ONR Training Technologies: Delivering to the Fleet and Force

NDIA Science & Engineering Technology

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Warfighter Performance S&T
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Human-Systems Integration

Training is part of a Larger Trade Space

Manpower & Personnel:
Right People

Design:
Right Cost / Right Jobs

Training:
Right Skills

Decision Support:
Right Information / Right Time

Making Better Decisions Faster / Avoiding Cost
ONR Training Transitions Cross Levels / Skills
## Delivering to the Fleet and Force

### Addressing All Naval Enterprises

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<thead>
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<th>Integrated (Information Dominance)</th>
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<td>• Fleet Integrated Synthetic Training &amp; Experimentation</td>
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<td>• ASW / ASuW / A2AD / MIW / OTH Strike / FAC</td>
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<td>• Carrier-based UAVs</td>
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<td>• Live, Virtual, Constructive (LVC) training / certification</td>
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<td>• Individual &amp; Team LCS CIC Decision-Making</td>
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<td>• TAO / CO / Department Head Tactics</td>
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<th>Subsurface</th>
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<td>• Submarine Piloting and Navigation</td>
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<td>• Individualized Training for Sonar Operators</td>
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<td>• Periscope Operations and basic training</td>
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<td>• Mixed Reality Simulation-Based Training</td>
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<td>• Infantry Immersion Trainer</td>
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<td>• Small Unit Decision Making</td>
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Training Objectives

New Threats – Increasing Complexity – Costs

**Integrated and Affordable Scenario-based Simulation**
-- Reduce reliance on live assets, On-the Job training
-- Integrated Team, Platform and Fleet Training

**Self-paced Instruction tailored to Individuals and Teams**
-- Minimize One-Pace-Fits-All Classroom-based training
-- Mobile training capability Anywhere / Anytime

**Performance-Based Readiness Assessment**
-- Limit subjective, checklist-based assessments

**Training to Emerging Threats**
-- Artificially Intelligent Agents model new mission sets
Self-paced or instructor-paced for Readiness Control Officer & Engineering Plant Technician

Trainee moves through virtual engineering spaces / accesses technical procedures

Instructor generates casualty cascades and can control, monitor, quantitatively assess performance of multiple students simultaneously

**Virtual Maintenance Performance Aid**
- Physics-based model of LCS gas turbine & Ship spaces
- LCS bridge / Machinery Plant Control & Monitoring System

**FY13 Accomplishment**
- Extended from LCS-I and II to DDG51 Block 9 Integrated Bridge Navigation System Technical Training

**FY14 Plan**
- Delivering system to Center for Surface Combat Systems-Dam Neck for training DDG51 Block 9 navigation technicians
**Conning Officer Virtual Environment (COVE)**

Increased Student Throughput, Scenario Authoring, Quantitative Training Effectiveness Assessment

**COVE Currently Deployed and In Use**

- **Newport**: 12 COVE-1 Head-Mounted Display, 6 COVE-2 Full Mission Bridges, 2 Small Vessels
- **Norfolk & San Diego**: 12 COVE Systems at Basic Division Officer Course
- **San Diego**: 2 COVE LCS Simulators at LCS Shore-Based Training
- **Bath MN, Pascagoula MS**: 2 COVE variants for Pre-Commissioning Crew

**COVE-ITS (Intelligent Tutoring System)** in trial use at SWOS and NPS

Compared to Expensive, Dedicated Ship Handling Simulators

**Dr. Ray Perez**
Augmented Immersive Team Training (AITT)

an Augmented Reality training system for Forward Observers

- **Augments live battlespace** with virtual aircraft, vehicles, personnel, weapons
- **Reduces training costs** by minimizing live air sorties or live artillery
- **Improves training realism**
  with virtual “actors” unconstrained by live range safety constraints

**AITT Milestones**

- FY13: Simulated Vector 21 (binoculars) & Portable Lightweight Designator delivered to Joint Terminal Attack Controllers (JTACs), Forward Observers (FOs), Air Naval Gunfire Liaison Company (ANGLICO) and Artillery personnel
- FY14: Demonstrations planned for Squad Leader Observer at MCB Quantico and US Army Expeditionary Warrior Experiment at Fort Benning

