



Aptima[®]
Human - Centered Engineering

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Test Environment for FORCEnet Concepts*

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A UNIQUE FOCUS ON HUMAN-CENTERED ENGINEERING

Test Environment Challenges

- Integration of three separate technologies
 - Simulation, Decision Support System, Knowledge Desk
- Unite research on novel FORCEnet architectures (**A2C2**) with research designed to develop innovative information displays (**Decision Support System & Knowledge Desk**) to support network-centric operations



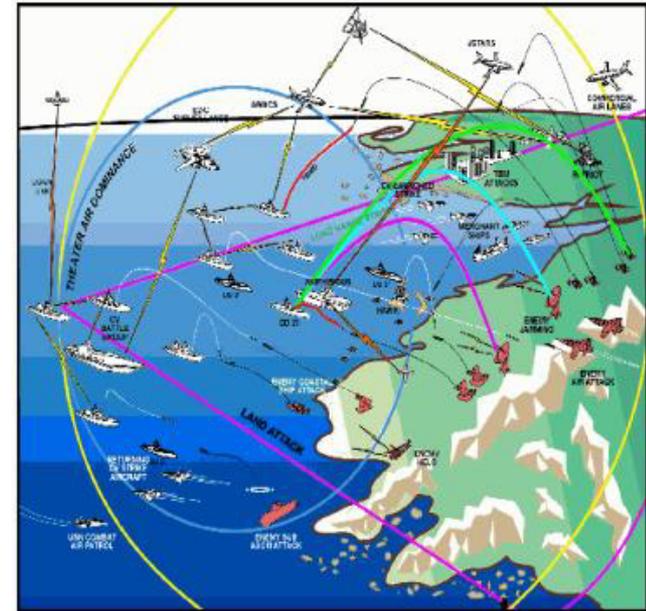
- Design C2 organizations that support emerging FORCEnet concepts
 - Take advantage of network connectivity to conduct new types of operations
- Provide a testbed to investigate novel organizations & associated displays and tools



The A2C2 Project

The Charge:

→ Designing command and control organizations that are congruent to their missions



