BAA 10-018 Industry Day

FNT-FY09-04 Dynamic Command and Control (C2) for Tactical Forces and Maritime Operations Center (MOC)

BAA Technical Overview

21 May 2010
Need Capability To:

- Compose Forces
  - Ships, Subs, Aircraft, Shore Sites, Weapons, Sensors, …
- Satisfy Commander’s Critical Information Requirements
  - Threats, Missions, Resources
- Collaborate / Plan Across all Echelons
  - All information is exposed by all systems; is available where needed, in a usable form
  - Core information management functions are automated
- Operate effectively over RF Networks
  - in Opposed Environments
Dynamic C2 for Tactical Forces and Maritime Operations Center (MOC)

Product Description:

Software for Command Control and Combat Systems that provides dynamic and responsive management and control of net-centric enterprise theater and tactical Anti-Submarine Warfare (ASW).

- Flexible command and control (C2) among tactical units (air, surface, subsurface, and shore including tactical mobile shore C2) & MOC
- Ability to operate in a severely degraded comm environment
- Allow all echelons of command (from individual ship or aircraft mission commander to Joint Force Maritime Component Commander) to conduct dynamic missions in a coordinated and effective manner

Co-evolve technology with tactics techniques & procedures through experimentation

Transition through acquisition partner’s Peer Review Process

Warfighter Payoff:

- Increased access and shared awareness of relevant data, activities, and enterprise status among tactical forces and the Maritime Operations Center.
- Automated support for synchronized planning, coordination, and execution of network enterprise resources to meet evolving mission demands.
- Visualization of critical performance indicators of networked force capabilities, and ability to manage the complex problem spaces.

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UNCLASSIFIED
Common Tactical Picture Synchronization Over Disconnected, Intermittent or Limited Communications Networks (CTPoDIL)

**Objective:**
Develop automated and distributed services that:

(1) Create an accurate and near-zero latency Relevant Common Tactical Picture (RCTP) on each node based on all available information from all nodes and theater and national sensors.

(2) Optimize the transmission of relevant information among nodes, within the constraints of disconnected intermittent, or limited (DIL) communications links, while maintaining critical pedigree and both kinematic and non-kinematic attribute data.

**Deliverables:**
- Relevant Common Tactical Picture Generation (RCTPG)
- Track-to-Object Multiple Hypothesis Data Association and Fusion Module (TOAM)
- Own-Node Fused Picture Generation (ONFPG)
- Information Flow Prioritization and Control (IFPC)
- Common Tactical Picture Synchronization (CTPS)
- Redundant Track Filtering (RTF)
- Object Classification, Alerting, and Information Utility (OCAIU)

Dr. Reynolds Monach, reynolds@va.wagner.com, 757-727-7700
Naval Interoperability Network (NION)

Objective:
Automated collaborative data exchange of timely, relevant, and prioritized enterprise data to enable increased operational tempo between the MOC and Tactical Assets

- **Information Exchange**: Automate collaboration among heterogeneous data providers and provide adaptive content-based routing and prioritization of information in DIL environment
- **Tactical Overwatch**: Provide tactically relevant threat, planning, and resource information from the MOC to tactical platforms
- **Tactical Insight**: Provide operationally relevant information (contacts, negative information, and status) from tactical platform(s) to MOC(s)

Technical Challenges:

**ASW Extensions**:
- Design for easy integration of new domain knowledge
- ASW ontology development to capture domain knowledge
- Identification of significant MOC/Tactical Use Cases

IntellEx (CUBRC): Assess information relevance using Interest Models

Data Dissemination Manager (Adaptive Methods): Assess information priority using Context/Situation

**DIL Extensions**:
- Partial data updates using subset of payload
- Optimization with multiple data payload sizes at runtime
- Optimal transmission of multi-connected peers

POC: Jim Farrell, jfarrell@adaptivemethods.com, (703) 968-4061
Objectives:

• Share data across enterprise and tactical environments in a scalable, adaptable manner
• Support dynamic decision making by providing commanders with highest quality data possible
• Simplify awareness, organization and consumption of tactical data sources

Deliverables:

• Distributed Cache Service.
• Distributed Exposure Service
• Tactical Data Enrichment Service
• Tactical Data Broker Service

POC: Dale McKay, dale.mckay@ngc.com, (858) 514-9394
Federated Collaborative Decision Spaces (FCDS)

Objective:
Enable Commanders and staffs to collaborate and dynamically control forces from the operational through the tactical levels:
• Focus on their own tasks while facilitating automated horizontal and vertical collaboration
• Automatically coordinate tasks and resources across multiple decision activities
• Easily assess the impact of individual courses of action to the larger force.

