



# 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**



# Training Continuum

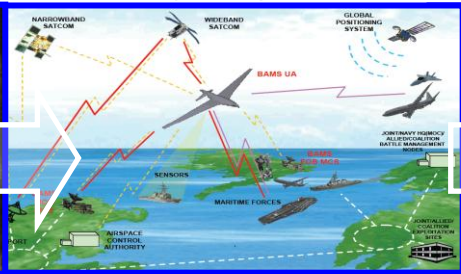
**Individuals – Teams – Platforms – Fleet – Joint**

**Recruit**

**Schoolhouse**

**Unit / Platform**

**Integrated Cross-Platform**



**Basic Skills**

**Occupational Specialty**

**Individual & Team Skills**

**Joint Readiness & Performance**

**ONR Training Transitions Cross Levels / Skills**



# Delivering to the Fleet and Force

## Addressing All Naval Enterprises



### Integrated (Information Dominance)

- Carrier Strike Group Sea Combat Commander & CSG H-60 Helicopter Crews
- Fleet Integrated Synthetic Training & Experimentation
- ASW / ASuW / A2AD / MIW / OTH Strike / FAC



### Aviation

- P3 / P8A / SH-60 ASW Tactical Teams
- Carrier-based UAVs
- Live, Virtual, Constructive (LVC) training / certification



### Surface

- Individual & Team LCS CIC Decision-Making
- TAO / CO / Department Head Tactics
- Conning Officer Virtual Environment Shiphandling
- LCS Virtual Maintenance Performance Aid



### Subsurface

- Submarine Piloting and Navigation
- Individualized Training for Sonar Operators
- Periscope Operations and basic training



### Expeditionary

- Mixed Reality Simulation-Based Training
- Infantry Immersion Trainer
- Small Unit Decision Making



# 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



# Fleet Maintenance Training

## Virtual Maintenance Performance Aid

Physics-based model of LCS gas turbine & Ship spaces

LCS bridge / Machinery Plant Control & Monitoring System

- 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

Dr. Harold Hawkins

### FY13 Accomplishment

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

### FY14 Plan

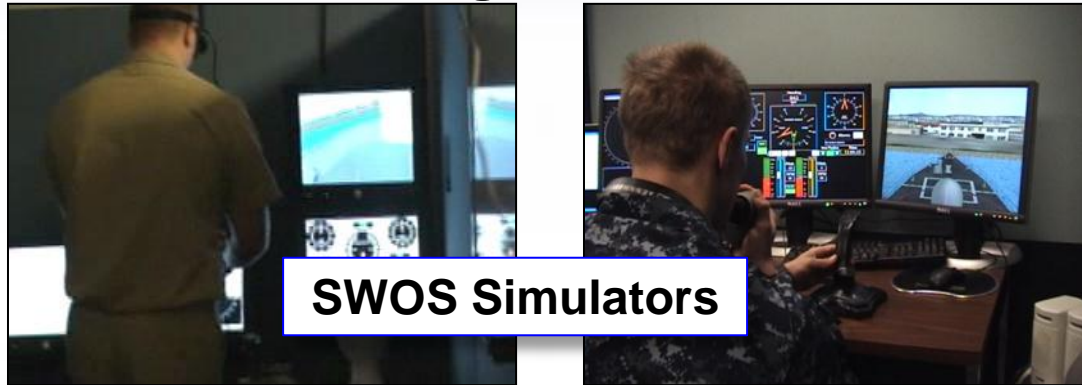
- Delivering system to Center for Surface Combat Systems-Dam Neck for training DDG51 Block 9 navigation technicians



# Fleet Deployment of Shiphandler Systems

## Conning Officer Virtual Environment (COVE)

Increased Student Throughput, Scenario Authoring,  
Quantitative Training Effectiveness Assessment



