Unmanned Systems Network-Centric Operations

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Program Executive Office, C4I & Space

Outline

- Network Centric
- SSC San Diego UV Initiatives
- Network ISR (NISR)
- Way Ahead

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Network Centric

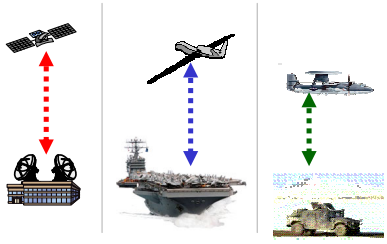
- C3 Transformation
- Notional Operational View
- FORCEnet Services Infrastructure (FSI)
- Composeable FORCEnet (CFn)
- Enabling Technologies

SSC San Diego's Joint Vision

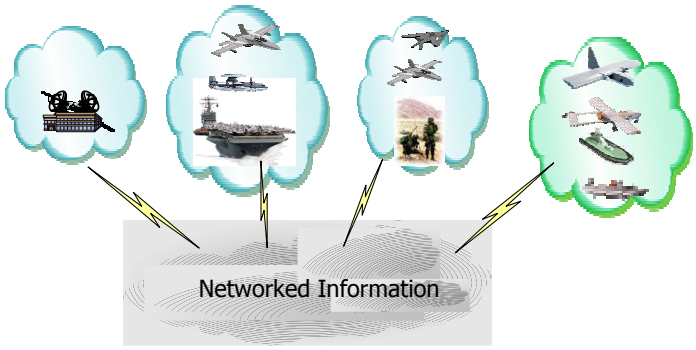
To be the nation's pre-eminent provider of integrated C4ISR solutions for warrior information dominance

C3I Transformation

Legacy : Stovepipe



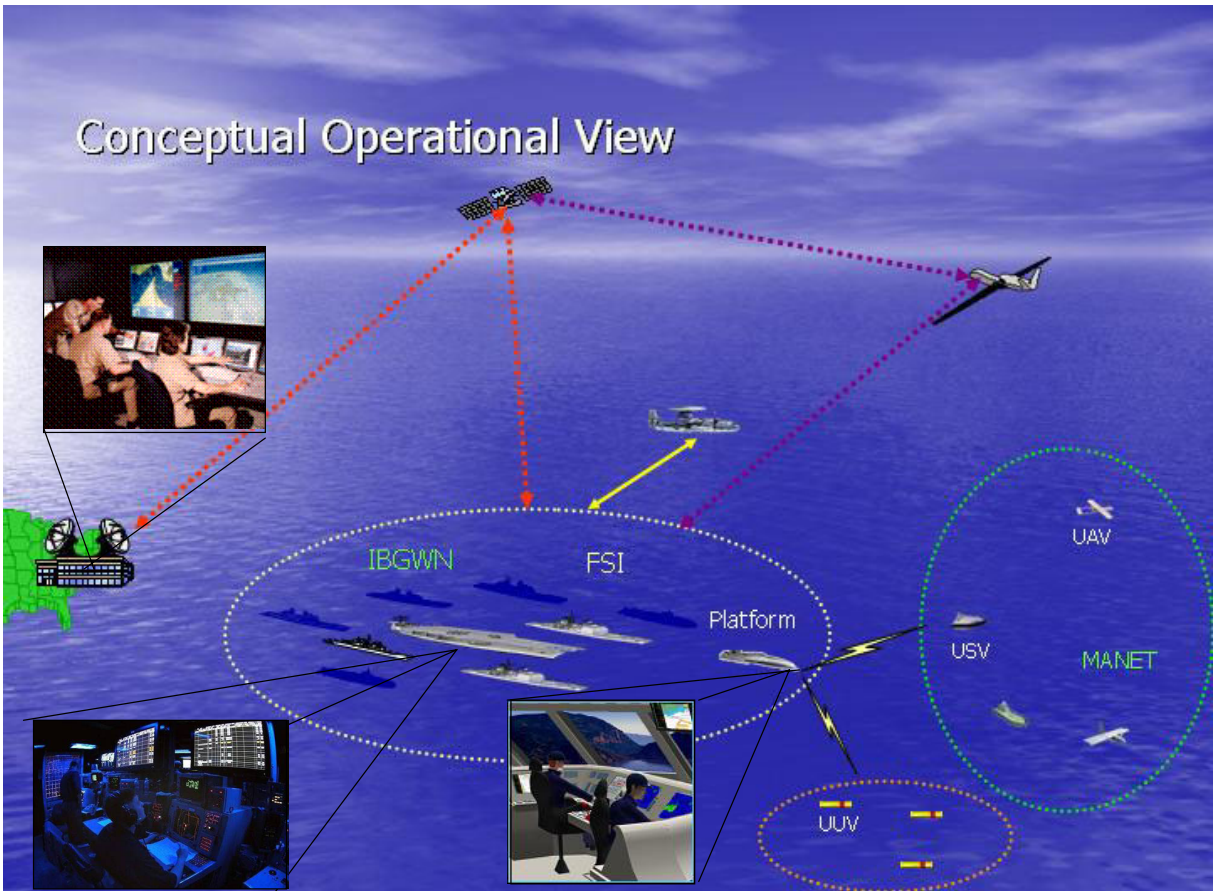
Network Centric Operations



- Manual Stovepipe Operations
- Non coherent architectures
- Limited Operational Capabilities
- Islands of C2 capability