**Simulation Training for Expeditionary Operations**

Dr. Peter Squire
Live, Virtual, Constructive Scenario-Based Training

“... an integrated LVC Training Environment [is] essential for future force readiness.”
– FFC-Atlantic / PACFLT LVC Training Capability Requirements, July 2013

“... Live, Virtual, Constructive-Training Environment (LVC-TE) provides a critical component that enhances objective training efficiencies and economies achieved in training transformation, and enables the achievement of previously unattainable goals and objectives in a variety of venues.”
– Marine Corps Training and Education Modeling and Simulation Master Plan 2010

**LVC:** Real-world Platforms and Operators (Live) interacting with

**Networked Simulators (Virtual) and**

**Synthetic Forces (Constructive)**

“The cost to operate present and future platforms - combined with advanced capabilities that are rapidly exceeding the capabilities of our current training ranges - demands that we innovate in combining live, virtual, and constructive training.”
– VADM Buss, Vision of Naval Aviation 2025, January 2013
**Live**  Design guidelines for safe, effective simulated assets on Live Displays, Safety of Flight protocols
- I/ITSEC 2012 - Live flight demo of LVC augmented aircraft and constructive entities driven by Next Generation Threat System

**Virtual**  Carrier Qualification Training Feasibility; Performance measurement tools
- Man Flight Simulation Tests: F/A-18 simulator upgraded with visual and motion systems

**Constructive** – Realistic Entities: Quickly develop and modify intelligent computer-generated forces that reflect realistic tactical training / Adaptive behaviors
- I/ITSEC 2013 - Demo constructive entities developed through machine learning and integrated into the Next Generation Threat System (NGTS)
Unmanned Aerial Systems Interface, Selection, & Training Technologies

The Right People
Personnel Selection & Assignment

**Deliverable:** UAS Aviation Selection Test Battery; current ASTB for Pilots/NFOs avoids $38M/yr attrition cost
- Similar savings projected for UAS

The Right Skills
Simulation-Based Training

**Deliverable:** Computer generated forces built from raw data;
- Rapid generation of large entity numbers in realistic scenarios
- First adopter – Next Generation Threat System & UCLASS

The Right Information
Common Control Station Display Design

**Deliverable:** Next Gen “cockpit” designs for UAS supervisory control
- First adopter – Common Control Station

Future?

LCDR Brent Olde, PhD
Sea Combat Commander
FIST2FAC Integrated Training

Fleet Integrated Synthetic Training / Testing Facility
Ford Island Hawaii

- LVC Training for Sea Combat Commander and team
- Model-based Training Scenarios and Experimentation
- Joint and Coalition Collaboration in PACFLT AOR
- Mission Readiness and Proficiency Assessment Metrics
- ONR / NWDC Fleet Training Memorandum of Agreement

ONR FIST Training Systems Deployed or in Pipeline
- FY11-12: Helicopter / P-3 ASW training inserted into FST events
- FY13: Virtual Carrier / Carrier Strike Group Training
- FY15-18: Anti-Access / Area-Denial Training & Experimentation

Now: ASW, FAC & FIAC, ASuW
Coming: MIW, EMW, A2AD, NIFC-CA
FIST2FAC Integrates ONR Training Products

Fleet Integrated Synthetic Training / Testing Facility

ONR S&T Base Funding Programs

Aviation (ASW)
- MRT3: Mission Rehearsal Tactical Team Trainer (SH-60)
- PACT3: P3/P8A Aircrew Tactical Team Trainer
- BRASS: Bravo/Romeo Active Sonar System trainer
- BATT'T: Advanced Bravo ASW Tactical Team Trainer

Surface
- EFAAS: Effective Active Acoustic System
- HIFAST: Hi Fidelity Active Sonar Training
- VCP: Virtual Carrier Platform
- MEET2SEA: Experimentation tool
- A2AD EC: Anti-access/area denial

