provides another opportunity to gather information on real operations in real environments with new systems to <u>support Fleet training</u>

  - Spiral development and Build/Test/Build strategies generate <u>at-sea and on-range experiments utilizing Fleet platforms and personnel</u>

  - Real-time, <u>hands-on Fleet involvement</u> during actual DT and OT events

  - <u>Virtual, real-time participation</u> by Fleet personnel

  - Employ information from real system operations in real environments to <u>rapidly build and field Fleet training tools</u>

- Information from these experiments which employ Fleet units can enable operational testers opportunity for early assessment of operational effectiveness and suitability

Meeting the Challenge

Training Transformation

Joint National Training Capability (JNTC)
– Future of T&E intertwined w/ Joint Experimentation & Training –

"… a collection of interoperable training sites, nodes, and events that synthesizes Combatant Commander and Service training requirements ...."

"Test and Training Partnership is Essential to Transformation"

Mr. John Bolino, DOT&E

Rapid Evaluation & Analysis to Support a Nation at War
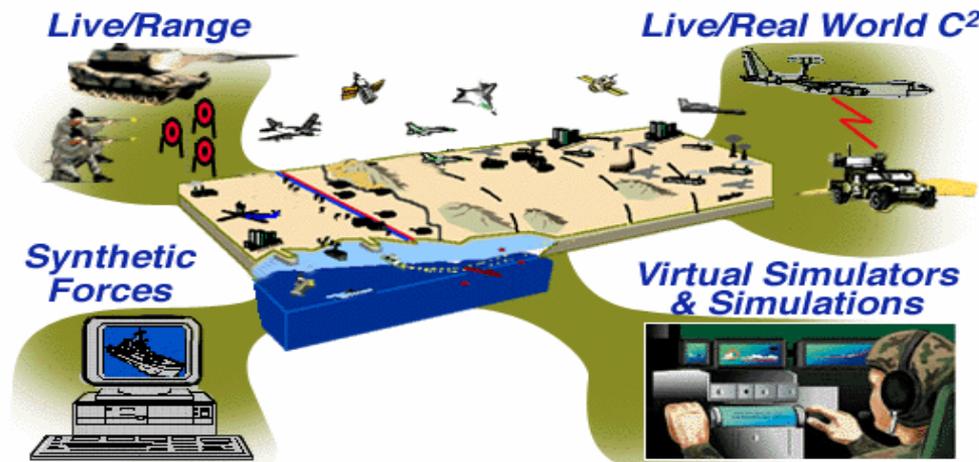
Transformation Drivers - *Navy*
Sea Trial: The Process of Innovation

"… integrate war-gaming, experimentation, and exercises … Embracing spiral development … a process of rapid prototyping and fleet experimentation."

Training Transformation Implementation Plan (T2IP):

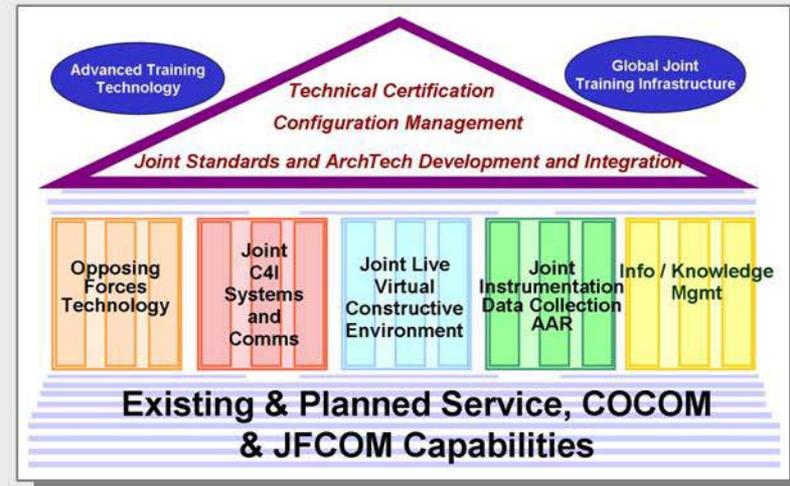JFCOM - Integrate joint experimentation and lessons learned into new training processes and systems

A cost effective, realistic synthetic test & training environment / capability

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Joint National Training Capability (JNTC)