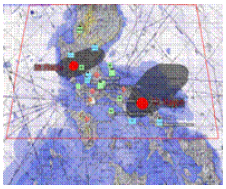
- Fully Integrated & Automated C3I
- Flexibility & Adaptability
- Interoperability
- Information Operations

Legacy → Objective

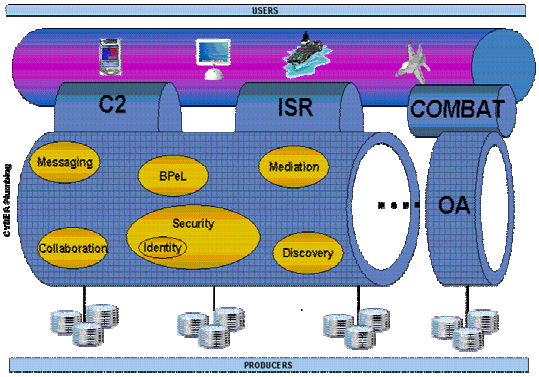


FORCEnet Services Infrastructure (FSI)

- FORCENet
  - Network Centric Warfare is the Theory
  - Net-centric operations is the Concept
  - FORCENet is the process of making the Theory & Concept a reality.
  - FORCEnet is the foundation for Sea Power 21

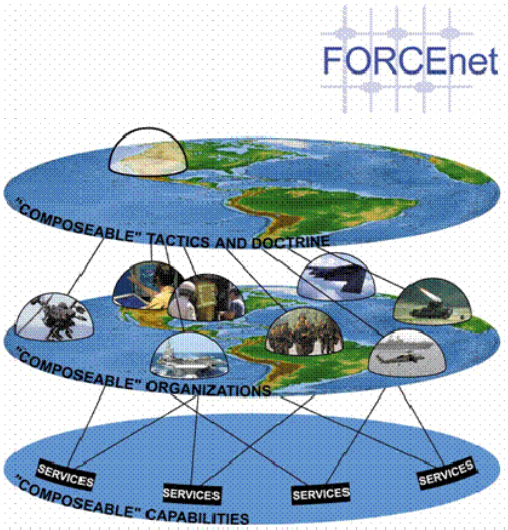


- FSI
  - FSI is FORCENet's mechanism for delivering Service Oriented Architecture environment
  - An open architecture, …… web-based C2 and information management system
    - Provides ability to "fuse" data from multiple otherwise non-interoperable systems on a single display
  - Installed in CTF72, CTF74, LCC19 (USS Blue Ridge)
  - Planned installation in CVN76 (USS Ronald Reagan)



"Transforming Information Into Decisive Effects"

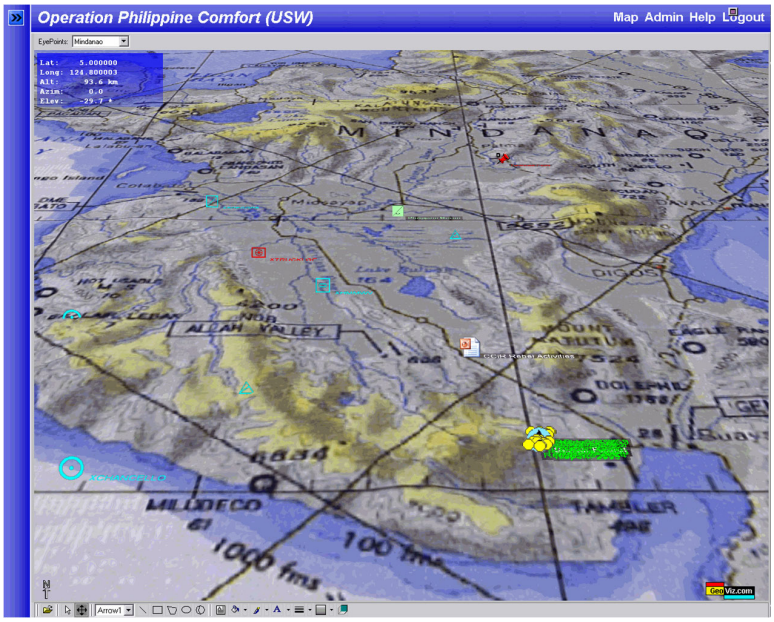
Composeable FORCEnet



Transform *Operations*

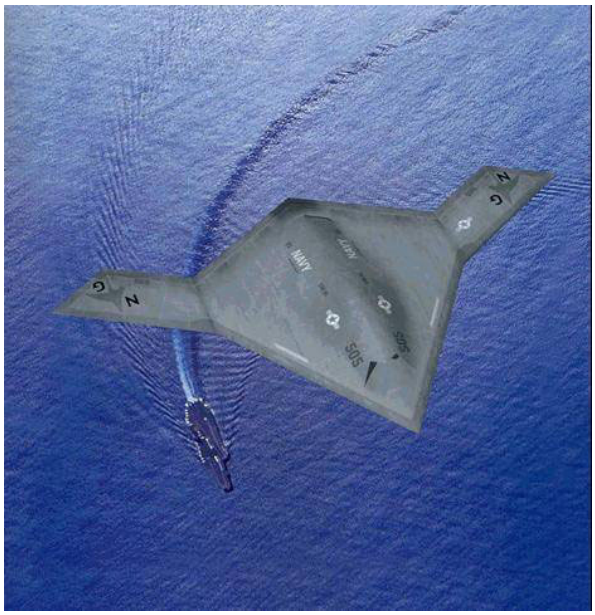
- Assemble components on the fly
- Interoperable – Agile – Tailorable
- Geospatial – based shared awareness & collaboration
- Intuitive linkage to information