Integrated (Surface/Aviation)
- FIST2FAC: Fleet Integrated Synthetic Test / Training Facility
- Discovery Machine Inc Synthetic: “Constructive” tactical entities
- FST: Fleet Synthetic Training

Fleet Synthetic Training begins in FY99

Dr. Harold Hawkins
Mr. Glenn White
Fleet Integrated Synthetic Training / Testing Facility

Fleet Integrated Synthetic Training
Aviation and Surface Platforms

NCTE
JTEN
DREN
SDREN

Missions
Now
- ASW
- FAC/FIAC
- ASuW

Coming
- MIW
- EMW
- A2AD
- NIFC-CA

FY-14
FY-14/15
FY-14/15
EDRT w/ LINK, Radar, ESM

Virtual Carrier Platform v2.0 w/ CV-TSC, CENTRIX, GCCS-M, Comms Suite

Virtual Ship Platform v1.0 w/ CIC, VASTAC, Bridge, SCAT Gunner

Virtual LCS Platform v1.0 w/ Sea Frame

BRASS w/ Acoustics, LINK 16, ISAR, MMR

PACT3 w/ Acoustic, Radar, ESM, MAD, Harpoon, Torpedoes, FLIR, ISAR, LINK 16

BATT w/ Door Gunner

Generic UAV w/ ISAR, FLIR, Radar

F-18 w/LINK, Radar, ESM

FY-14

MTS w/ Door

Gunner
FIST2FAC YouTube video

http://www.YouTube.com/USNavyResearch
ONR addressing surface and air elements of NIFC-CA Distributed Network

The Navy’s Naval Integrated Fire Control-Counter Air (NIFC-CA) will link aircraft and ships with high-bandwidth data connections — like the emerging TTNT capability. Those big data pipes will work with smaller bandwidth connections — like the standard Link 16 data-link. The information from the NIFC-CA network will be routed to the strike group commander aboard the strike group’s carrier.

--US Naval Institute Graphic
US Naval Institute News
23JAN2014

http://news.usni.org/2014/01/23/navys-next-air-war
Fleet Integrated Synthetic Training & NIFC-CA

LVC Simulation-based Training and Experimentation

- Fleet Integrated Synthetic Training for Sea Combat Commander
- Joint Semi-Automated Forces
- Aviation LVC
- Next Gen Threat System
- Carrier-Based UAVs
- Carrier Air Wing Mission Rehearsal
- A2AD Training & Experimentation
- Integrated Multi-Mission
- Multi-platform
- Multi-Echelon
- Decision-Making

Navy Continuous Training Environment
Fleet Integrated Synthetic Training, Experimentation, Mission Planning

New Science: Near-real time collaboration in distributed systems

**Distributed, Real-time Integration & Collaboration**
- Multiple Platforms, Surface and Air
- Multiple Simultaneous Missions
- Multi-Echelon Scenarios
- Over-the-Horizon Strike / NIFC-CA

**Training Modeling and Simulation**
- Fully Automated, Realistic Synthetic Forces
- Quantitative Readiness Assessment
- Scenario Generation / CONOPS Development

**Mission Planning**
- Submarines, Surface Ships, Carrier Strike Group
Summary

**ONR Delivering to Fleet and Force**

1. Reducing Training Costs / Time / OJT while Enhancing Training Effectiveness

2. Seamless Integration of Live, Virtual, Constructive elements

3. Objective Metrics: Individual, Team, Platform, Fleet, Joint Readiness

4. Extending Effective Range of Distributed, Multi-Platform training

5. Scenario Generation for Experimentation and CONOPS Development
Back-Up
1969: First ONR investment in Intelligent Tutoring