SWOS Simulators

Compared to Expensive, Dedicated Ship Handling Simulators

Dr. Ray Perez

### 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



# Expeditionary Maneuver Warfare Training

## 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



Dr. Peter Squire

### 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**





# *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, Virtual, Constructive Aviation Training (FY12-16)

Dr. Ami Bolton  
LCDR Brent Olde

**Live** Design guidelines for safe, effective simulated assets on Live Displays, Safety of Flight protocols

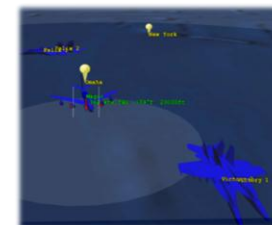
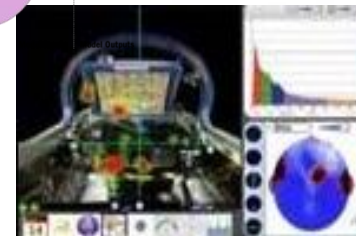
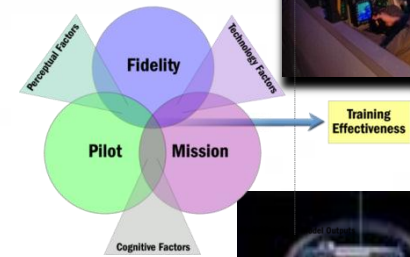
- **ITSEC 2012 - Live flight demo of LVC augmented aircraft and constructive entities driven by Next Generation Threat System**

**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

- **ITSEC 2013 - Demo constructive entities developed through machine learning and integrated into the Next Generation Threat System (NGTS)**