Sample CFn View

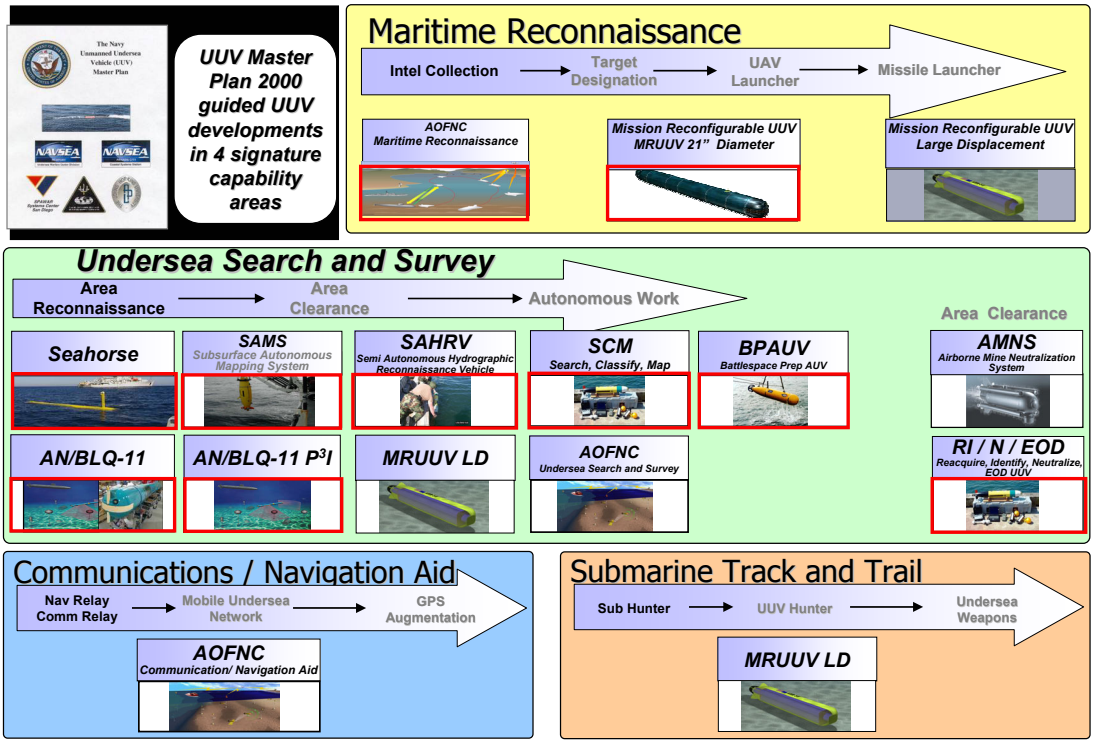


Enabling Technologies

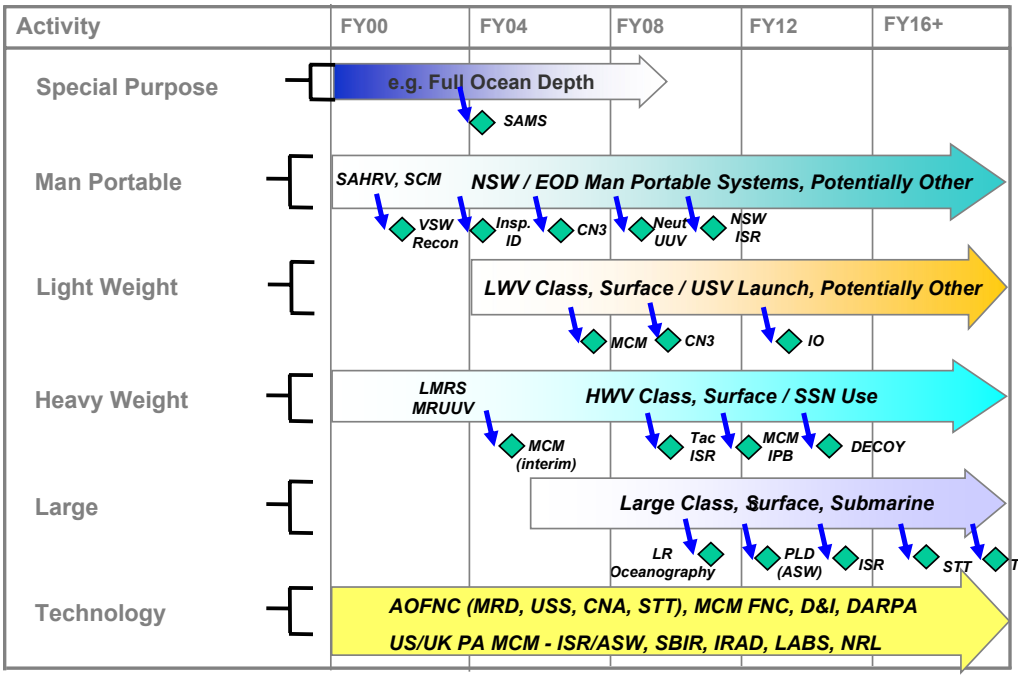
- Unmanned Vehicles
- Sensors / Payloads
- UV C2
- Secure Wireless Network
- Data Management & Fusion