JNTC: A National Strategy

Development of Joint synthetic environment (L-V-C*) in support of <u>training and experimentation capability</u> - a persistent network that <u>seamlessly links select ranges and simulation centers</u> throughout the world

JNTC Technical Focus Areas

Advanced Training Technology

Global Joint Training Infrastructure

Technical Certification
Configuration Management
Joint Standards and ArchTech Development and Integration

Opposing Forces Technology

Joint C4I Systems and Comms

Joint Live Virtual Constructive Environment

Joint Instrumentation Data Collection AAR

Info / Knowledge Mgmt

Existing & Planned Service, COCOM & JFCOM Capabilities

* *Live*, *Virtual* and *Constructive* ("L-V-C") Training

Asset Realization	People	Systems	Environment
Live	Real	Real	Real
Virtual	Real	Simulated	Simulated
Constructive	Simulated	Simulated	Simulated

Navy Implementation of National Strategy

Navy Continuous Training Environment (NCTE) … capabilities to conduct *training on demand* … through a persistent network that connects geographically dispersed training simulators and systems with geographically dispersed forces.

- Modeling & Simulation to complement and enhance constrained *Live* training time with *Virtual* training events … in a *synthetic battle space employing tactical training ranges, infrastructure, … joined in a common network for training events*

- Use the Test and Training Enabling Architecture (TENA) standards for training, and operational systems and ranges ...

NCTE - 2009 Goal: Train any audience … a persistent network focused on *joint training, experimentation, testing, education, and mission rehearsal*, by linking command and control, training facilities, ranges, and simulation centers throughout the world.

RADM David B. Hart, Director, Fleet Readiness Division, CFFC
Testimony to HASC March '04

Sea Trial – The Fundamentals

- <u>The Fleet must drive innovation and experimentation</u>.

    - Fleet identifies specific warfighting challenges and the urgency ...

    - ConOps: capitalize on an existing or emerging technology.

    - Experimentation evaluates potential solutions with sufficient analytical rigor.

    - <u>The cycle is complete when the doctrine development, training, and acquisition</u> process reflect those results.


- <u>Active involvement of our operators in the testing and evaluation</u> of the technology … and the tactics and doctrine ...

- <u>Our ships and aircraft will serve as sea-based laboratories</u>, with our operators helping to answer the most pressing question… *"What new ConOps will make the most effective use of existing and emerging technologies?"*

