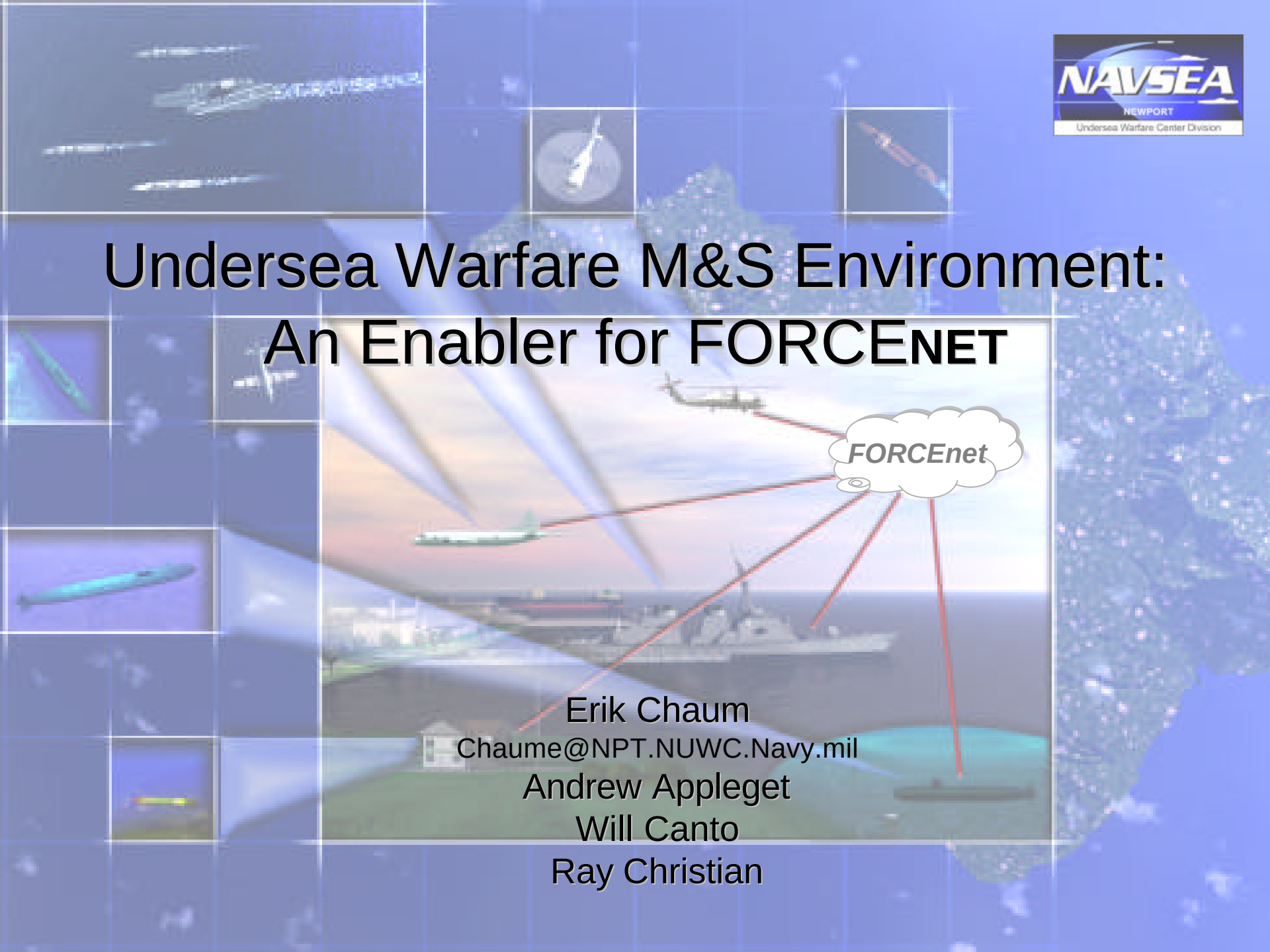
Undersea Warfare M&S Environment: An Enabler for FORCENET



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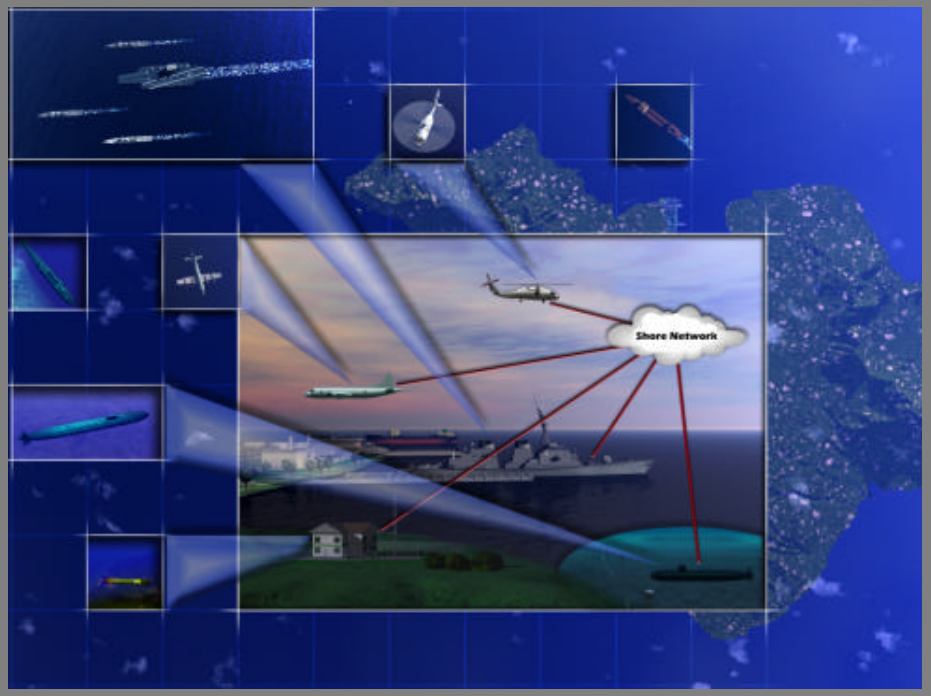
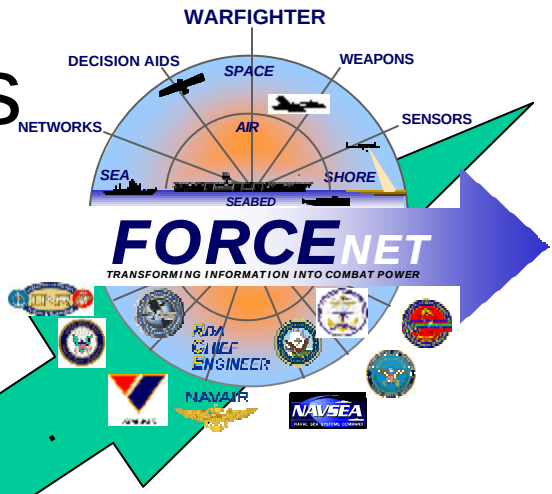
Ray Christian

Outline

- FORCENET - the challenge
- Engineering and Experimentation
  - FBE
  - USB
  - SETI
- Summary