Deliverables:
A decision support tool that will enable Fleet personnel to define, implement and manage decision processes, including:
• Inter-DPM Collaboration
• Utilization of Open Agent Architecture

• Ability for Decision Processes to Dynamically Find and Communicate with One Another
• Ability to Aggregate Decision Process Instances Employing Heterogeneous Missions and Resources

POC: Brad DiDio, Brad.Didio@solers.com, (617) 448-8881
Unified Pedigree Services
Integrated Data Environment (UPSIDE)

Objective:

Pedigree management capability including:

- Software and enterprise business logic for the generation, propagation, and collection of pedigree information
- Inferencing, analysis, and visualization tools for use of pedigree information
- Use of national and tactical SIGINT (ELINT & COMINT) data for the organic Carrier Strike Group Anti-submarine Warfare Mission

Deliverables:

- Metadata for sources, services, and processes
- S/W for the generation and reporting of metadata
- Designs for pedigree propagation in a DIL network
- Ontology for Information Pedigree for SIGINT

- Tools for validation and consistency checking
- User Facing Tools for Pedigree Analysis: Inferring confidence, reach-back and drill-down,
- Analyst software tools for reconstituting the information process with new assumptions

POC: Dr. Michael Hultner, michael.hultner@lmco.com, (858) 795-1379
Thrust Areas:

- Automated data access and shared awareness
- Automated synchronized planning and execution (Tactical to MOC)
- Visualization of critical performance indicators
- Combat System to C2 Network Integration
BAA 10-018 Key Objectives

• Maximize Information Transparency
  – Between combat systems networks and C4I networks aboard U.S. navy combatant ships, and
  – Between U.S. navy combatant ships, and between ships and shore sites, while

• Minimizing the Level of Design Complexity
  – imposed on individual applications developers for both combat systems and C4I applications
Technology Challenges

• Domain Bridge Services
  – Enable information exchange between the shipboard Combat Systems (CS) network and shipboard Command and Control (C2) systems network

• Domain Edge Services
  – Optimize information exchange between ships, aircraft, and shore sites over naval radio frequency (RF) communications networks

• Common Information Functions
  – Data Quality Attributes (context and usability)
  – Service Level Agreements / Quality of Service (QoS)
  – Information Assurance (IA)
  – User Facing Services (UFS)
Domain Bridge Services

• Avoid C2 loading on CS network
  – Provide gateway service
  – Consolidate C2 queries
• Provide Protocol conversion
  – DDS (Data Distribution Service) on CS Net
  – Advanced Message Queuing Protocol (AMQP) on C2 Net
• Provide Quality of Service
  – Provide support for limited CS pedigree needs
  – Mediate between DDS QoS parameters and future C2 QoS parameters (including edge services)
• Provide Information Assurance
  – Limit access to CS from C2

Enable information exchange between the shipboard Combat Systems (CS) network and shipboard Command and Control (C2) systems network
Communications Reality

• **DIL** – Disconnected, Intermittent, Limited
  – A useful characterization of navy communications

• Factors impacting communications
  – Readiness Status
  – Weather
  – Operations (location, course, EMCON)
  – Impacts of opposing forces (jamming, damage, etc.)
  – Competing Demand (operational, tactical)
Domain Edge Services

- Support distributed decision makers with the means to collaborate using shared information space.
- Allow individual nodes (of a distributed enterprise) to function while temporarily disconnected from internal and external domain services.
- Automatically and adaptively monitor and manage the functioning of the domain edge services to diagnose problems and make repairs as needed.
- Provide information to the applications to enable the applications to be network aware and respond accordingly.