Sea Trial – ADM Robert J. Natter, former Commander, CFFC, October 2003

Meeting the Challenge

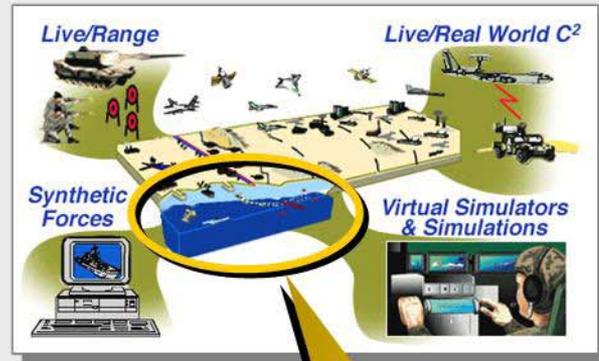## *The Sea Trial Process – Focus on Capability*
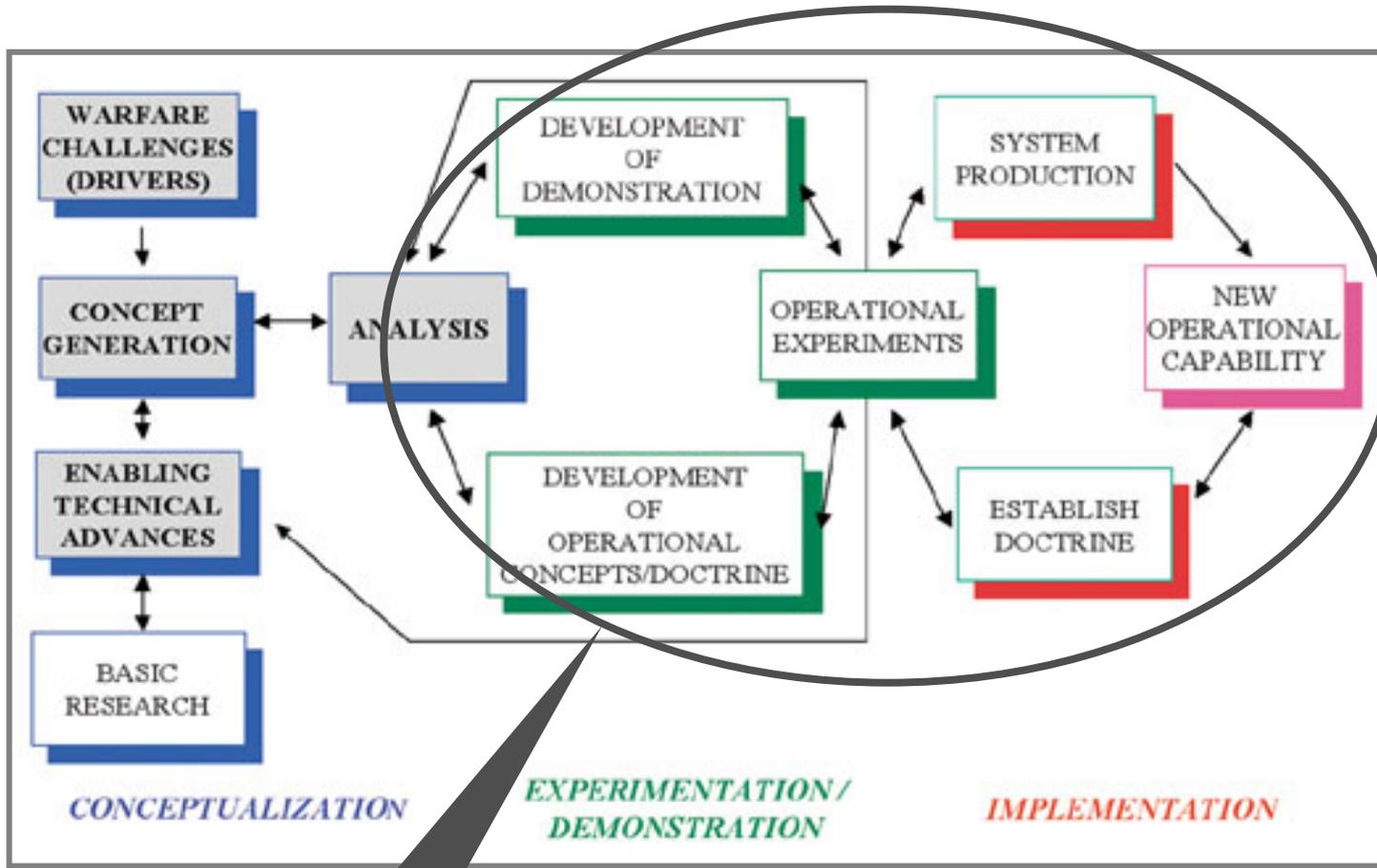
Sea Trial: More than equipment development. New capability necessarily includes the doctrine, tactics, and associated training for Fleet employment.
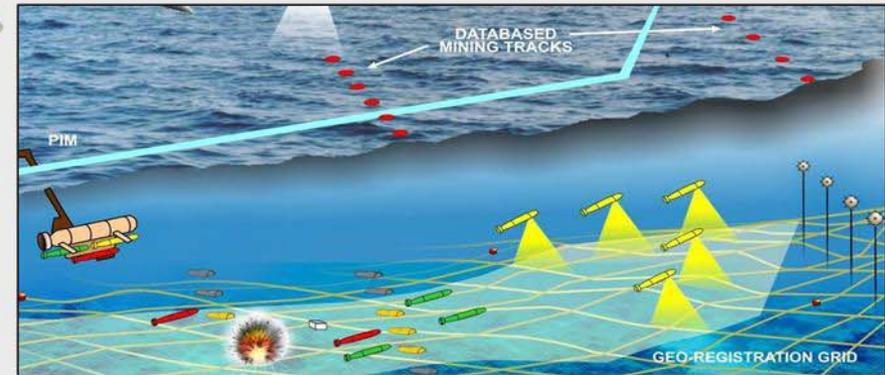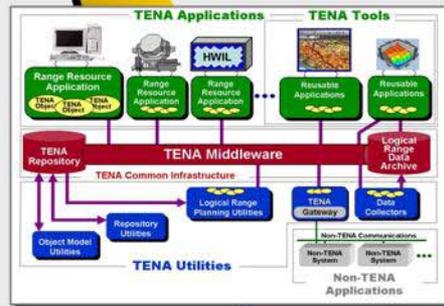
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Distributed USW T2E2 and JNTC