FORCENET Genesis



1997 1998 1999 2000 2001 2002 …

- SSG XVI
  - Systems of Systems
  - Net-based USW

- SSG XVIII
  - OPNET

- SSG XIX
  - FORCEnet

- SSG XVII
  - Fully Netted Warfare

- SSG XX
  - FORCEnet and the 21st Century Warrior

- Director FORCEnet

- SSG XV
  - Warfare based upon networks
  - Cognitive Warfare

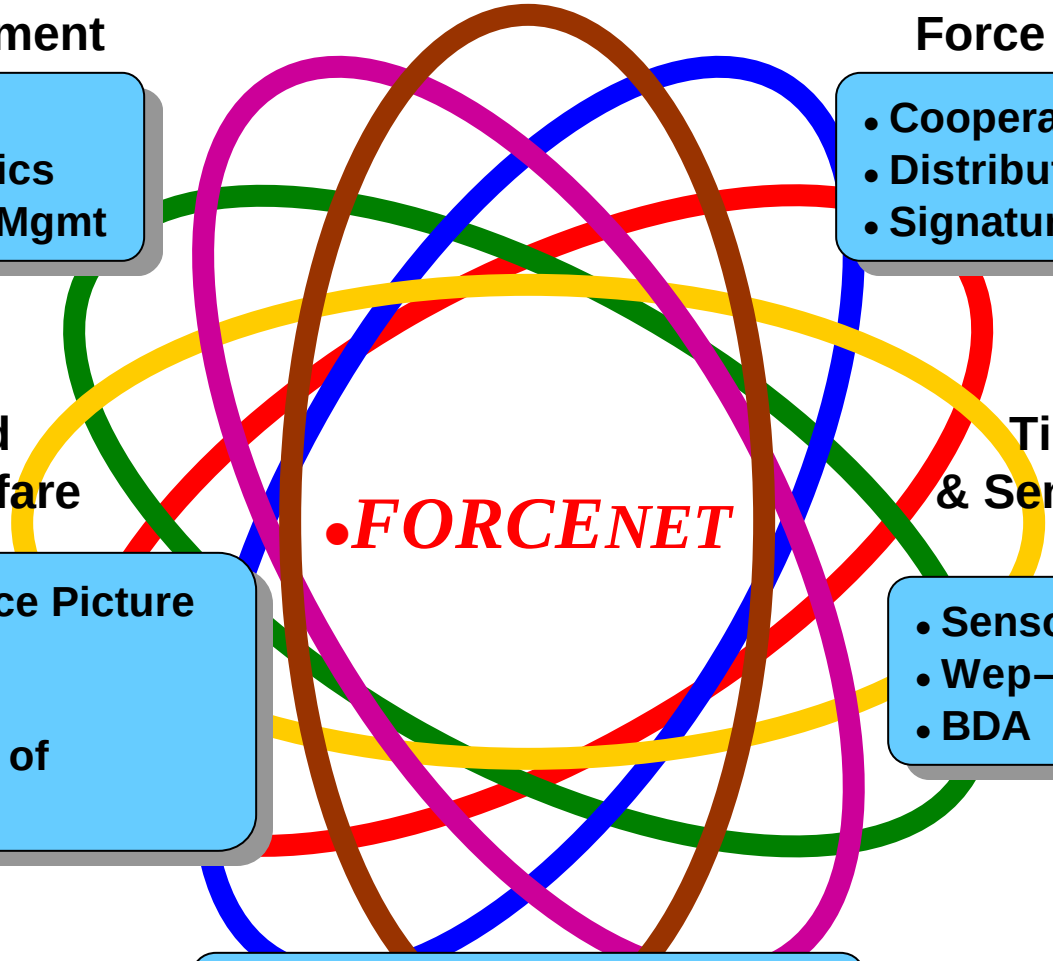
What Is FORCENET *

- FORCEnet is the architecture and building blocks of sensors, networks, decision aids, weapons, warriors and supporting systems integrated into a highly adaptive, human-centric, comprehensive system that operates from seabed to space, from sea to land.
- By exploiting existing and emerging technologies, FORCEnet enables dispersed human decision-makers to leverage military capabilities to achieve dominance across the entire mission landscape with joint, allied, and coalition partners.

FORCEnet is the Integrator of technologies and Warfighting systems to provide agile, lethal and effects based combat power to counter any and all threats

***Definition from SSG-XX as referenced in CNO/N7 FORCEnet Designation Letter dated 21 February 2002**

Desired Warfighting Capabilities



In-stride Sustainment

- Asset Visibility
- Prognostic Logistics
- Combat Casualty Mgmt

Force Survivability

- Cooperative Deception
- Distribution and Dispersal
- Signature Management

Fully Netted Maneuver Warfare

- Shared Battlespace Picture
- Synchronization
- Combat ID
- Controlled Speed of Command

Tiered Weapons & Sensors Architecture

- Sensor Mgmt
- Wep–Target Pairing
- BDA

- Infrastructure Mapping
- Complexity-based Targeting
- Computer Network Attack

Integrated Knowledge Operations

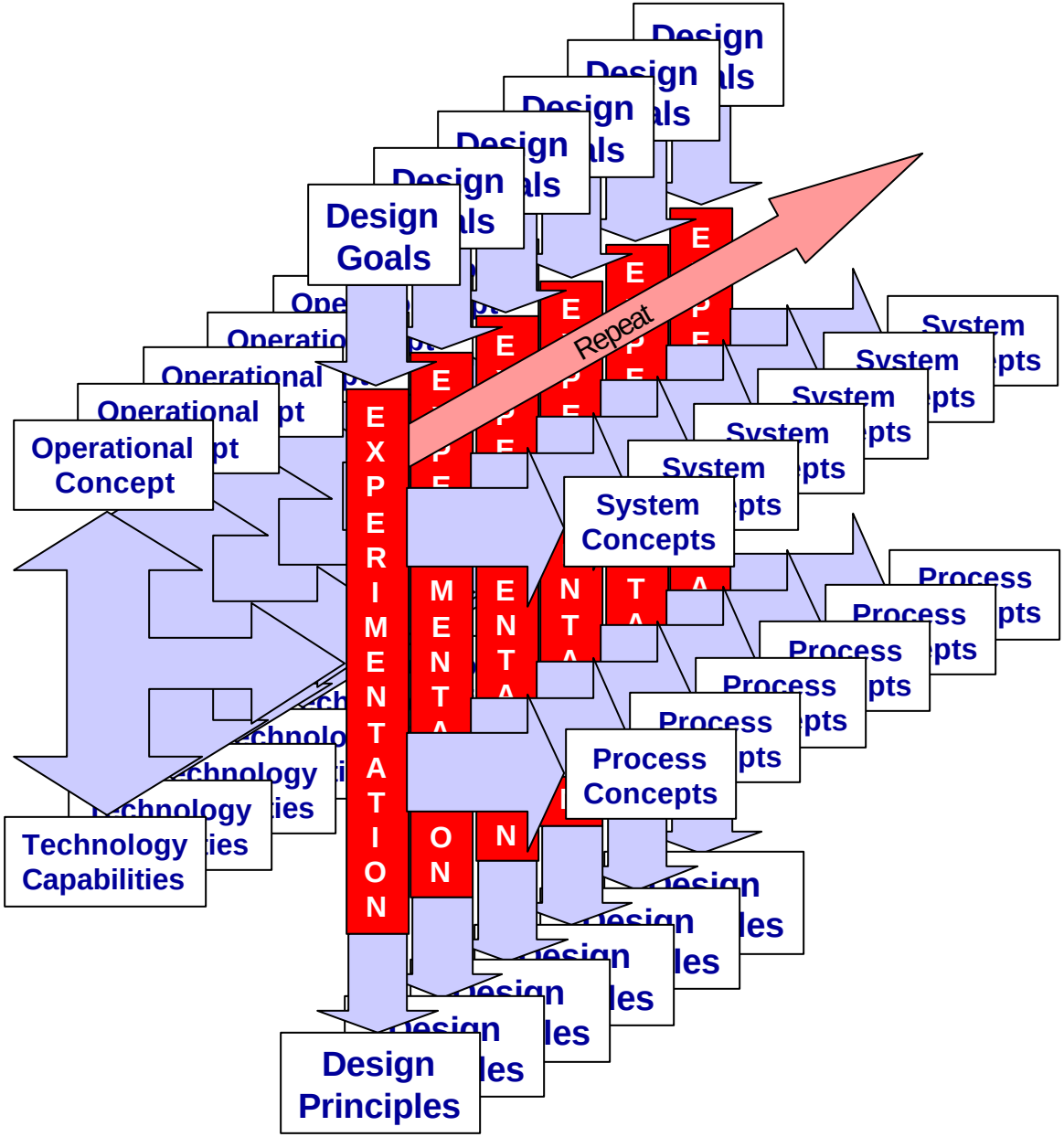
Experimentation:
A Key Process for Inventing the Future

Engineering the Net-Centric Vision

- Naval Net-Centric Future:
  - Each warfare capability in the theater, and its associated systems, are an element of the networked theater and global systems and processes.
  - “Team Sports”
- The Naval Force is a distributed integrated system-of-systems
  - Off-board sensors and systems easily accessed
  - Traditional platforms now expected to be highly integrated
  - Reach-back to support the warfighter forward
  - New operational concepts, tactics, techniques and procedures
- Many options, many operational and technical trades to assess.

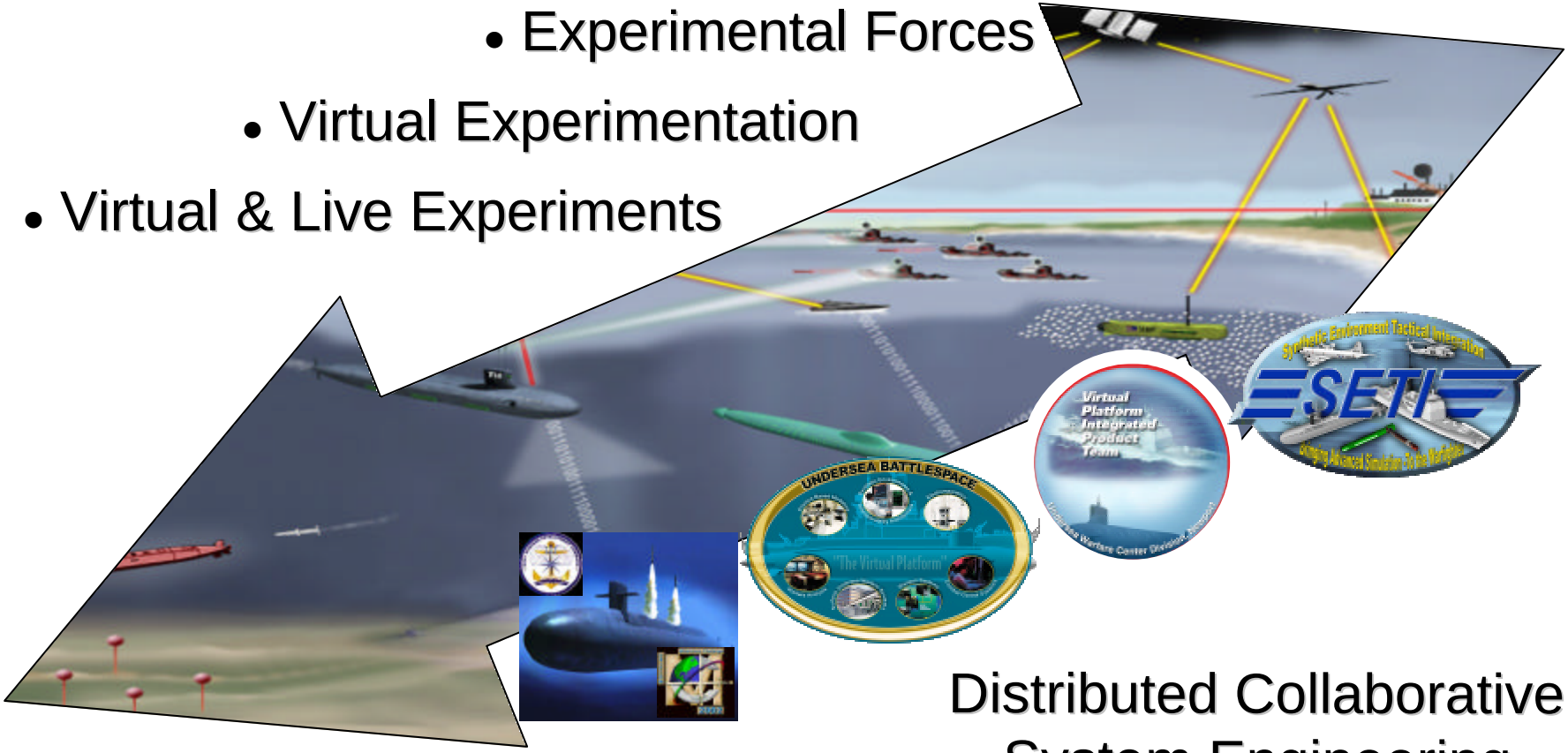
Prototyping/Experimentation required to reduce risk and ensure warfare effectiveness