→ *Deriving human requirements for the organization*

→ *Evaluating organizational performance for the mission*

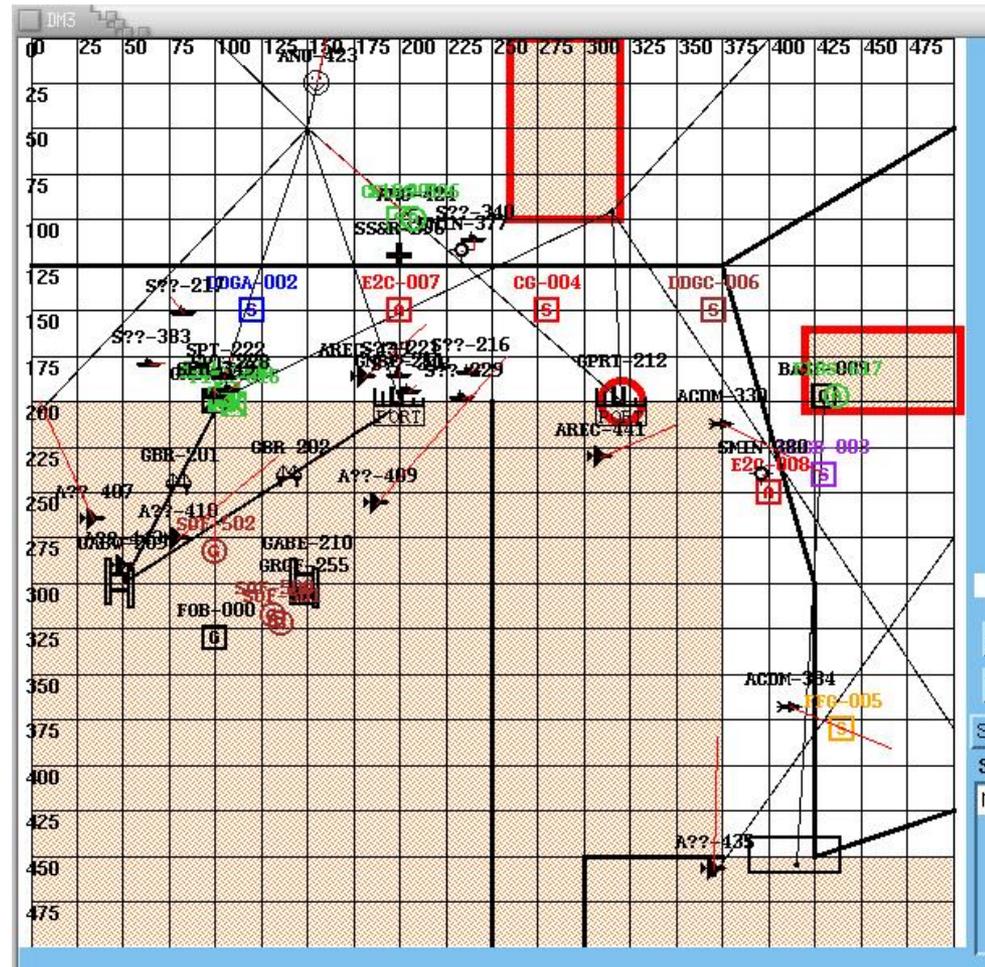
→ *Designing adaptable organizations*

→ *Employing the tenets of Network Centric Warfare*



The Distributed Dynamic Decision-making (DDD) Simulation

- Cornerstone of the A2C2 program is model-based experimentation using the DDD
- DDD application
 - A versatile distributed multi-person simulation
 - An extensive set of capabilities
 - Supports complex synthetic team tasks



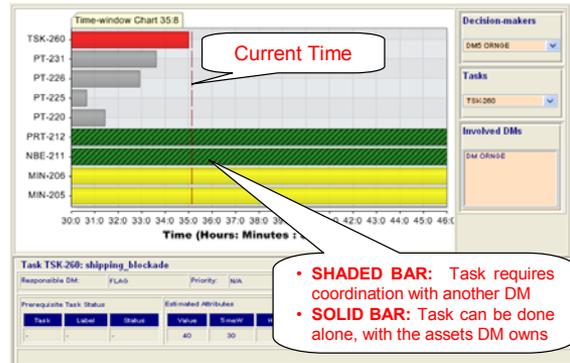
Decision Support System

Prototype to:

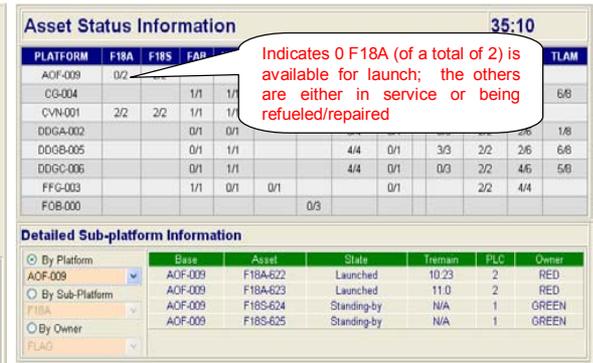
enhance organizational awareness & decision making

By providing real-time information relevant to :

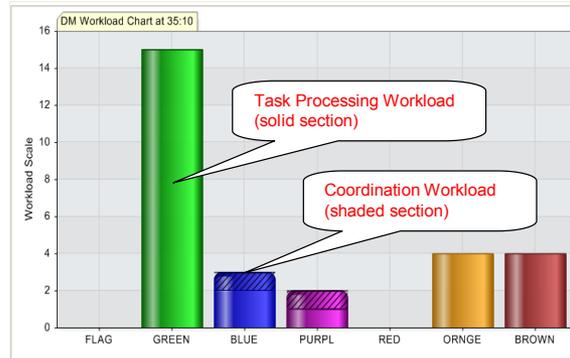
organizational structure, adaptation, & process, as well as environmental attributes of the battle-space & mission