Optimize information exchange between ships, aircraft, and shore sites over naval radio frequency (RF) communications networks.
Domain Edge Services

• Today
  – Systems “discover” remote systems by loading IP addresses
  – No specific guidance on how to handle Naval WAN characteristics
  – Systems compete for resources based on static governance (ADNS Differential Service Code Points)

• Future (desired)
  – Dynamic Identity / role – based “discovery”
  – Abstraction Layer provides smart WAN interface
    • Network aware, smart queues, persistent connections
    • Dynamic policy-based competition for resources
  – Developers are provided with standards, patterns and practices to enable design for effective use of limited communications resources
Common Information Functions: Data Quality Attributes

- Need to identify standards and best practices for implementation by PEO IWS and PEO C4I
  - Address employment of data quality attributes in qualifying sensor/processor information products
  - Representation of uncertainty associated with such information products in a way that aids user understanding.
  - Develop the appropriate form and function for efficient enterprise sharing of data models and data representation
  - Standards and guidance for developers to achieve standardized data quality usage in machines
  - Effective methods for visual representation to aid understanding by humans.
Common Information Functions: SLA / QoS

• Develop standards, patterns, practices and software tools for managing SLA/QoS handling
  – between shipboard CS and C2 networks, and
  – between shipboard C2 networks and off-board networks (ship, shore, aircraft)

• Deliver standardized models and utilities for
  – capturing SLA/QoS properties and for
  – negotiating and maintaining services between dissimilar networks and across RF WAN environments
Information Assurance

• At the Combat Systems Domain Boundary
  – Control loading to the CS network
  – Access (authorization)
  – Pedigree (Provenance)
  – Accuracy (traceable error calculation)

• At the C4I Network Domain Boundary
  – Secure “discovery” (authentication)
  – Access, Pedigree, Accuracy
User Facing Services

• **Provide visualization of critical network performance indicators**
  – Spanning CS, C2 and ADNS networks
  – Tailored, role relevant presentation
  – Support monitoring, tuning and mission alignment of the network capabilities
  – Conditions-of-Interest alerting and monitoring
  – Statistical measures and graphic display
  – Support remote WAN/LAN access

• **Provide access to the following information, minimally:**
  – Utilization of the data stores,
  – Timing of data exchange operations,
  – Density of operations (parallel and overlaying operations),
  – Size of data exchanges,
  – timing of repeat data store access, and
  – time to complete operations.

Identify standards and best practices that can be used by both PEOs, specifically to provide awareness of the near-real-time performance of the navy’s distributed warfighting network.
BAA Intent

• Augment significant ongoing efforts to build an information management infrastructure across Navy PEOs, that will enable operational Forces to
  – Compose Forces
  – Satisfy Commander’s Critical Information Requirements
  – Collaborate / Plan Across all Echelons
  – Operate effectively over RF Networks

• Develop software tools, standards, patterns and practices that will
  – Enable effective CS – C4I network information sharing
  – Enable effective WAN information sharing
  – Enable developers to effectively deploy capability to navy networks, without becoming experts in those networks
  – Provide for reliability, maintainability and extensibility over time
Contract Execution Approach

- Work in a Team environment
  - With Government and other contract Performers

- Actively participate in Experimentation
  - At the contractor site, at Government sites, and potentially at sea

- Actively develop a transition-able product
  - Develop a Concept of Employment (CONEMP)
  - Support development of Technology Transition Agreements (TTA) with potential sponsors
    - Including exit criteria
  - Minimize the use of proprietary middleware products
Current Experimentation Continuum

**Focus:**
- Joint / Maritime Operational - to - Tactical C2 Challenges
- Rapid, Smooth & Dynamic, Agile Joint / Maritime Force Integration

**SOA Technology Development**
- ASW C2LOE
- JSOA LTE
- Security
- Joint DS LTE
- Navy DS LTE

**MOC Automation**
- MOC focused LTE/LOE Sp1
- MOC focused LTE/LOE Sp2
- MOC focused LTE/LOE Sp 3
- MOC focused LTE/LOE Mainex

**Tactical-to-MOC Automation**
- CSC2 LTE Sp1
- CSC2 LTE Sp2
Summary

• The promise of “FORCEnet” in terms of Dynamic C2 is still yet to be achieved. Key Challenges are:
  – Ability to dynamically compose forces
  – Information sharing over naval RF networks in a challenged environment
  – Architectures, patterns and practices that result in an open information environment across all platforms, networks, systems

• FNT-FY09-04 is one of several technology development projects that are addressing related issues
  – Consider proposed solutions in the larger context
  – Plan to participate in Navy & Joint experimentation

• Information architecture and automation is key
  – Enable developers to rapidly deliver solutions
  – Enable warfighters to dynamically construct solutions (Apps)
  – In an environment where available WAN bandwidth is very, very limited.

• Pay attention to the “Research Opportunities Description” (Section I.6.) articulated in the BAA