Evolutionary Engineering Approach



Undersea Warfare M&S and Experimentation

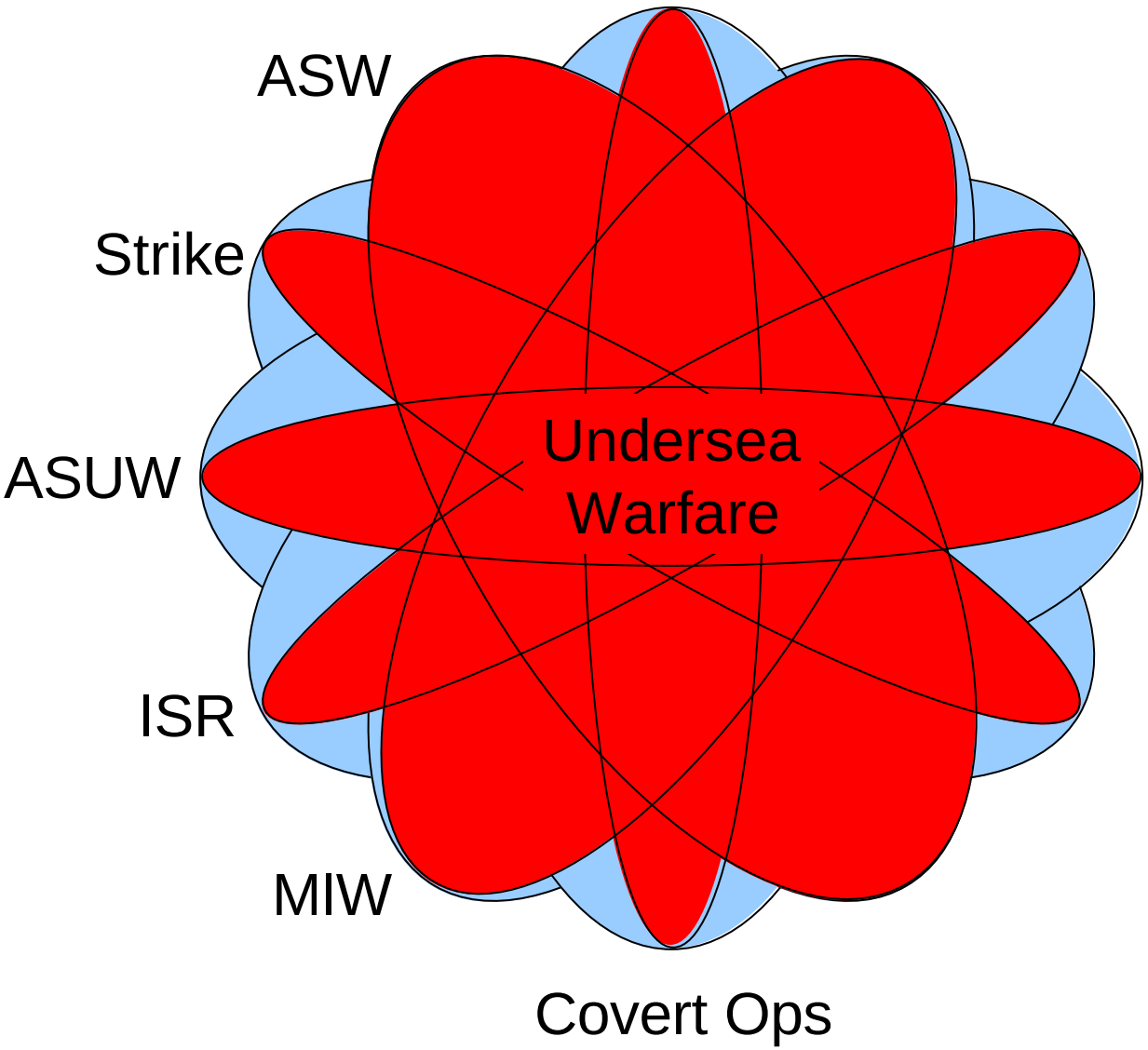
- Real-World Deployment
- Experimental Forces
- Virtual Experimentation
- Virtual & Live Experiments



Distributed Collaborative System Engineering

Undersea Warfare:
Multi-Dimensional, Multi-Community, Distributed & Collaborative

Multi-dimensional Naval Operations



Undersea Warfare Domain

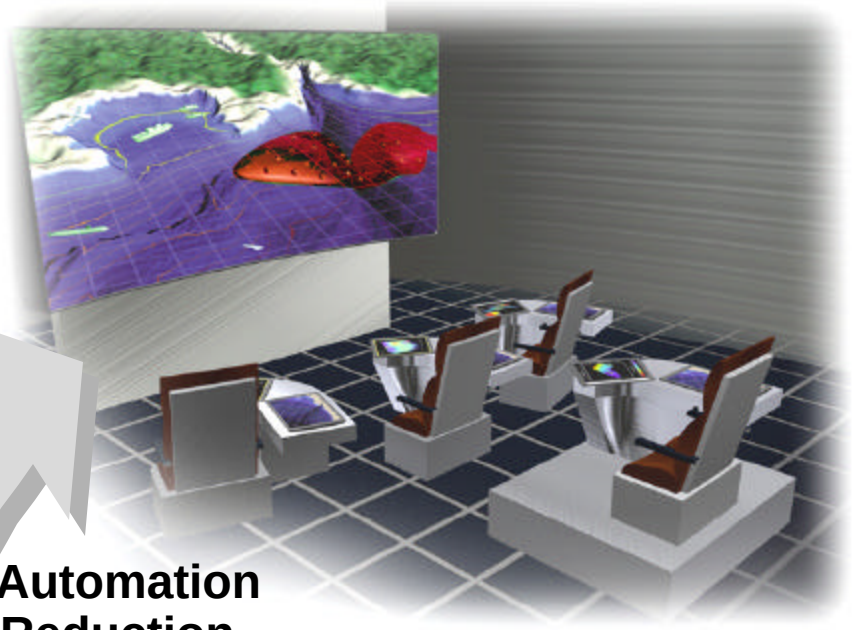
Warfare Directed Against Undersea Threats

Warfare Emanating From Under The Sea

Examples of ongoing Undersea Warfare Engineering and Experimentation

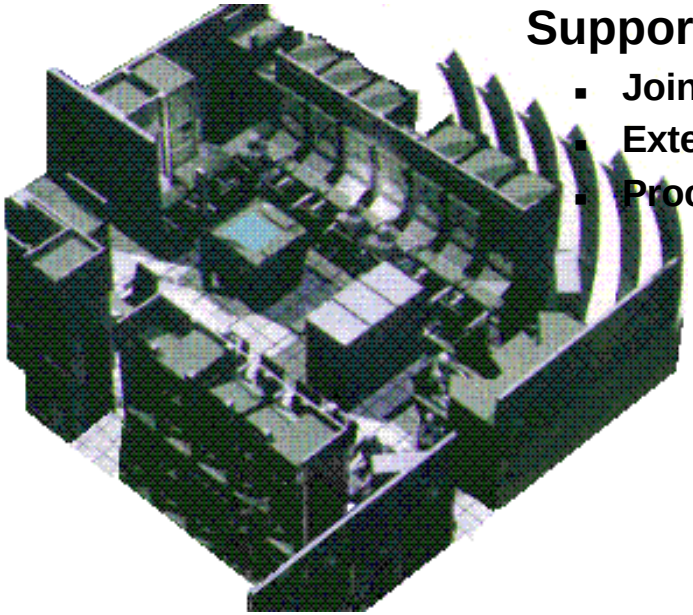
FORCENET and Submarine Warfare System Vision

Warfare System Vision



- **Net-Centric & Autonomous Modes**
  - **Shared Tactical, Operational and Environmental Picture**
  - **Distributed & Collaborative Operations in the Littorals**
  - **Net-Centric "Stealth" Node**

- **Knowledge-Enabled Automation Supporting Manning Reduction**
  - **Joint Operational Context Awareness**
  - **Extended Information/Knowledge Exchange**
  - **Process and Processing Automation Required**

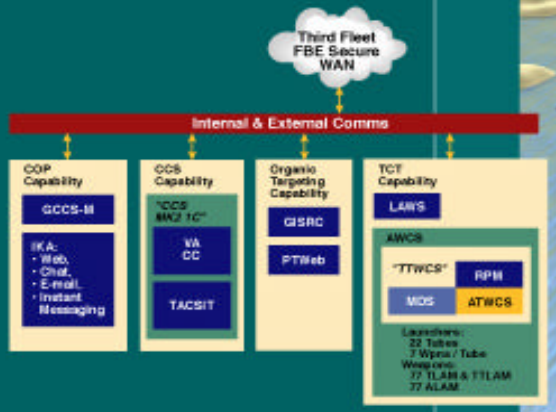


- **Common Functionality and Architecture**
  - **Open Affordable Architecture Standards and Components based on COTS**
  - **Open Affordable and Common Functional Components Developed by DoD**
  - **Transparent Connectivity**