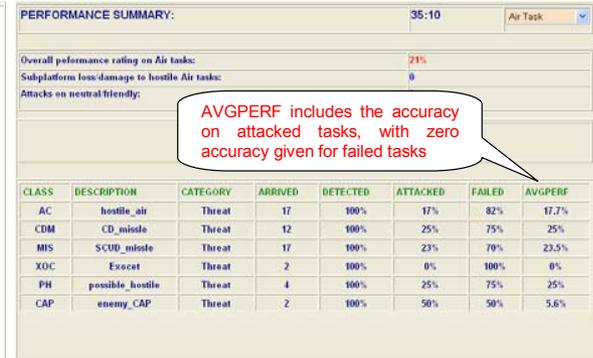
(i) Time-Window



(ii) Asset Status



(iii) Decision-maker Workload



(iv) Performance Summary

Developed by the University of Connecticut & NPS



Knowledge Desk Display System

K-Desk is web based

Developed to integrate mission relevant information, tools, & displays

To Facilitate group interaction & augment decision making

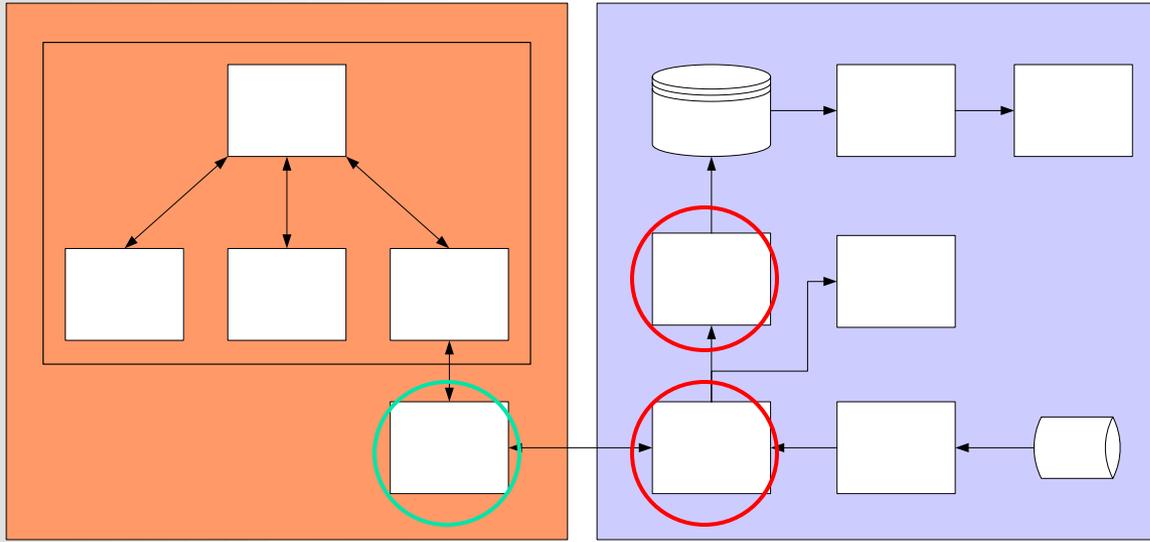


Information displayed in each of the screens can be chosen by the commander from a number of available displays

Facilitates the utilization of the myriad of information available under emerging network-centric operations (Developed jointly by SPAWAR & PSE)



DDD Interface & Support Module Design



Allowed for the Linux based DDD to communicate with windows-based DSS

Employed the DDD external conduit

Two new application were developed:

- A new software infrastructure was developed
 - To create integrated system that incorporated the DDD, DSS, & K-Desk

DDD

Linux

DDD

Global

DDD state module – modeled the DDD dynamic state info based on messages received from the DDD – shared with DSS