Y2K UUVMP and UUV Programs



UUV Master Plan Program Roadmap

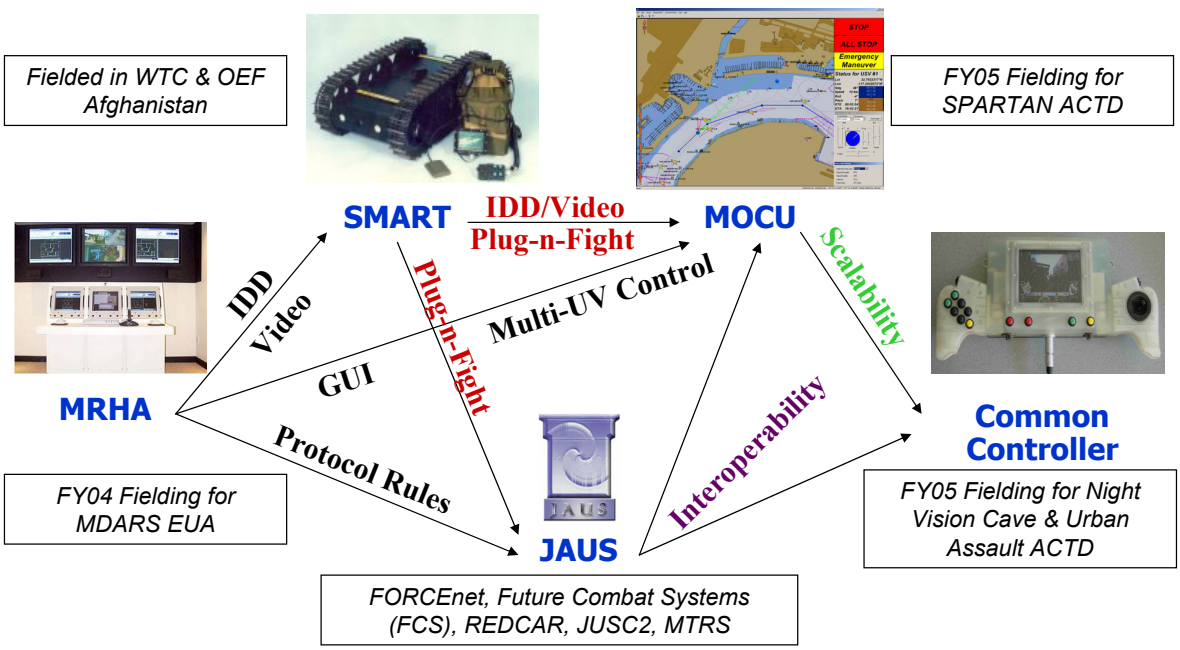


SSC - San Diego

C4ISR UV Interoperability Imperatives

- Unmanned Systems Command and Control (C2)
- Unmanned Ground Vehicle (UGV) C2 Interoperability
- Unmanned Surface Vehicle (USV) C2
- Autonomous UAV Mission System
- UGV Remote Operations

Unmanned Systems Command and Control (C2)



Unmanned Ground Vehicle C2 Interoperability

Matilda

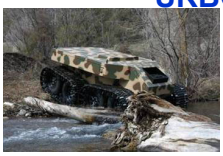
Common Controller

URBOT

Andros

Eel

Packbot



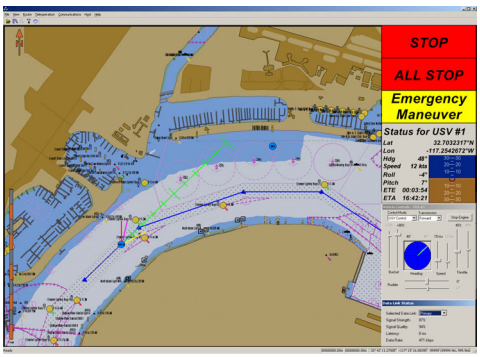
TAGS

SSC San Diego
NSWC-PC (Navy)
AMRDEC (Army)
AFRL (Air Force)
AAC/WMO (Air Force)
Remotec/Apple Aid
Autonomous Solutions
iRobot

Joint Architecture for Unmanned Systems (JAUS)

- JAUS is standards-based approach defining common message sets
- Operator Control Unit (OCU) Experiment - Dec 2003 (SSC San Diego)
  - 9 organizations – 5 DoD and 4 industry
  - 6 Unmanned Ground Vehicle (UGV) systems
    - Each UGV dynamically registers with every OCU
    - Each OCU displays status of all UGVs on network
    - Each OCU is able to take control and drive any UGV

Unmanned Surface Vehicle C2



Operational Relevance

- C2 system for the Spartan ACTD
- Provides C2 of multiple heterogeneous unmanned systems
- Controls and monitors up to 4 Spartan USVs simultaneously with 1 operator

Technology Development

- Provides tele-operation and mission planning for each USV
- Expands on the Multi-robot Operator Control Unit
- Displays up to 30 radar contacts for each vehicle
- Displays raw radar image for selected vehicle
- Allows user to define operation areas as well as exclusion areas
- Interfaces to the Spartan Modular payloads

Autonomous UAV Mission System (AUMS)