Prototyping and Experimenting with the Net-centric Submarine Vision in Fleet Battle Experiments

Virtual SSGN

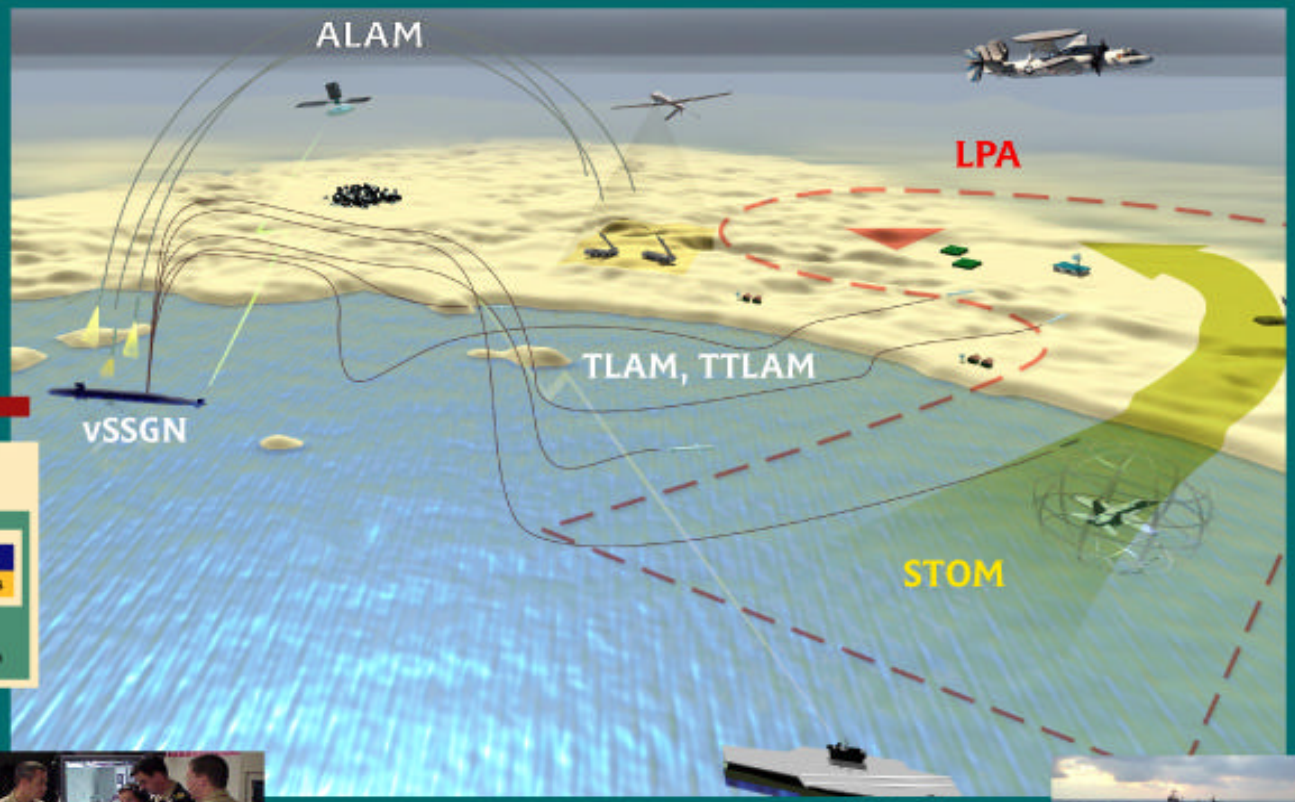
- Net-centric Warfare / Operations
- Fires in Support of Maneuver
  - Organic Sensor and Mensuration Capability:
    - GCCS-M ISR Capability
    - Precision Targeting Workstation (Web)
  - Collaborative Battlespace Management and Deconfliction:
    - Land Attack Warfare System
    - Shared Sensor-Weapon-Target Information
  - Next Gen Onboard Mission Planning Capability:
    - TTWCS-like: RPM plus MDS plus ATWCS
  - Next Gen Weapons:
    - TLAM, TTLAM, ALAM
- Common Operational Picture (COP) Participant



Observers / Analysis

FLEET BATTLE EXPERIMENT FBE-I

Exploring Submarine Capabilities & Contributions to Fires in Support of Maneuver

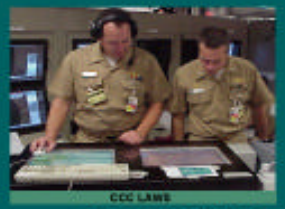


- Access to Denied Areas
  - Deeper Target Penetration, Shorter TOF
- Onboard Mission Planning
- Next Generation Comms at Speed & Depth

USS Stennis

Third Fleet

Joint Fires TCT



Command & Control Center

Navigation Center

Missile Control Center

Undersea Warfare Center

Stealth
Endurance
Firepower
Agility

- Trident Stealth and Reliability
- Joint Task Force High Data Rate Communications
- Command Center for Mission Planning and Execution
- Over 70% Operational Availablity Using Two Rotating Crews
- Up to 154 -Tomahawk/TACTOM Precision Strike Cruise Missiles
- Sustained On-Board Support for 66 Special Operation Forces (SOF)
- Dual Advanced Seal Delivery Systems (ASDS) and/or Dry Deck Shelters (DDS)
- Mission Capabilities of SSN for ASW, ASUW and Intelligence Collection

SSGN Conversion Baseline

NAVY Strategic Systems Programs From the Sea

- Covert Strike
- Clandestine SOF

Cruise Missiles

Transforming the Navy's warfighting capability

vSSGN

Communication Systems Emulation (MCBA, A-DBF, SohMDR, CDL, GBS)

GCCS-M (Common Tactical Picture)

IWS – e-Mail, Chat, Web (Collaboration Tools)

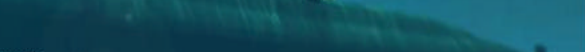
Attack Weapon Control System (Emulation) TTWCS (Engagement Planning)

GCCS-M ISR Capability (UAV Exploitation)

Naval Fires Network (SAT) Ready Room of the Future (Intel Access, Targeting)

Land Attack Warfare System (LAWS) (Fires Coordination & Fire Control)

RPM & MDS, LEAPS Mission PLanner (Tomahawk and LOCAAS Mission Planning)



Cruise Missiles | Ballistic Missiles | AUV Weapons

Millennium Challenge 02 FBE-Juliet virtual SSGN

The vSSGN is a "virtual" platform operating from a land based site at NUWC, Newport Rhode Island manned by a submarine crew and fully integrated into the MC02/FBEJ Joint Fires Initiative.

vSSGN MC02/FBE-J Weapon Loadout

BASELINE STRIKE WEAPONS

CRUISE MISSILES

TLAM III C — Qty (21) — Unitary

Single Aim-point 1000Lb BLAT / Fragment Unitary Warhead

TERCOM DSMAC and GPS Guidance RNG 1100+KM

TLAM III D1 — Qty (5) — Submunitions

Single or Multiple Tgt Submunition Despensor w/ Dispersion Bomblets

TERCOM DSMAC and GPS Guidance RNG 1100+ KM

TLAM III D2 — Qty (2) — Non-Lethal

Non-Lethal Tactical Warhead Capability

TERCOM DSMAC and GPS Guidance RNG 1100+ KM

TTLAM — Qty (28) — TACTOM

Penetrator Warhead & TTWCS On-board Control

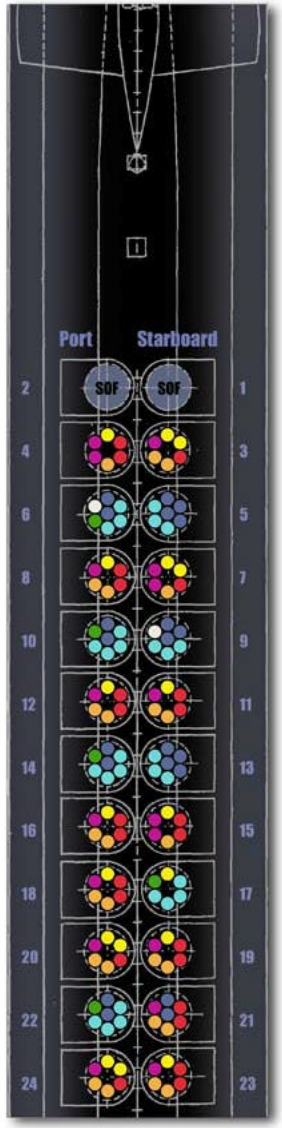
In-Flight Re-Targeting, GPS Re-Direct, Loiter and Battlespace Damage Assessment (BDA)

MINE RECONNAISSANCE

LMRS — System Qty (2)

UUV for Mine & Bottom Surveillance
Single Sortie Reach 75-120 nm
Area Coverage Rate 35-50 nm^2/day
Total System Coverage 400-650 nm^2

(One System Comprises two LMRS UUVs)



BALLISTIC MISSILES

TACMS-U — Qty (24) — Unitary

Monolithic 500Lb High Explosive Warhead

Limited Collateral Damage is Goal

TACMS-A — Qty (24) — APAM

Delivers (300) M74 Anti-Personnel Anti-Materiel Bomblets

Range 300 Km with GPS

TACMS-P — Qty (18) — Penetrator

Block III Earth Penetrator Warhead

Attacks and Destroys Hard and Deeply Buried Targets
Range 300 Km

TACMS-L — Qty (18) — LOCAAS

Deploys Four Miniature Autonomous Cruise Missiles with GPS

Qty (4) ea.