Cognitive Science
6.1 Theory

Team Decision-Making
TADMUS
6.1 Theory

C² Decision-making
6.1 Theory

Social, Cultural, Behavioral Science
6.1 Theory

BioRobotics, Brain-Based Computing
6.1 Theory

Cognitive Architectures

Individual Engineering Models

Team Engineering Models

Organizational Models

Social-Cultural Modeling

Digital Tutors / Adaptive Training
Artificially Intelligent Agents
Decision Support
Social Media Analytics for GWOT, Human-Autonomy Interaction


1988 Vincennes 9/11/01
Submarine Mission and Navigation Planning

- Passed Advanced Processor Build (APB) FY13 Step 3
- Capability integrated into submarine TACLAN for Step 4 testing at sea (2014)
- Early results with fleet operators demonstrate
  - less time to build comparable plan & brief
  - qualitative improvements in rapid mission re-planning

Carrier Strike Group Collaborative Planning / Common Planning Picture

- Reduce time for “Plan-Brief-Execution-Assess” cycle from hours to minutes
- Extract / display decision-critical information from multiple data sources
- Communicate mission plans across CSG with common graphical workspace.

1. Maritime Planning Group (> 3 days)
2. Future Operation Planners (24 hrs – 3 days)
3. Current Operation Planners (<24 hours)
   -> Schedule of Events (SOE)

Capable Manpower FNC
POM16 OPT proposal

- Streamline Coordination
- Communicate Updates
Operational Planning Tool

Common collaborative planning capability across the operational to tactical levels

- Provide a common planning picture from the Carrier Strike Group down to individual ships, submarines, and large deck ships
- Improve alignment of effort, utilization of multi-mission platforms, fuel

1. **Rule based algorithms** to allow commander and staff to rapidly and confidently move from data to options to informed decisions

2. **Decision supportive data analytics** to extract C2, GCCS-M, Combat, Navigation, data for “Plan-Brief-Execution-Assess” decisions

3. **New visualization techniques** to convey “Plan-Brief-Execution-Assess” in a single display

4. **Maneuver navigation planning widgets** that provides operating parameters – where units can and cannot physically operate – integrated with timeline events

5. **Timeline event agents** to link systems and watch bill impacts on operations tempo
CMP-FY10-01 Information Architecture for Improved Decision Making: The submarine force has taken ownership of this capability and is investing significant resource to distribute the application across all submarine platforms. Royal Australian Navy requested copy of Mission Planning Application for their submarine force.

CMP-FY10-02 Adaptive Training for Sonar Operators: The application generates periscope images with an integrated periscope simulator and adapts the difficulty of questions asked and the feedback that trainees receive to the performance of the trainee in estimating contact angle on the bow. This application also passed APB-13 Step 3.
Steps to A2AD Distributed Training

1. Realistic Entities, Environment, and Scenarios
   - Fully Automated, Realistic Synthetic Forces (LVC)
   - Carrier Air Wing Mission Rehearsal (LVC FY14 plus up)
   - Adaptive Computer Agents and Training (LVC)
   - Automated Scenario Generation (UASISTT)
   - Realistic Synthetic Environments (e.g., EW)

2. Facility and Infrastructure to Run Scenarios
   - FIST2FAC - Ford Island, HI
     - Multiple Simultaneous Missions
     - Multi-Echelon Decision-Making
     - CONOPs and TTP Development
     - Integrated across A2AD Domains
     - Basic Capability

3. Models and Analysis of A2AD Tactical Behaviors
   - FAC/FIAC (EDUCAT2E)
   - NIFC-CA (LVC plus up)
     - EW

Improvements to Synthetic Training Environment

Specific A2AD Training & Experimentation
**Current Funded Projects**

1. LVC Aviation (Bolton, Olde)
2. Carrier Air Wing Training (Bolton $1M FY14 CMP restoration)
3. FIST2FAC (Hawkins)
4. UASISTT Carrier-based UAVs (Olde)
5. Submarine Mission Planning Applications

**Approved Future Projects**

1. EDUCAT2E (Bolton) A2AD Fleet Synthetic Training
2. Carrier Air Wing Training (Bolton $1M FY14 CMP restoration)
3. POM16 Operational Planning Tool (Krebs): MOC, Carrier Strike Group