Operational Relevance

- Develop an automated system for a UAV to be launched, captured, refueled, and re-launched
- Can operate from USVs, UGVs, HMMWVs, and fixed stations
  - Decreases time and personnel required to refuel UAV
  - Increases the number of missions the UAV can complete
- Applicable to MDARS, REDCAR, FCS, PerceptOR, and SPARTAN programs

Accomplishments

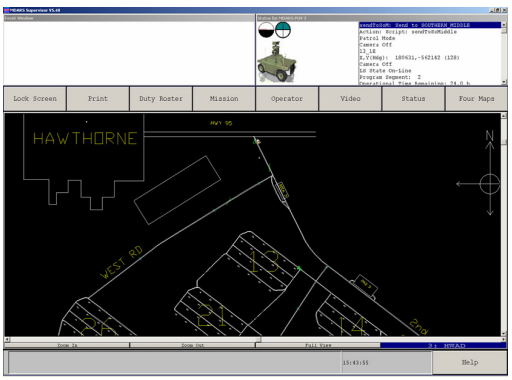
- Developed and tested several fixtures for launch and recovery of iSTAR UAV from MDARS UGV
- Established UAV test facility
- Developed automated refueling system for iSTAR mockup
- Working with USC on precision landing

UGV Remote Operations

MDARS: Mobile Detection, Assessment, Response System

MDARS Early User Assessment (EUA)

FY05 - One-year EUA at Hawthorne Army Depot, NV, 4 MDARS patrol units operating during evenings and weekends covering over 72 miles of roadways across largest depot in US



Navy Reserve Reachback MDARS Experiment

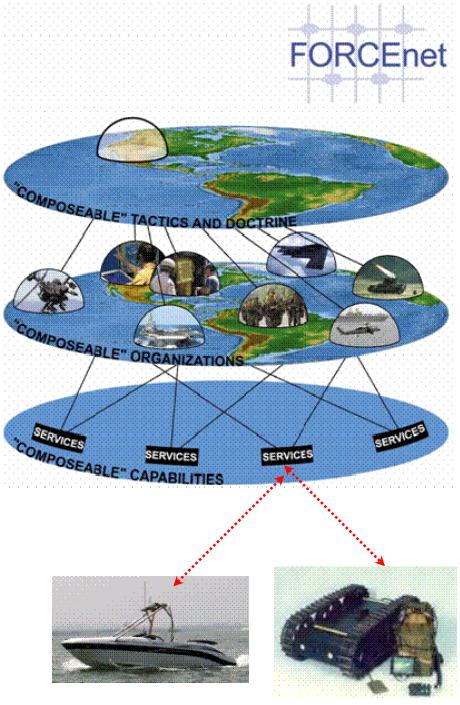
FY05 – Navy Reserve experiment for networked unmanned vehicles
Virtual Operation at SD Joint Reservist Intelligence Center (JRIC)
Controlling MDARS patrol units at Hawthorne Army Depot over 470 miles away via T1 and Virtual Private Network (VPN)

Networked ISR (NISR)

- Objective
- Requirements
- Development

NISR Objectives

- Integration of Unmanned Vehicle Systems into Composeable FORCEnet (CFn)
- Demonstrate from a remote site such as the SSC – San Diego Command Center of the Future (CCOF)

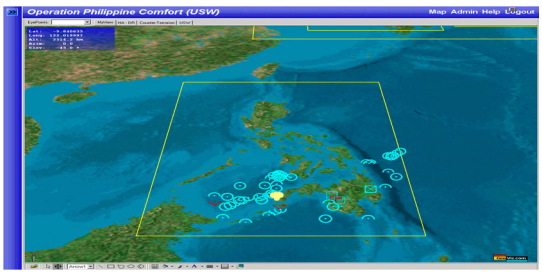


Requirements

- Operational approach
  - Hands-off monitoring – FCn is not the main controller
  - Data rate in the order of seconds
  - Net-centric web based interface
- Core requirements
  - Provide robotic data and functions common to most unmanned systems
    - Robot position
    - Local map imagery
    - Video feed
    - Way point

Spiral Development

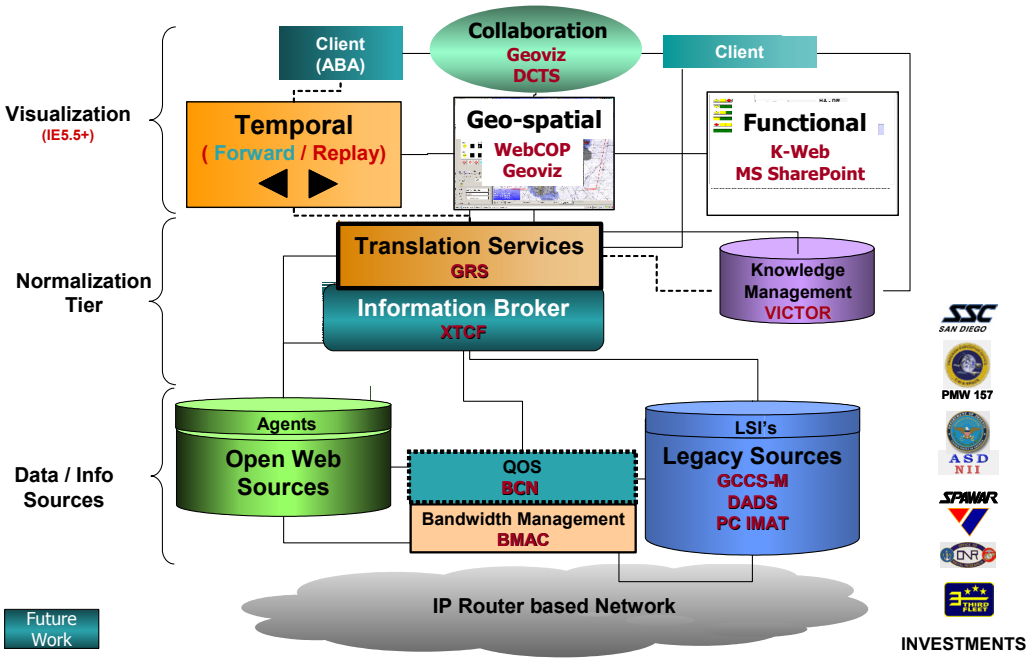
- Phase I – develop baseline capabilities for web-based robotic controls
- Phase II – integrate Phase I solution to Composeable FORCEnet, develop demo scenarios