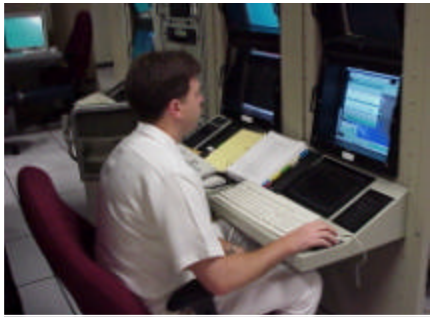
Search and Attack Specific Shape Targets

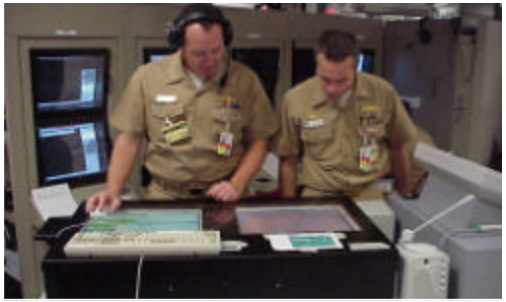
Multi-Mode Warhead

Autonomous Seeking :
- Scud Launcher
- Tanks
- APC's

MC02/FBE-J vSSGN

- **vSSGN Capabilities Supporting Joint Rapid Decisive Operations:**
  - **Global Command and Control System - Maritime [CTP]**
  - **GCCS-M ISR Capability [UAV Interface]**
  - **Remote Terminal Capability - Lite (NFN client) [Intel, Imaging, ESM, Track Correlation]**
  - **Ready Room of the Future [Target Mensuration]**
  - **Land Attack Warfare System x 2 [Fires Coordination & Control]**
  - **Attack Weapon Control System [Emulation]**
    - **Rapid Planning Module [Route Planning]**
    - **TTWCS [Engagement Planning]**
  - **Low Cost Autonomous Attack System (LOCAAS) Mission Planner [Autonomous Attack UAV]**
  - **IWS [Collaboration Tools: Chat, Email, Web Access]**
  - **Emulating a wide range of Communications system options: [MBCA, A-UHF, SubHDR, CDL, GBS]**
  - **Internal Bandwidth Management [COTS Packeteer]**
  - **LMRS and GCCS-M w/ MEDAL [UUV Mine Recon]**
- **Weapons:**
  - **Tomahawk: TLAM + TTLAM**
  - **Submarine Launched Canisterized TACM: Unitary + Penetrator + APAM + LOCAAS**
- **12 Man Military Crew**





FBE-J Coalition Entities

GCCS-M

GCCS-M

GCCS-M

P-3C

GCCS-M

SH-60

vDD
@ NSWC/Dahlgren

vSSGN
@ NUWC/Newport

DDG
@ SOCAL ASW Range

HSV
@ SOCAL

U.S. FBE WAN

Radiant Mercury Guard (RMG)

Coalition JSAF SIM

Coalition WAN

Sim RDS
@SOAR

vSSK
@ NUWC/Newport

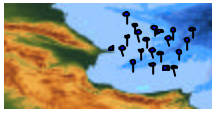
Horizon, IWS, C2PC

vFFH
@ DRDC Atlantic

Horizon, GCCS-M, IWS

vDDG
@ Dstl Portsdown

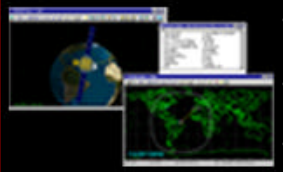
MTP, IWS



The Challenge of Effectively Leveraging and Integrating Existing Capabilities

Virtual Platform Initiative

Communications/ Distributed Engineering

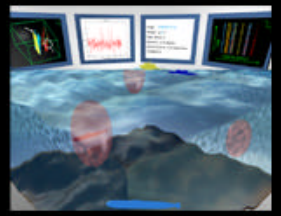


- Missile in Flight Simulation
- VSSN Connectivity
- Human Innovation Laboratory

Enabling Facilities

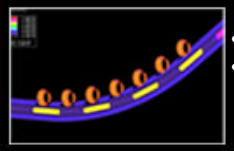
- WSPF
- C4ISR
- USWAL
- WAF
- LBITS
- SNMC
- CSTL

Visualization



- Integrated Display Center
- Chafee Auditorium
- Immersive Visualization Technologies

Modeling



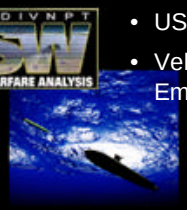
- SBD/SBA/PBM
- Dynamic Performance Modeling

Networks *RITN*
Tactical Architecture *CORBA*

Simulation

- Undersea Battlespace
- Virtual Prototyping Projects

Analysis



- USW Analysis
- Vehicle Emulation

Ships, Ranges, and Other Land-based Facilities

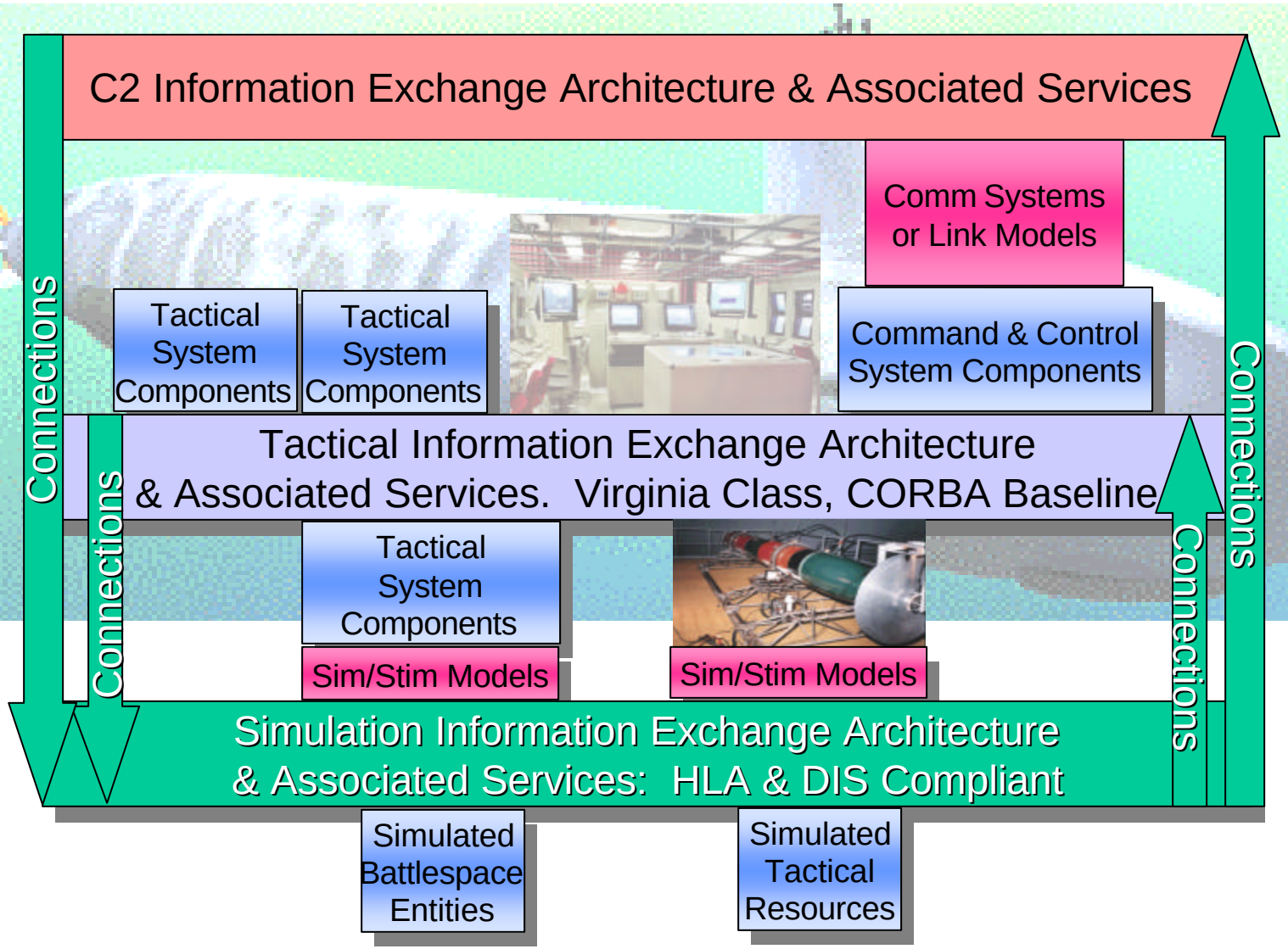
External Connectivity
- DREN
- SDREN
- ISDN

Coalition R&D Labs
- Australia
- United Kingdom
- Canada

Industry
- Electric Boat
- Raytheon
- Lockheed Martin
- Northup Grumman
- Sperry Marine

Navy / Government
- Navy Warfare Centers
- Underwater Tracking Ranges
- Other Service Ranges & R&D Laboratories