Navy Training Continuum
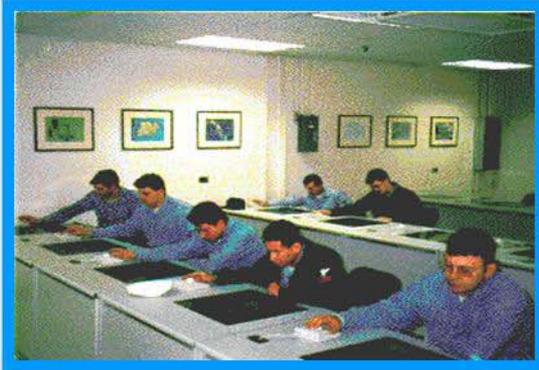
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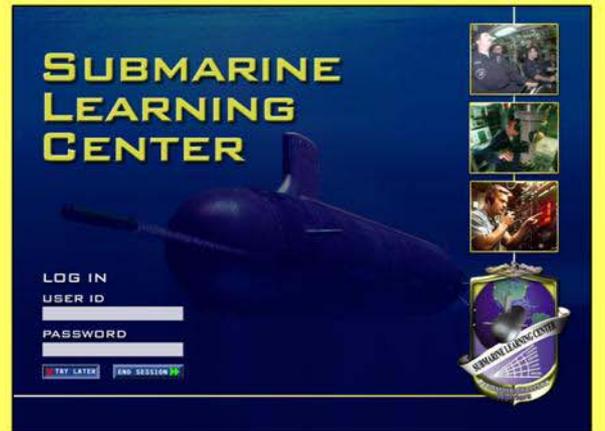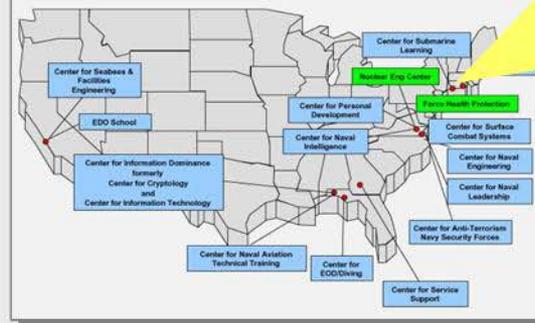
T&E Capability - to - Training Capability
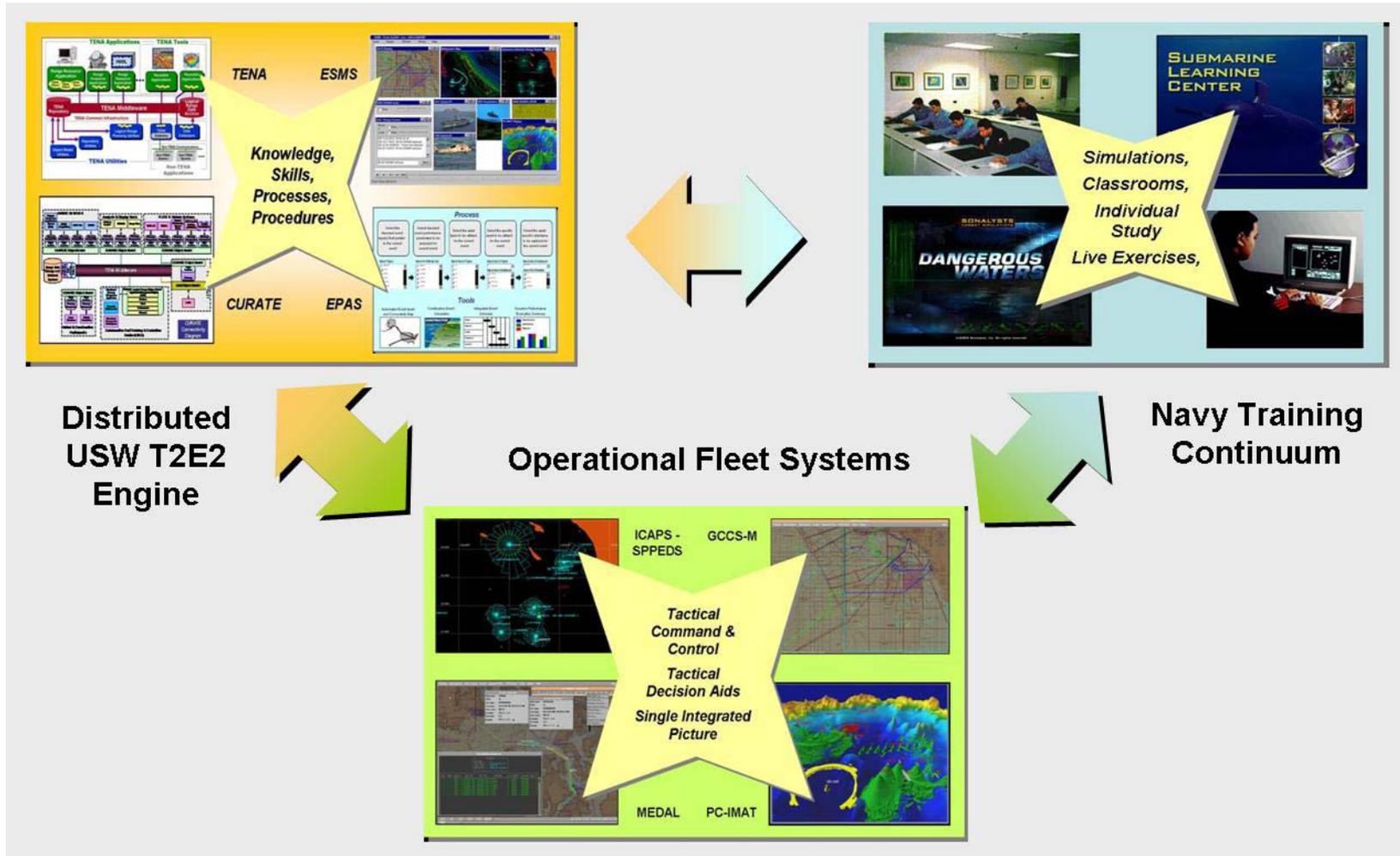
Success Strategy: *Integrate - Don't Re-Invent!*