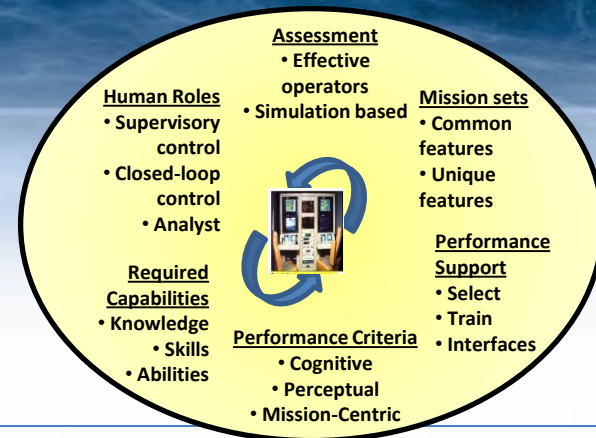




# Carrier-Based UAVs - UASISTT

## Unmanned Aerial Systems Interface, Selection, & Training Technologies FY14-17

LCDR Brent Olde, PhD

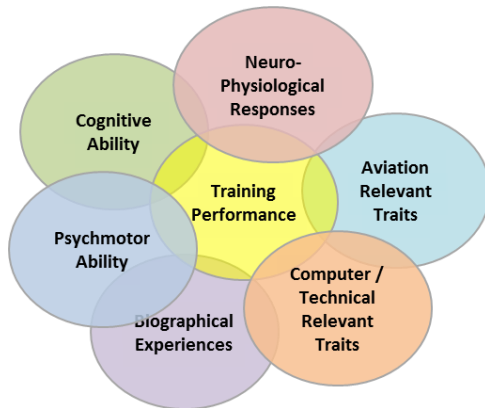


### The Right People

#### Personnel Selection & Assignment

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

- Similar savings projected for UAS

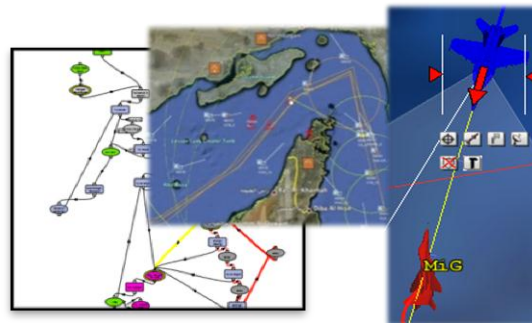


### The Right Skills

#### 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





# Sea Combat Commander FIST2FAC Integrated Training

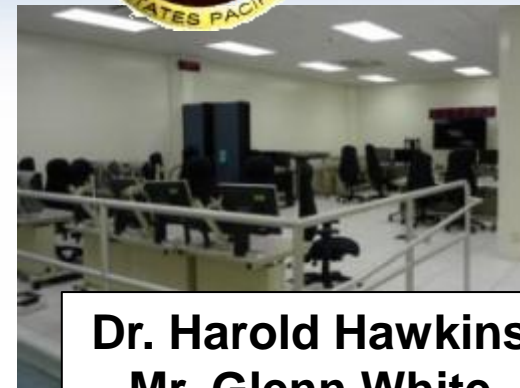


## Fleet Integrated Synthetic Training / Testing Facility



### 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



Dr. Harold Hawkins  
Mr. Glenn White

Now: ASW, FAC & FIAC, ASuW

### ONR FIST Training Systems Deployed or in Pipeline

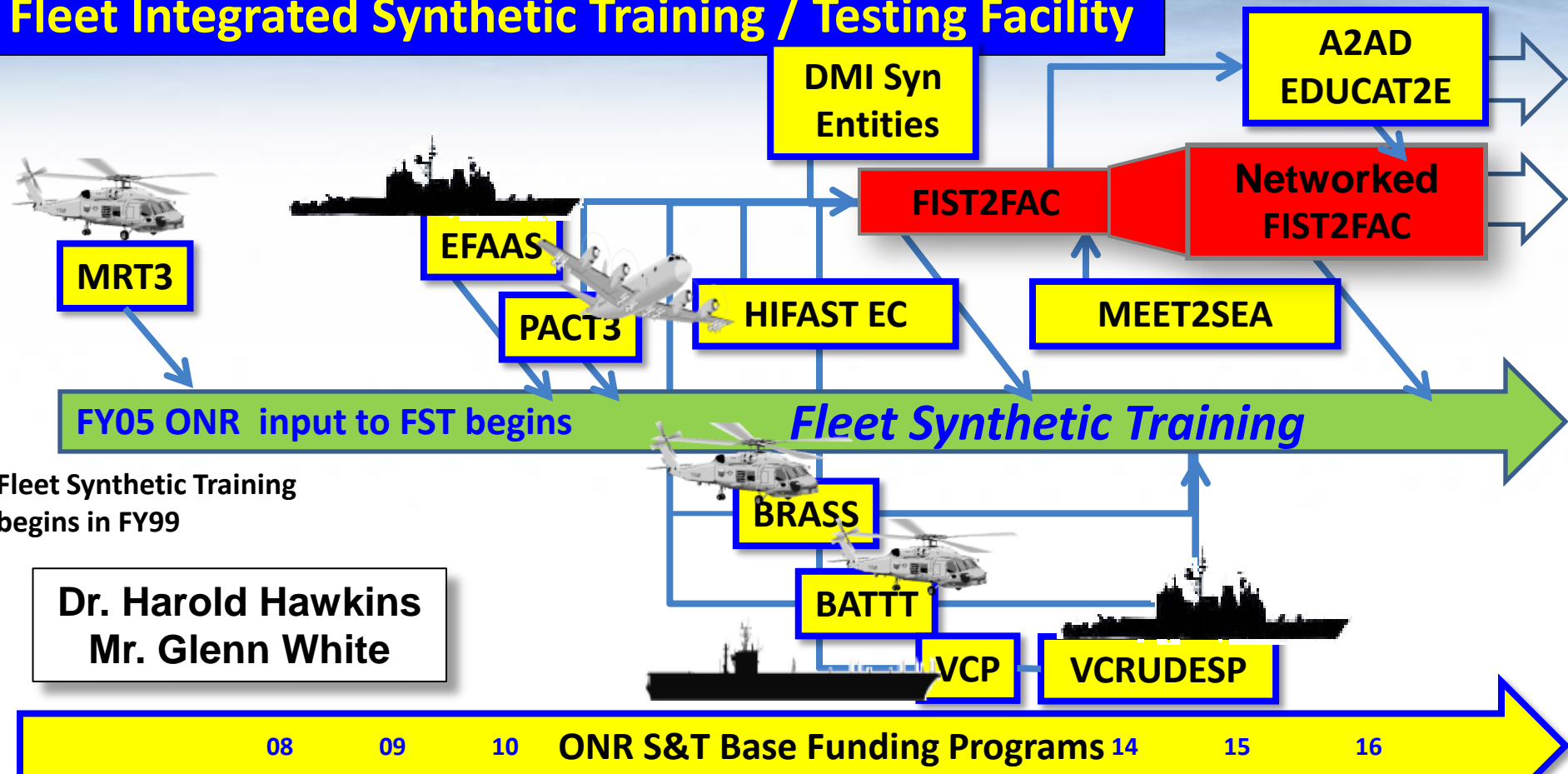
- FY11-12: Helicopter / P-3 ASW training inserted into FST events
- FY13: Virtual Carrier / Carrier Strike Group Training
- FY13: Fast Attack Craft & Fast Inshore Attack Craft Training
- FY15-18: Anti-Access / Area-Denial Training & Experimentation