Capability Component Architecture



Shared Standards and Protocols for Interconnection and Interoperability

An Virtual Undersea Battlespace Capability

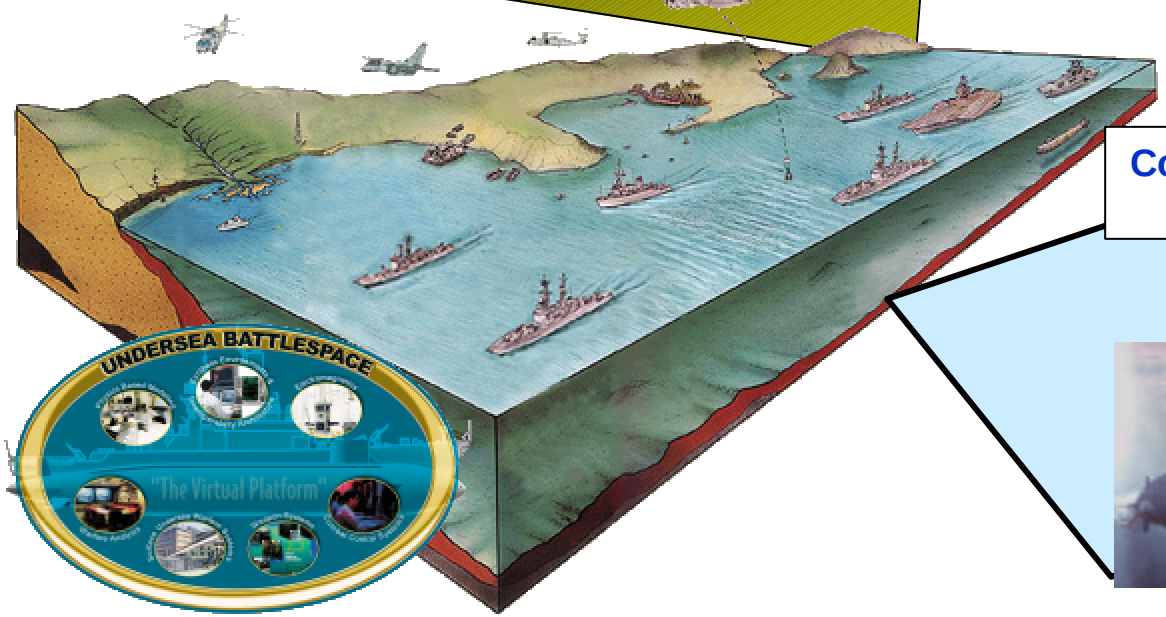
The Undersea Battlespace

A computer generated battlespace that creates simulated:

- Ships
- Submarines
- Aircraft
- Other Entities:
  - Neutral Shipping
  - Minefields
- Natural Environments

FORCENET:

- **Today's Navy:**
  - ***Fleet Support***
- **Next Navy:**
  - ***Acquisition & Modernization***
- **Navy After Next:**
  - ***Transformation***



Connected to Navy test & training ranges

Integrating Virtual and Live to Support Experimentation, Test & Evaluation, and Training

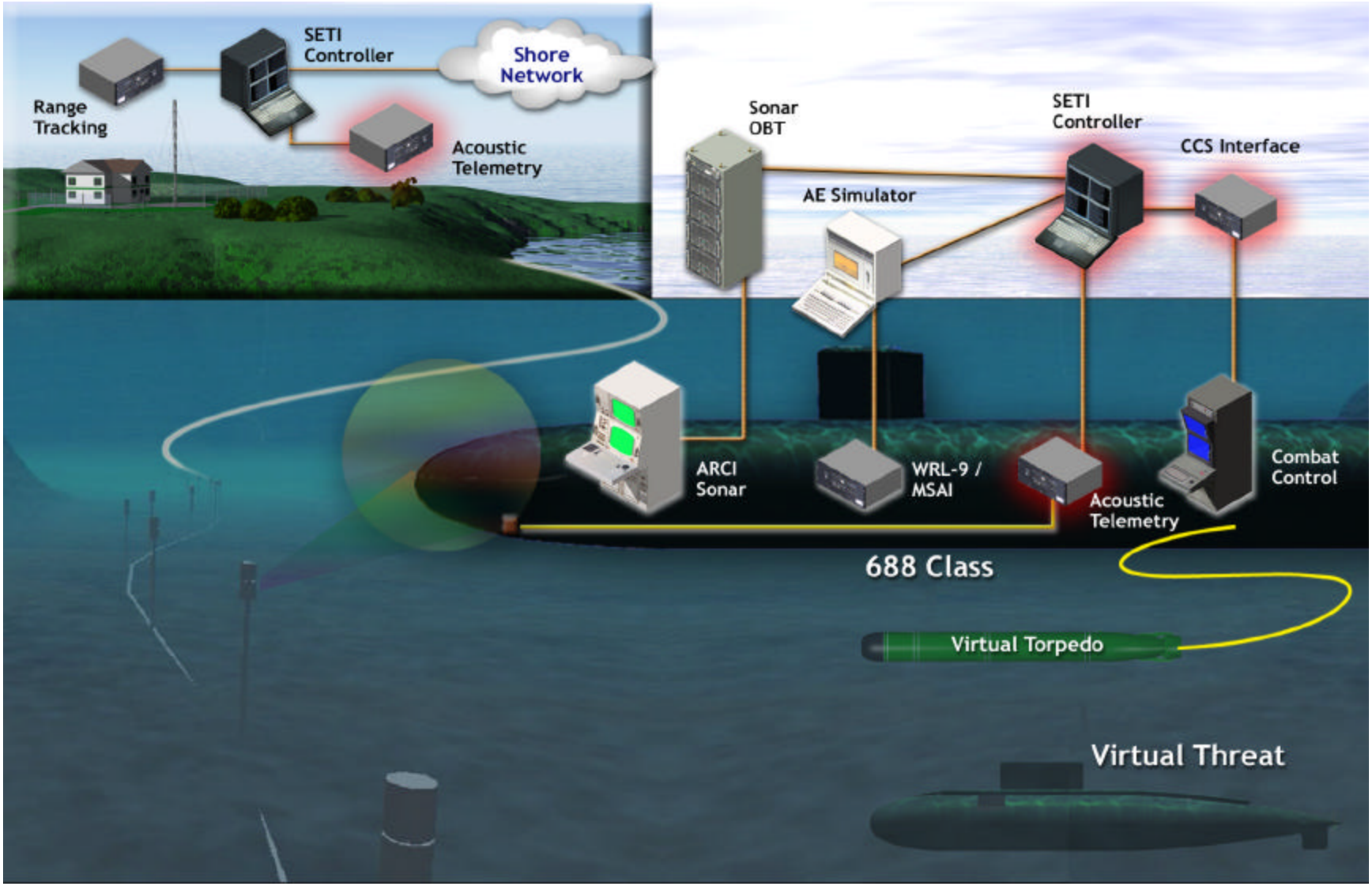
Synthetic Environment Tactical Interface

SETI VTP - 1998
Virtual Torpedo Exercise

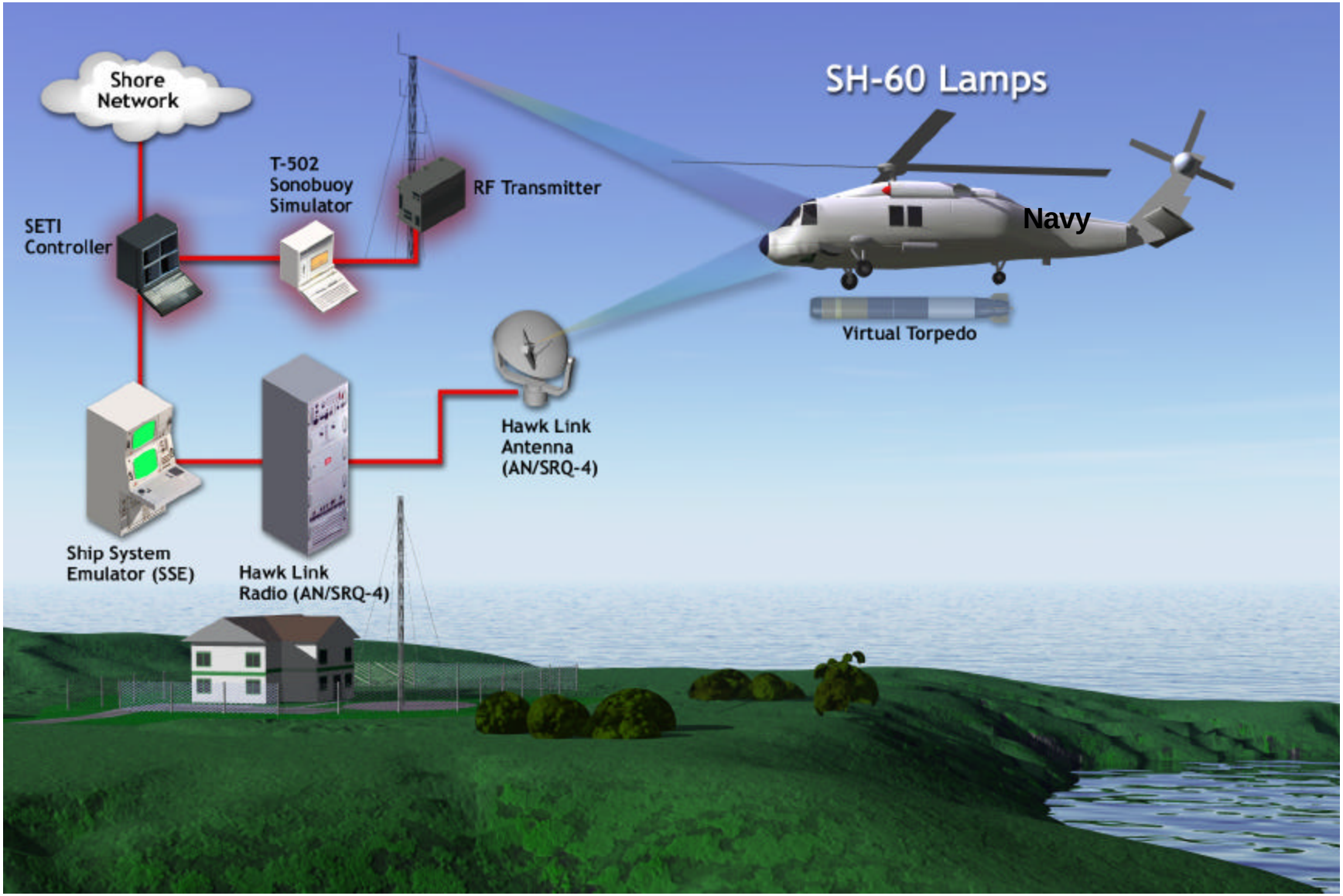
- **Full Duplex Communications**
  - **HW-in-the-loop Torpedo Sim**
  - **SSN Tactical Organic Systems**
  - **NSA Encryption Systems**
- **Bandwidth: 2Kbps**
- **Simulation Interface to Live Platform Tactical Consoles**
- **Virtual Torpedo Launch**
  - **Closed Loop Engagement**
  - **Launched Eight Simulated ADCAP Torpedoes**
  - **Submarine Tactical CCS**

Concept Proven: USS Oklahoma City crew (at AUTEC) launched eight virtual torpedoes (in Newport) which pursued a surface target at AUTEC. The entire scenario unfolded in real-time.