T&E Capability - to - Training Capability

Notional Integrated MIW & ISR T2E2 Exercise Scenario

UUV Test & Experimentation Operation at NUTEC

Distributed USW T2E2 Capability

Fleet Training Exercise in SOCAL Area with Live, Virtual, Constructive Components

Fleet RMS Exercise on Gulf Range

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AUV Fest Example

- UUV and NUTEC assets at Keyport, WA capture ISR information
- "Virtual" ISR picture to SDVT-1 mission planners in Hawaii
- SDVT-1 participants use captured ISR information to support a covert insert operation

A <u>Covert Special Ops Insertion (CSOI) Operation</u> involving a SDVT-1 vehicle (i.e. SDV) or diver using remotely collected ISR data transposed to transit a virtual range at Ford Island, Hawaii
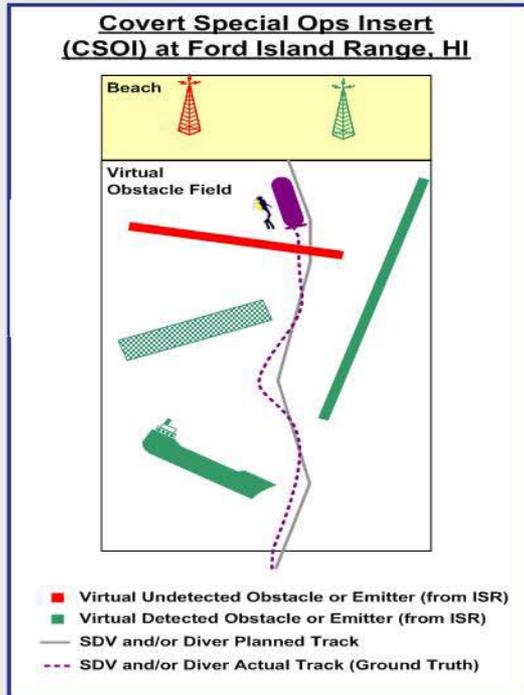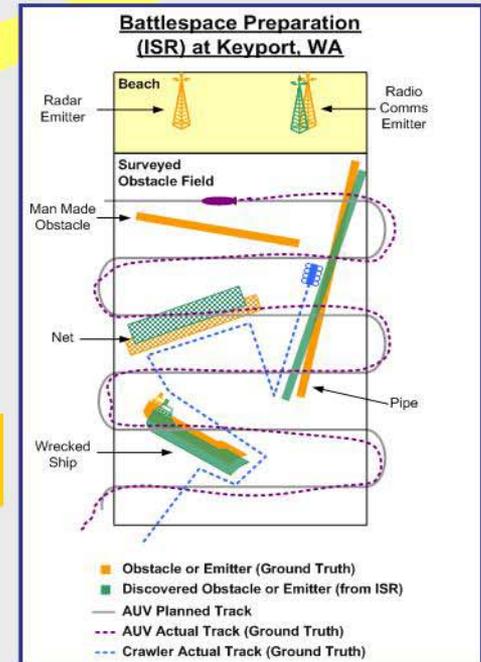
A <u>Battlespace Preparation Operation</u> in a shallow water zone at Keyport, WA, in which ISR information will be captured using several UUVs (i.e. SAHRV, MARV)