Coming: MIW, EMW, A2AD, NIFC-CA



# FIST2FAC Integrates ONR Training Products

## Fleet Integrated Synthetic Training / Testing Facility



**Dr. Harold Hawkins**  
**Mr. Glenn White**

### 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:** 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

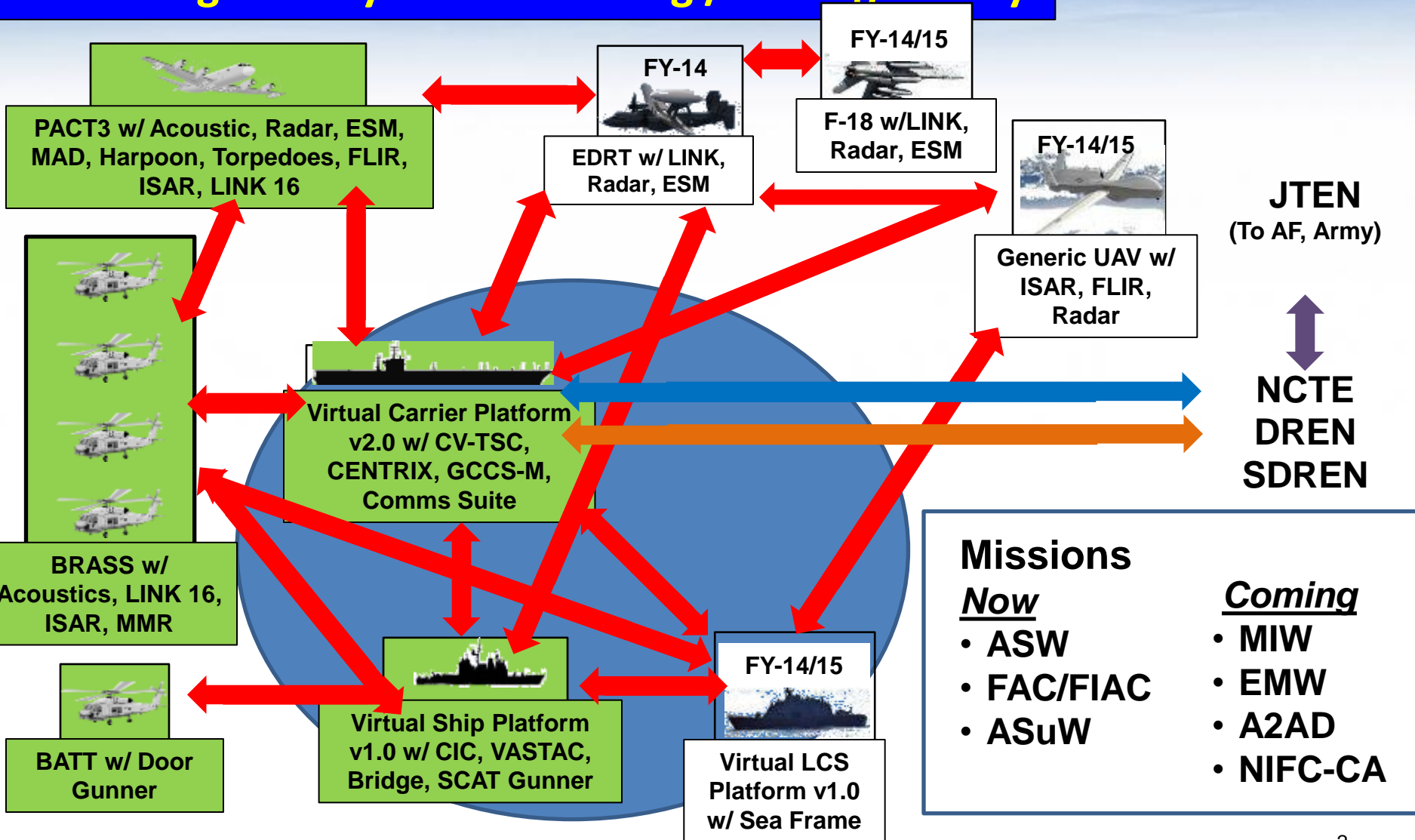
### Integrated (Surface/Aviation)