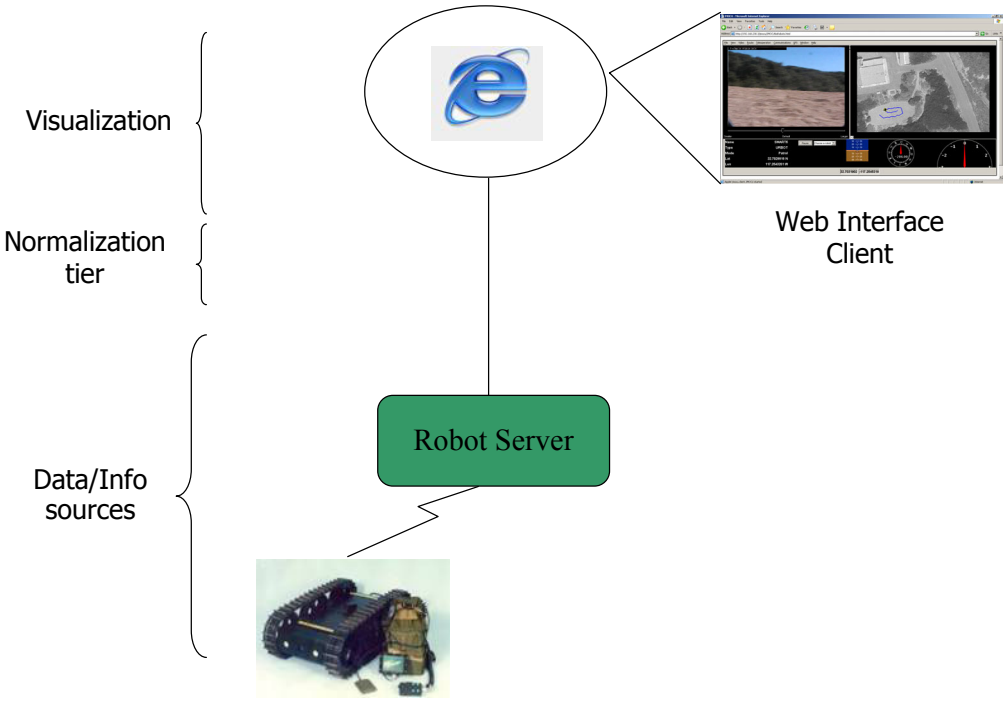
Phase I Development

- Development challenges
  - Network latency
  - Web interface to robotic resources
  - Wireless network security
- Design decisions
  - Java development
  - Client/Server model
  - SecNet 11

Composeable FORCEnet (CFn)



Phase I Block Diagram



NISR Phase I Network Layout

Web Controller

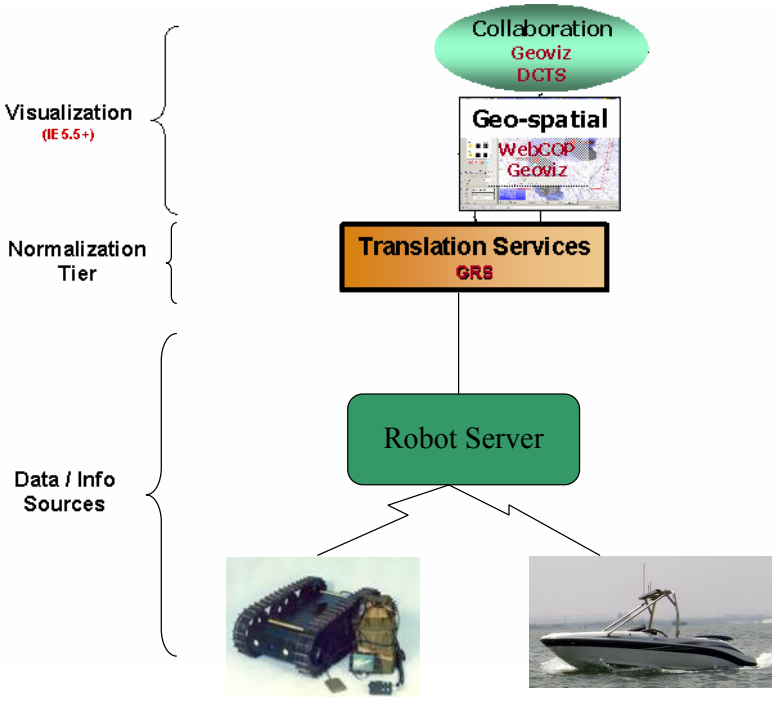
NISR Phase II

- Integrate Phase I with CFn
  - Publish robotic information to Geospatial Replication Service (GRS)/ Geospatial Collaboration Service (GCS)
  - Integrate USV
  - Integrate static sensors (fixed video cameras)
- Obtain network Certification and Accreditation