Translate Detected Obstacle Locations & Types

Covert Special Ops Insert (CSOI) at Ford Island Range, HI

Beach

Virtual Obstacle Field

- ■ Virtual Undetected Obstacle or Emitter (from ISR)
- ■ Virtual Detected Obstacle or Emitter (from ISR)
- — SDV and/or Diver Planned Track
- --- SDV and/or Diver Actual Track (Ground Truth)

Battlespace Preparation (ISR) at Keyport, WA

Beach

Radar Emitter — Radio Comms Emitter

Surveyed Obstacle Field

Man Made Obstacle

Net

Wrecked Ship

Pipe

- ■ Obstacle or Emitter (Ground Truth)
- ■ Discovered Obstacle or Emitter (from ISR)
- — AUV Planned Track
- --- AUV Actual Track (Ground Truth)
- --- Crawler Actual Track (Ground Truth)

Summary

Navy & Joint DoD thrusts powered by proven, advanced-technology capabilities promise the potential to equip the organic warfighter with the knowledge and skills necessary to effectively and efficiently employ new Unmanned Undersea Systems to meet the demands of the Fleet Response Plan.

Joint National Training Capability (JNTC)
- Joint Synthetic Environment
- Integrated Test, Training and Experimentation

Navy Transformation
- Sea Power 21 *(Sea Trial)*
- The "Revolution in Navy Training" (*Task Force Excel*)
- Navy Continuous Training Environment *(NCTE)*

New Tools
- Test & Training Enabling Architecture (TENA)
- USW T2E2 Infrastructure and Processes (NUTEC, CTEC, etc.)
- Simulation-Based, PC-Hosted Trainers

Test & Experimentation Events of Opportunity

The most valuable products of a T&E event are not necessarily fixed at the test location on the day of the test.

Recommended Path Forward

Integrated, Distributed, Testing and Training

- Begin now to develop a Fleet Unmanned Maritime System segment to the Navy Training Continuum

- Exploit existing distributed USW Test and Evaluation capabilities to enable a full distributed, integrated Test, Training, Evaluation and Experimentation capability
  - Hands-on operator training and ConOps development (Sea Trial)
  - Virtual training through remote participation in live events
  - Development of *UUV Test and Experimentation Event Archive* for use as schoolhouse and embedded training products

- Engage the Fleet as much as possible in early UUV experimentation and demonstration
  - Experiment design with a future ConOps/Tactics perspective
  - Live (Hands-on) and virtual involvement in operations
  - Participation by Fleet Trainers and curricula developers

Integrated, Distributed, Testing and Training

- Capitalize on scarce resources: Every formal T&E event (contractor test, DT, OT) viewed as a potential Fleet Training event.

  – Employ real time remote event links to operators and trainers at distant locations (home ports, forward deployed)

  – Digitize, catalogue, and archive UUV event information for future Fleet classroom and shipboard use

- Encourage participation by the Distributed Learning and Simulation-based training product community

- Allocate residual T&E program assets (Developmental Vehicles Test Targets and Shapes) for use as training assets as recognized at initial National UUV Test & Evaluation Center (NUTEC) Workshop in 2001

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Revolution in Navy Training

The "Revolution in Navy Training" (*Task Force Excel*):

EXCELerate Sea Warriors through innovation and lifelong learning by being the world's best force development organization.