DDD DB module – takes dynamic state info & populates the DSS database

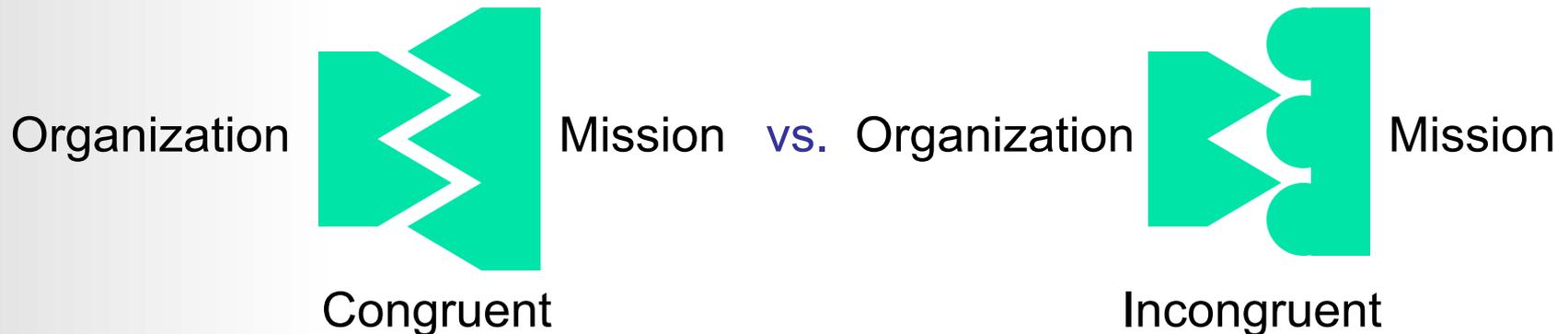


| | |
|--------------------------------------|---|
| <p>Participants</p> | <p>12 Naval Officers – Lt Cmd or higher organized into two teams of 6</p> |
| <p>Simulation environment</p> | <p>Integrated: DDD, DSS, & K-Desk (testbed)</p> |
| <p>K-Desk testbed</p> | <p>Six video displays, two mice, & supporting software</p> |
| <p>Testbed configuration</p> | <p>Middle display DDD Sim, other five displays used to display mission relevant info & graphic info provided by DSS</p> |



Organizational Structure and Mission Scenario

- Scenarios were from Diedrich et al.(2003)
 - Teams performed under a Functional organizational structure
 - Performed a congruent (functional) mission followed by incongruent (divisional) mission
 - Functional organization characterized by the type of assets within each members control
 - Controlled functionally similar assets that were dispersed throughout the mission battle space (e.g., all ISR assets or all Strike assets)
 - Congruent meant team's organizational structure matched mission
 - Incongruent implied a mismatch between organizational structure & mission





- DDD training
- K-Desk DSS training
- Two data collection scenarios: **congruent** followed by **incongruent** mission scenario
 - AAR conducted after first scenario – discussed team performance & lessons learned
 - Intel brief then informed team enemy had changed their tactics
 - Team organizational structure now incongruent to mission scenario
 - AAR conducted at end of second scenario
 - All measures observational based on second AAR
- DDD scenarios conducted at half usual speed to facilitate use of the DSS & K-Desk information





Observations (1)

- **Primary goal attained: demonstration was successful** 🍌
 - **System performed well** 🍌
 - **System was stable** 🍌
 - **User acceptance was high** 🍌
- **Participants felt**
 - **Tools facilitated decision-making by providing info that improved ability to coordinate the planning & distribution of assets**
 - Info regarding resource requirements, asset ownership, task precedence
 - Helped keep straight who owned what & what assets were available
 - **Increased SA**



Observations (2)

- Team members used both DSS and mission-relevant information (K-Desk)
 - Changed the type of info displayed as circumstances necessitated
 - Many left a screen blank to limit distractions
 - Preference for weapons/assets status display & performance summary screen
 - To facilitate task & mission execution as well as SA
 - Reported that system reduced workload by making info more accessible
 - Accessibility helped individuals anticipate increases in workload
 - Liked ability to display info concurrently
 - Some felt number of screens too high – most thought four about right
- Majority hinted at information load
 - Common problem in network-centric warfare
 - Some thought DSS may be overly complex



- Demonstration outcomes indicated that integration process was a success
 - A viable testbed to investigate FORCEnet concepts, processes, & technologies is at hand
 - Participants embraced the available information and technology
 - Felt information & technology facilitated completion of tasks and overall mission
- Improvements
 - Development of computer based agents to extend user's capabilities and control overhead
 - Deeper integration of DDD, DSS, & K-Desk to increase types of information that can be presented
- A testbed to examine organizational designs in modern military organizations such as the Expeditionary Strike Group, based on emerging FORCEnet concepts



The A2C2 Project

■ Objectives

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