Phase II Development

- Development challenges
  - Defining XML interface to GRS
  - System integration
  - Certification and Accreditation (CA) of wireless network
  - Develop demonstration scenarios
- Design decisions
  - OpenGIS standard for geospatial XML definition
  - Java Messaging Service (JMS)

Phase II Block Diagram



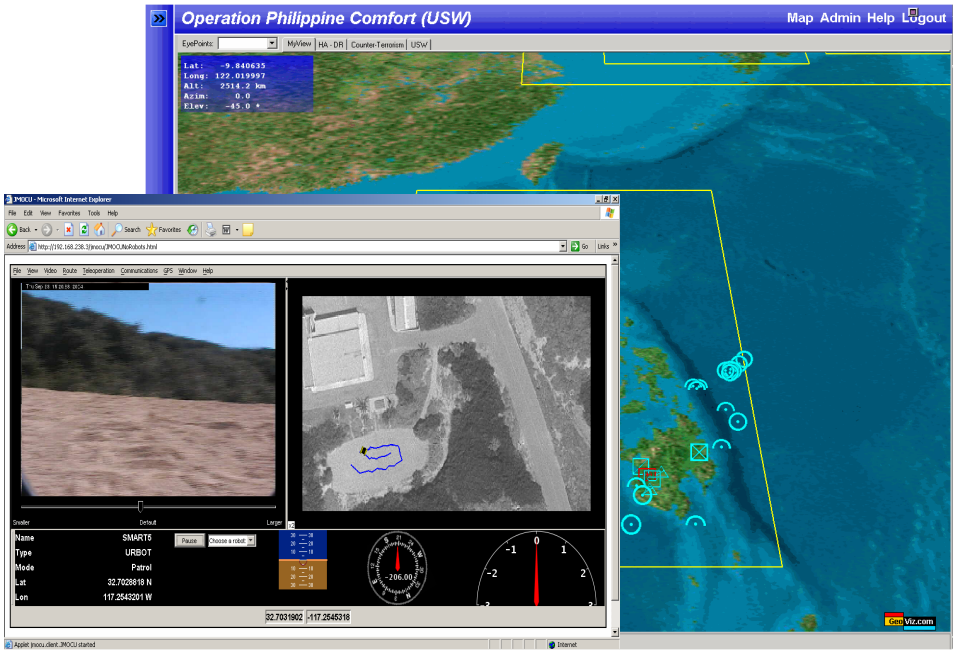
Phase II Network Layout

802.11b

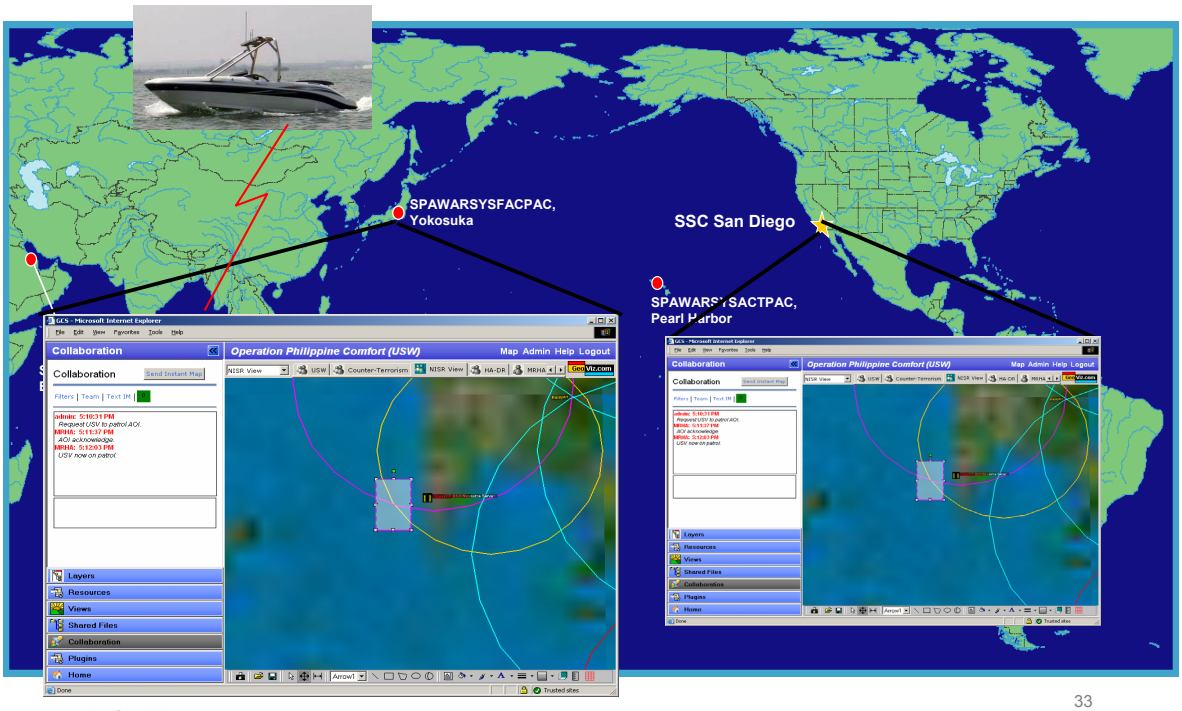
ROUTER

S&T

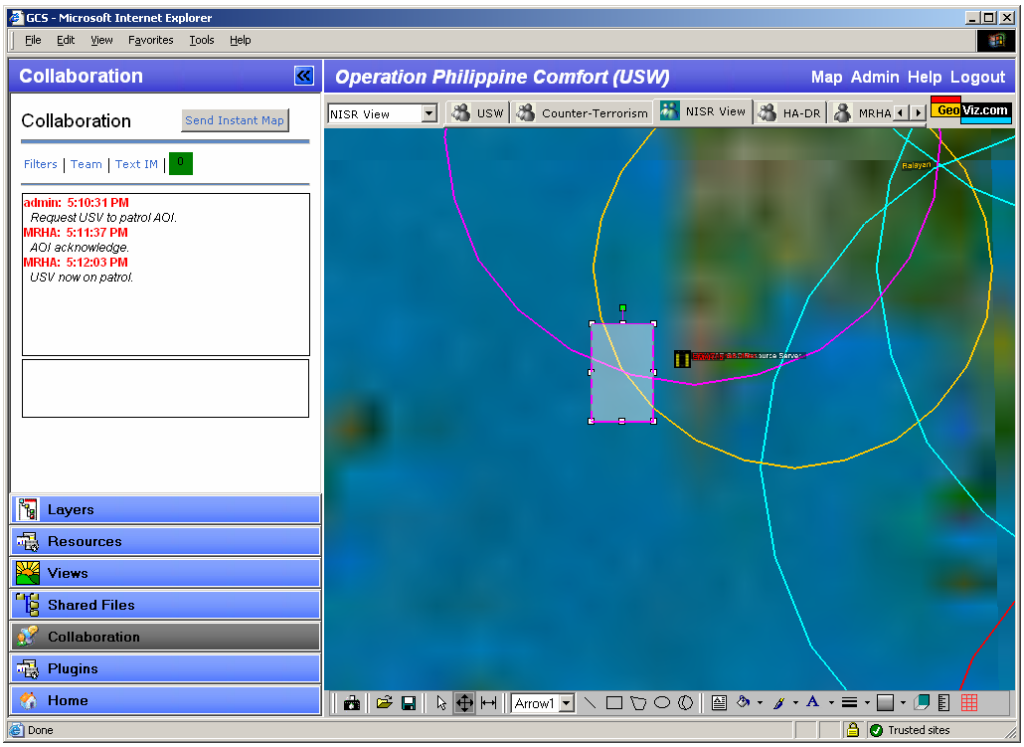
NISR Operation – Direct Control



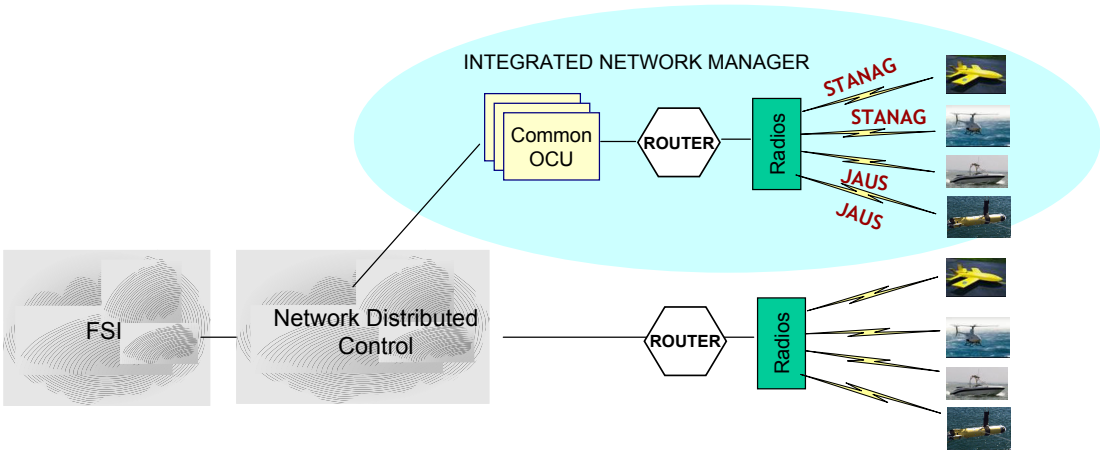
NISR Scenario - Collaboration



Collaboration Scenario



NISR Spiral Development



FSI: FORCENet Services Infrastructure
JAUS: Joint Architecture for Unmanned Systems
OCU: Operator Control Unit
STANAG 4586: Standard for NATO UAV interoperability

Partners

- NAVSEA
  - Carderock
  - Newport
  - Panama City
  - Philadelphia
- Naval Post Graduate School
- MCTSSA – Pendleton
- CERDEC* - Ft. Monmouth

* Communications-Electronics Research, Development and Engineering Center

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http://www.spawar.navy.mil/robots/