- Submarine Learning Center has been developing Interactive Multimedia Instruction (IMI) to improve learning and allow for standardized training between classroom and onboard
- PC simulation-based training will support operator training and reduce risk associated with deployment experience (while keeping cost down)
- Multimedia can be used to support Replay (Lessons Learned) as well as Distance Learning

Naval Personnel Development Command: *"We develop Sea Warriors."* Mission:

Integrate, standardize and support the Learning Centers in delivering the knowledge necessary to satisfy validated Fleet individual performance requirements that will improve Fleet readiness through the professional and personal growth of Sailors and Marines.

Revolution in Navy Training

- The Navy is fully engaged in this important transformation of training designed to merge the training and operational environments across the Services … enabled by a potential spectrum of training environments:
  - *Live* = real people in real locations using real equipment
  - *Virtual Simulation* = real people in simulators
  - *Constructive Simulation* = simulated entities in a simulated environment
- The LVC environment melds existing operational and strategic facets of exercises with live forces, creating a more robust and realistic experience by ...
  - Creating joint warfighting conditions through a networked collection of interoperable training sites and nodes that synthesize personnel, doctrine, and technology
  - Providing participants will have a global, network-centric capability that strengthens military transformation efforts to promote war fighter effectiveness.

RADM David B. Hart, Director, Fleet Readiness Division, CFFC - Testimony to HASC March

Sea Trial – Who's Who?

- *CFFC's Sea Trial Executive Steering Group (STESG)* … creates and maintains the environment supportive of discovery and learning … in the experimentation process.

- *Navy Warfare Development Command (NWDC)* ...
  - Plans and coordinates execution, analysis, and assessment of Fleet Battle Experiments … and Navy participation in joint experiments.
  - Synchronizes experimentation to co-evolve technologies, tactics, techniques, procedures, doctrine, and organizational changes needed to field capabilities.

- *Second and Third Fleet commanders, with Commander, Naval Network Warfare Command* … are responsible for developing Sea Trial concepts, conducting operational assessments, and validating evolving fleet capabilities in their respective areas.

- *Sea Trial Pillar Groups* … provide the numbered fleets and Naval Network Warfare Command, with the expertise to develop and evolve "Sea Power 21" operational concepts ... and direct development and implementation of an iterative experimentation process design to bring transformational capability to the Fleet.

- *Collaborative Teams* … leverage the intellectual capital of warfare centers of excellence, along with NWDC, the Office of Naval Research, type commands, system commands, fleets, and other commands … to participate in Sea Trial experiments, and contribute to doctrine and tactics development for the new capabilities being delivered to the Fleet.

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The Sea Trial Efforts

- Examples of productive Sea Trial experiments:
  - *Exercise Giant Shadow*, in which the USS *Florida* (SSBN-728) conducted complex operations designed to test SSGN technology and operational concepts in conjunction with a variety of air, land, and sea-based assets.
  - *Fleet Battle Experiment Kilo* conducted in April and May 2003, in which spiral events with Second Fleet tackled the thorny problem of collaboration between geographically separated elements of an integrated staff. The equally challenging tasks of commanding theater antisubmarine warfare, area air defense, joint fires, and the new expeditionary strike group were examined in an operational environment with Seventh Fleet during Tandem Thrust '03.
  - Experimentation with the High-Speed Vessel, *Swift,* to help develop mine warfare command ship operating concepts and will fuel the Littoral Combat Ship's attendant concept of operations.

- FY '04 Experimentation in support of Sea Shield
  - Develop an undersea network and nonacoustic detection methods to enable a sensor-rich antisubmarine warfare environment and advanced weapon technology to counter littoral threats.
  - Evaluate the contribution of multiple autonomous UUVs to improving mine warfare rate of detection.