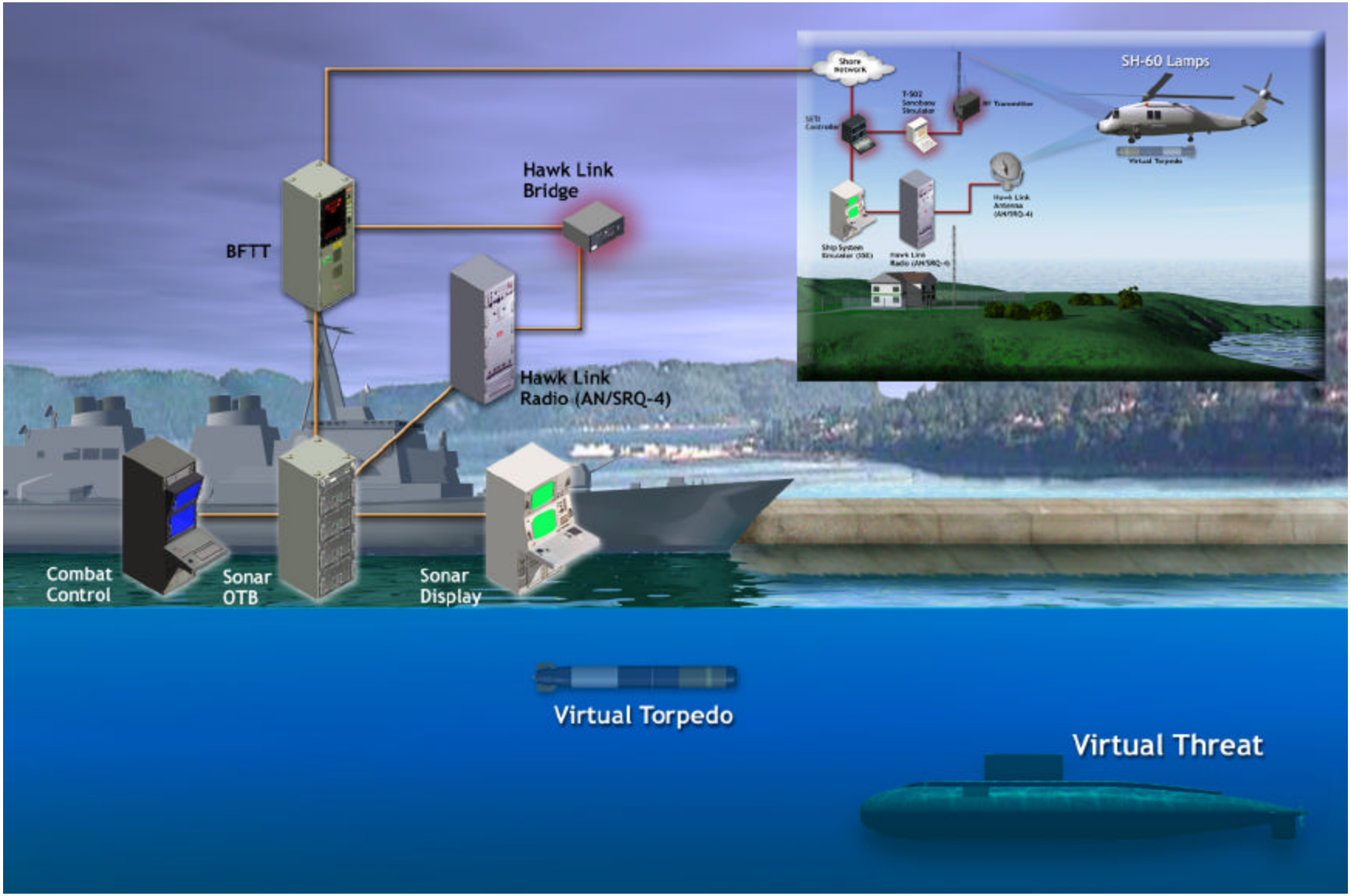
Submarine ASW Integration



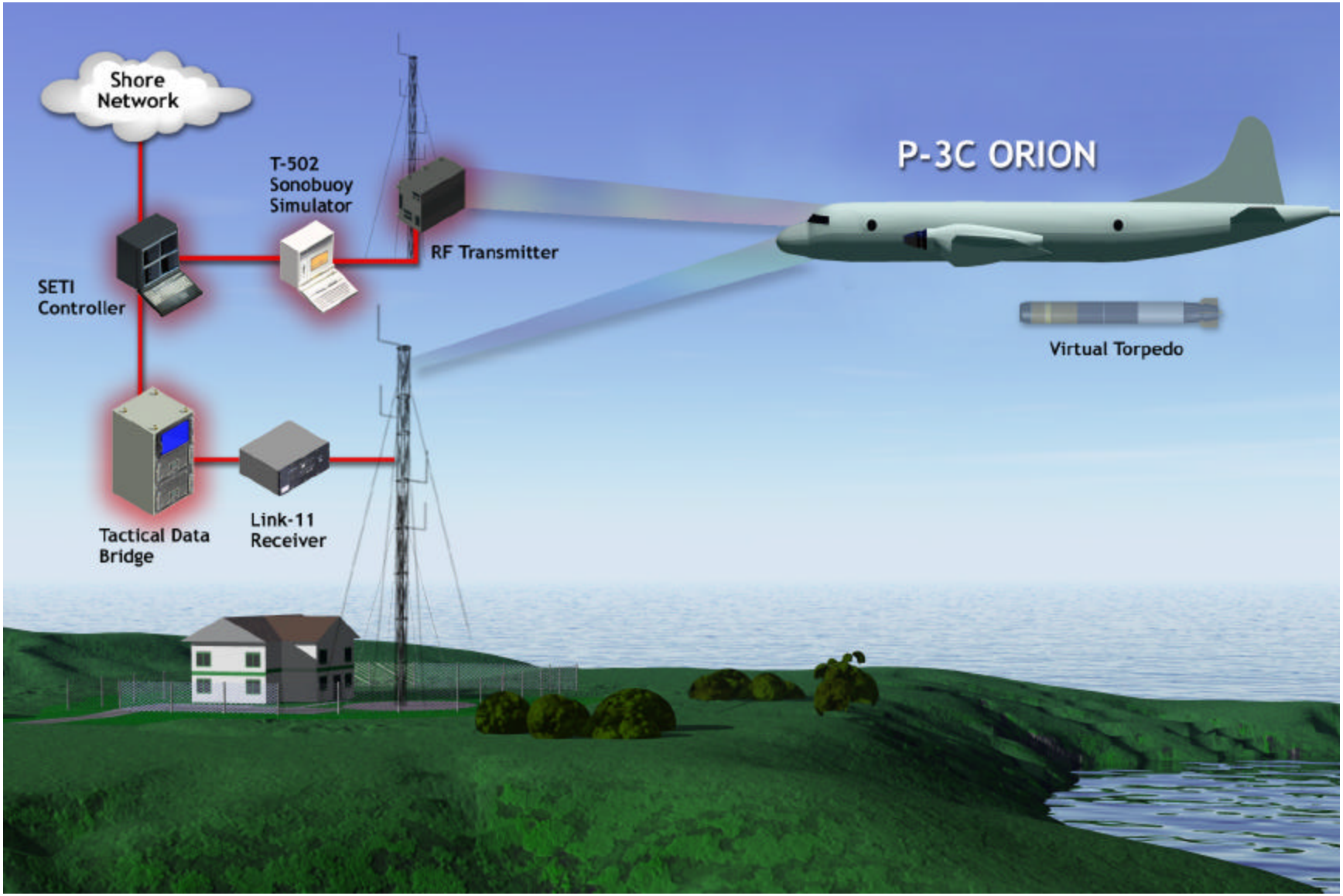
LAMPS ASW Integration



Ship ASW Integration



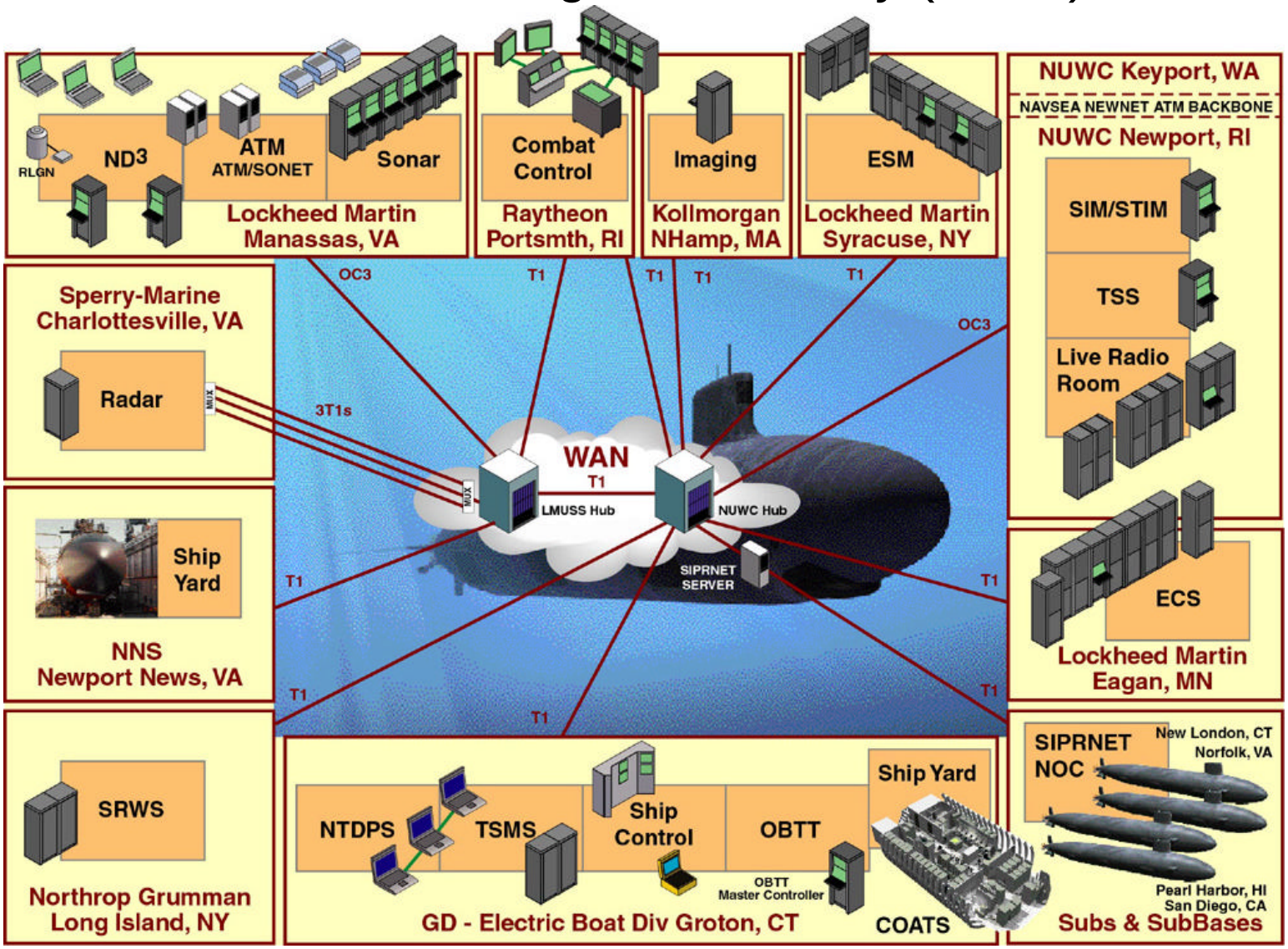
P-3 ASW Integration



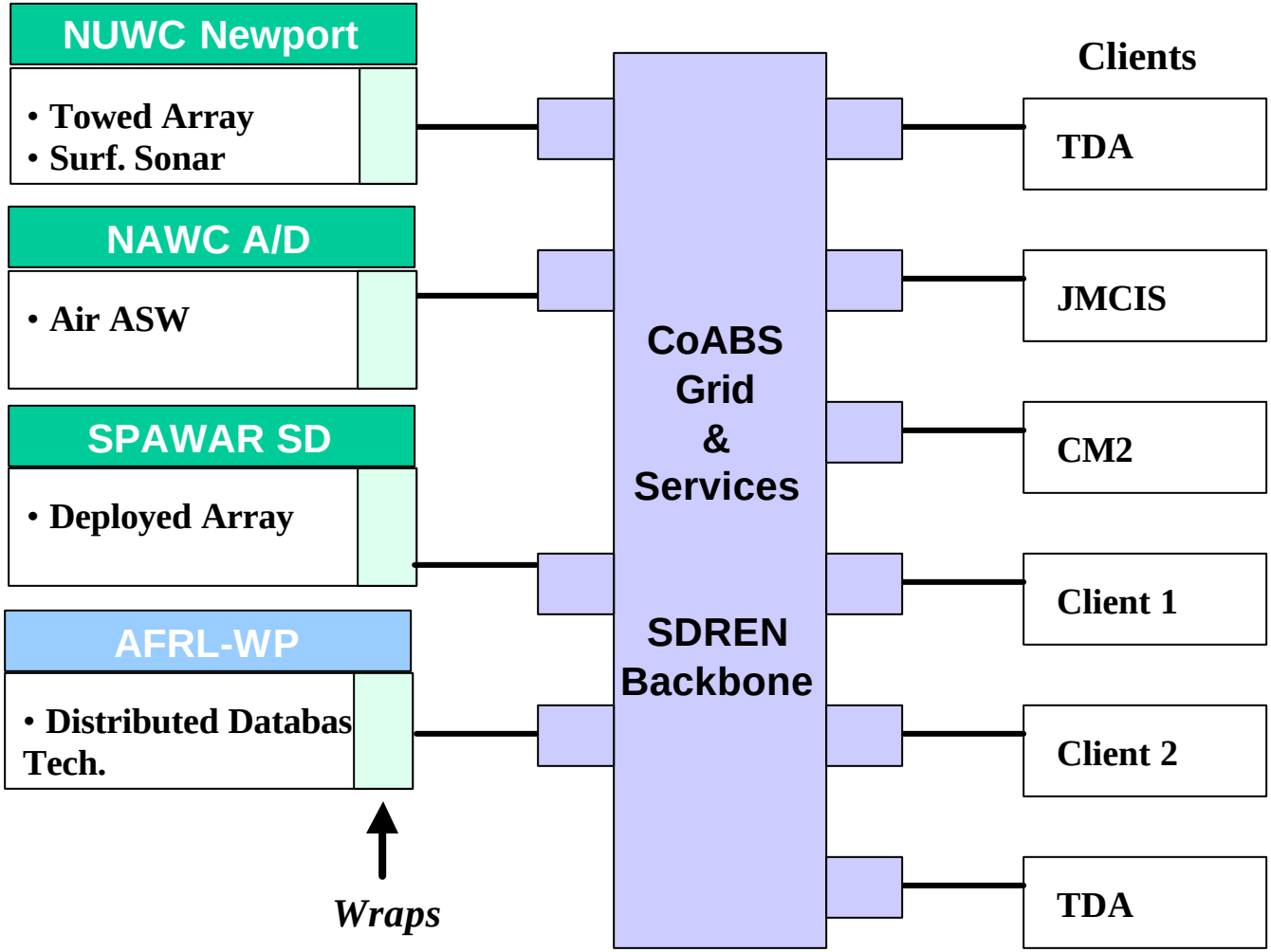
Distributed & Collaborative Engineering: A Cost Effective Way to Achieve Integrated Warfare Capability

VIRGINIA Collaborative Engineering

Wide Area Integration Facility (WAIF)

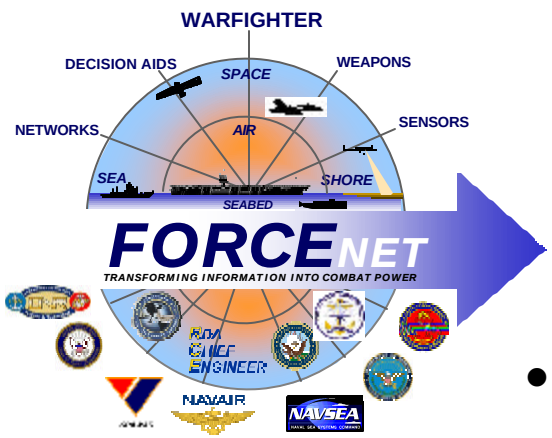


NWDC ESG Enabling Experimentation

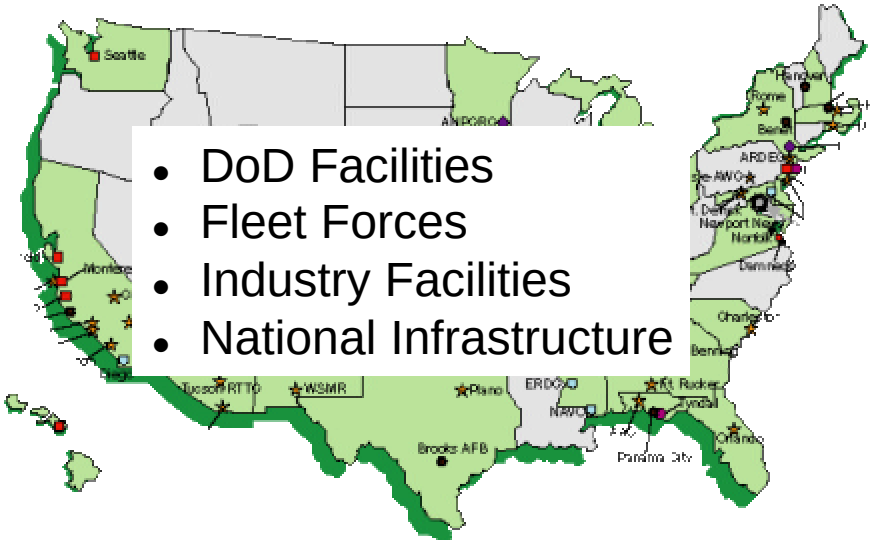


Distributed Testbed Simulation Architecture

Distributed Engineering & Experimentation



- Local
- National
- International



- DoD Facilities
- Fleet Forces
- Industry Facilities
- National Infrastructure

- Allied Military Facilities
- Allied Fleet Forces
- International Infrastructure

Summary

- Evolution of FORCENET requires an integrated and extensive M&S capability
- Distributed collaborative system engineering and experimentation capabilities **exist today**

- **Challenge**: Accelerate the integration of these capabilities to support the development of FORCENET