- **FIST2FAC:** Fleet Integrated Synthetic Test / Training Facility
- **Discovery Machine Inc Synthetic:** "Constructive" tactical entities
- **FST:** Fleet Synthetic Training



# Fleet Integrated Synthetic Training Aviation and Surface Platforms

## Fleet Integrated Synthetic Training / Testing Facility



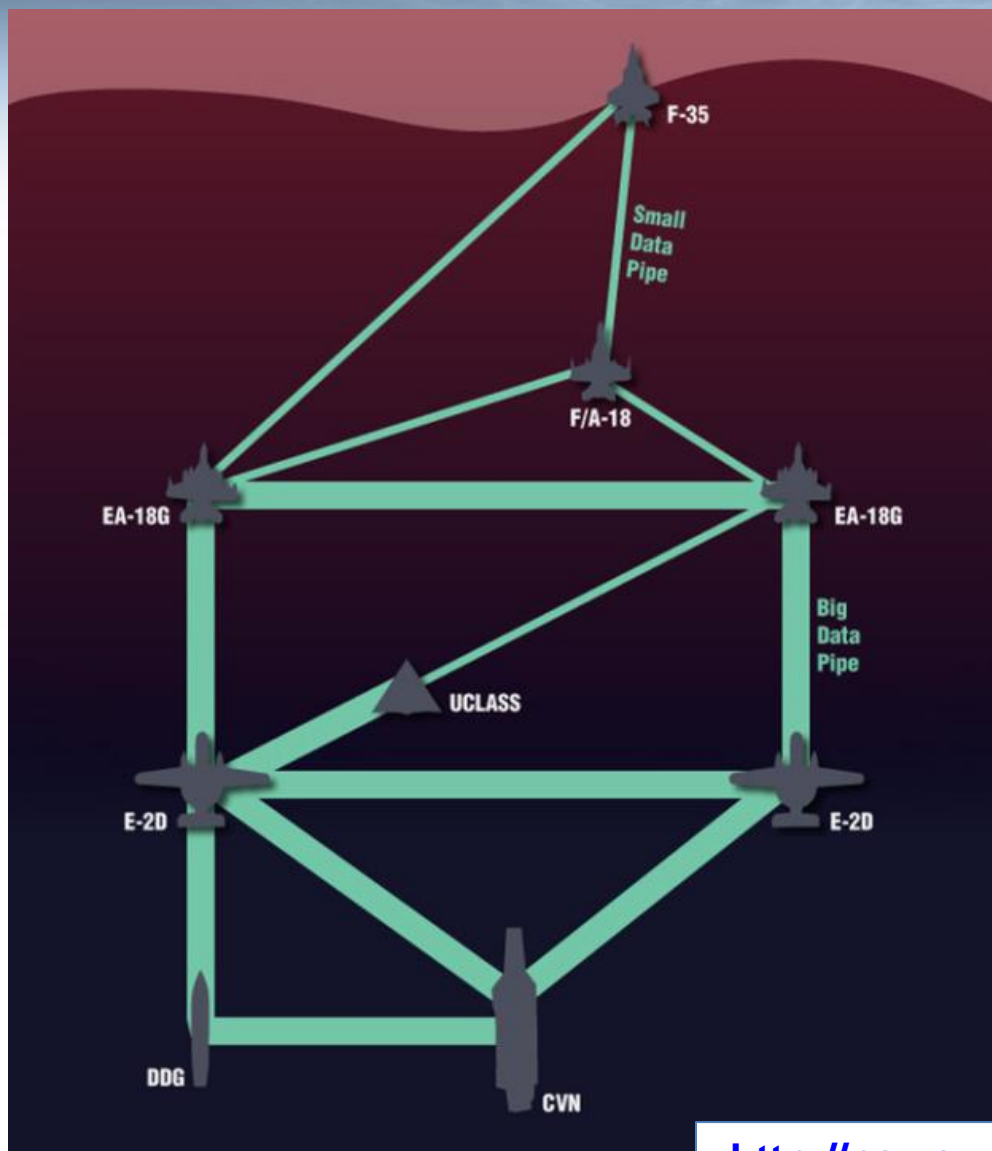


# **FIST2FAC YouTube video**

[\*\*http://www.YouTube.com/USNavyResearch\*\*](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