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TENA: A Common Architecture & Protocol Standard
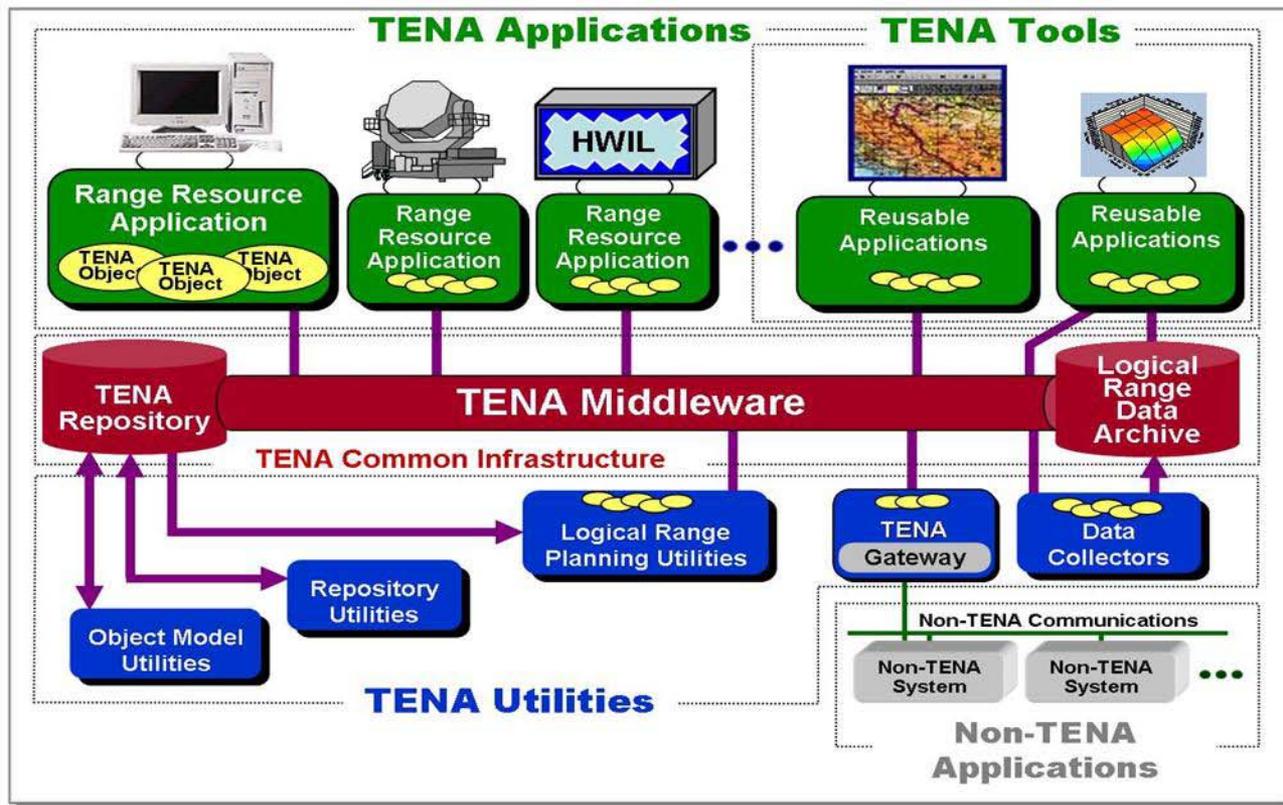
Test and Training Enabling Architecture (TENA)

- Distributed USW T2E2 tool used for T&E system interoperability
- Developed and managed by DOT&E via CTEIP
- Recently mandated by DoD Secretary of Defense

- TENA supports the implementation of the Joint Vision 2020 by promoting integrated testing and simulation-based acquisition through the use of the concept of a *"Logical Range."*

    - *A logical range* integrates testing, training, simulation, and high-performance computing technologies, distributed across many facilities, and ties them together with a common architecture.

    - In a *logical range*, real military assets can interact with each other and with simulated weapons and forces, no matter where these forces actually exist throughout the world. TENA is designed to make the logical range vision a reality.

- A *common infrastructure* through the medium of the TENA object model encodes all of the information that is transferred between systems during a range event. It is the common language with which all TENA applications communicate.

- The core of TENA is the *TENA Common Infrastructure*, including the TENA Middleware, the TENA Repository, and the TENA Logical Range Data Archive. TENA also specifies the existence of a number of tools and utilities, including those necessary for the efficient creation of a logical range.

- *TENA Gateway applications* allow the integration of TENA applications with non-TENA resources. Gateways communicate with both a TENA logical range (via the TENA Middleware) and another set of applications using some other protocol.