A2AD Training & Experimentation

Aviation LVC

Next Gen Threat System

Carrier Air Wing Mission Rehearsal

Carrier-Based UAVs

NIFC-CA

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



Recruit

Schoolhouse

Unit / Platform

Integrated  
Cross-Platform



# Back-Up



# Human Computational Models

**1969: First ONR investment in Intelligent Tutoring**

**Cognitive Science**

6.1 Theory

Cognitive Architectures

Individual Engineering Models

**Team Decision-Making TADMUS**

6.1 Theory

Team Engineering Models

**C<sup>2</sup> Decision-making**

6.1 Theory

Organizational Models

**Social, Cultural, Behavioral Science**

6.1 Theory

Social-Cultural Modeling

**BioRobotics, Brain-Based Computing**

6.1 Theory

Smart Sensors  
Unmanned Vehicles

Digital Tutors / Adaptive Training

Artificially Intelligent Agents

Decision Support

Social Media Analytics for GWOT,

Human-Autonomy Interaction

1985

1990

1995

2000

2005

2005

Today

1988 Vincennes

9/11/01



# POM16 Operational Planning Tool



## 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

Capable Manpower FNC  
POM16 OPT proposal

## 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.

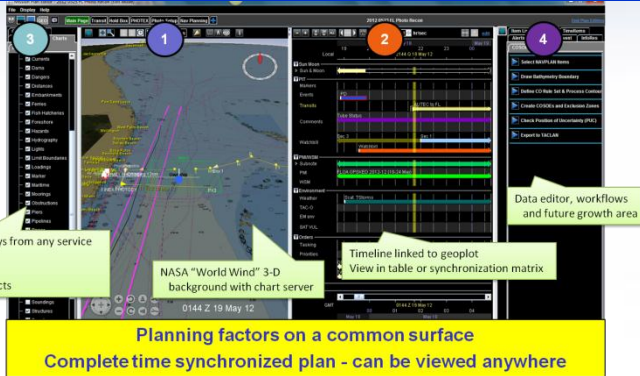
- Streamline Coordination
- Communicate Updates

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

# Operational Planning Tool

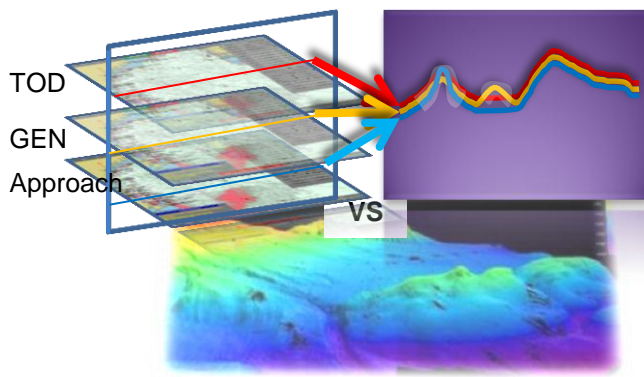
Capable Manpower FNC  
POM16 OPT proposal

**Common collaborative planning capability across the operational to tactical levels**



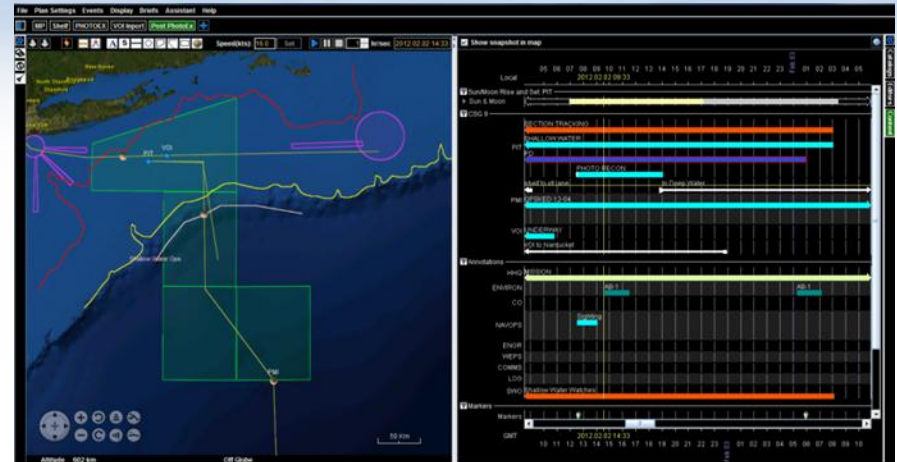
- Provide a common planning picture from the Carrier Strike Group down to individual ships, submarines, and large deck ships
- Improve alignment of effort, utilization of multi-mission platforms, fuel

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 and 10-02 Transitions

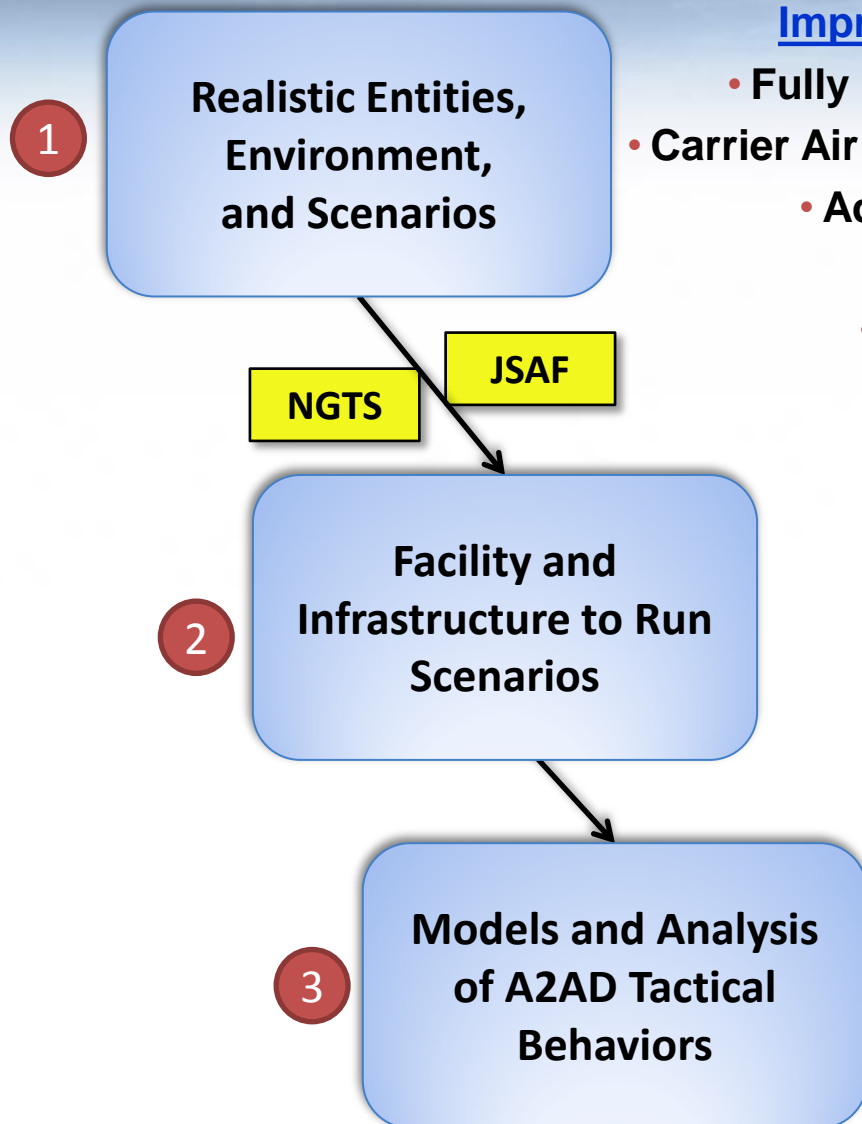
**CMP-FY10-01 Information Architecture for Improved Decision Making :** The submarine force has taken ownership of this capability and is investing significant resource to distribute the application across all submarine platforms. Royal Australian Navy requested copy of Mission Planning Application for 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



## Improvements to Synthetic Training Environment

- 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)

## FIST2FAC - Ford Island, HI

- Multiple Simultaneous Missions
- Multi-Echelon Decision-Making
- CONOPs and TTP Development
- Integrated across A2AD Domains
  - Basic Capability

## Specific A2AD Training & Experimentation

- FAC/FIAC (EDUCAT2E)
- NIFC-CA (LVC plus up)
  - EW



# Fleet Training, Experimentation, Planning

## 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