Advanced Battlespace Information System (ABIS)

Task Force Report
Volume III

Battle Management Working Group Results

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Preface

This is Volume III of the final report of the Advanced Battlespace Information Systems (ABIS) Task Force. The entire final report is organized into six separately bound volumes:

I. Executive Summary

II. Major Results

III. Battle Management Working Group Report

IV. Sensor-to-Shooter Working Group Report

V. Grid Capabilities Working Group Report

VI. Supporting Annexes

This volume is the full report of the Battle Management Working Group. It contains an executive summary of the major findings and conclusions and a detailed discussion of the specific areas that were considered by the working group.
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1. Executive Summary
Definition and Scope

*Battle Management* includes operations planning, force management and coordination, and direction of C3ISR during mission execution. It spans current operations through future operations to future plans, with the corresponding situation/crisis assessment and operational evaluation at each level. Battle management deals with multiple decision loops including a fast, sensor-to-shooter decision loop that is dealt with separately by the Sensor-to-Shooter Working Group. It also deals with complex issues like the uncertainty of large amounts of information and aggregation of many variables into the assessment of progress in achieving a given objective.

Scope:
- **Reviewing, Refining, and Expanding the System-of-Systems Concept**
- **Developing and Refining Revolutionary Capabilities Objectives**
- **Constructing a Roadmap of Relevant Technologies and Demonstrations**
- **Supporting the Secretariat in Developing the Overall Integrated System-of-Systems Construct**
Executive Summary...

Definition and Scope

Battle management encompasses operations planning, force management and coordination, and direction of ISR and C3. In the evolving joint force staff structure, it spans current operations through future operations to future plans, with the corresponding situation/crisis assessment and operational evaluation at each level. Battle management deals with multiple decision loops including a fast, sensor-to-shooter decision loop that is dealt with separately by the sensor-to-shooter working group. It also deals with complex issues like the uncertainty of large amounts of information and aggregation of many variables into the assessment of progress in achieving the desired end state of a battle or campaign.

The Battle Management Working Group addressed operational and C2I concepts in the context of Major Regional Contingencies (MRC), Lesser Regional Contingencies (LRC), or during the transitional (e.g., Early Entry) phases of the MRC when the United States can dominate a much larger force by rapid action, overbearing lethality, high-quality information, and high survivability. This dominance is derived from rapid mobility and dispersion in an “empty battlespace” to minimize large force-on-force throughout the conflict spectrum.
Executive Summary...

The United States Is Fundamentally Changing the Prosecution of War Through IT Dominance

- Exploiting IT Enables New Operational Concepts
  - Flattened Command Structure: Widespread Dissemination of Information and Understanding
  - Quicker Decision and Execution; Operate Within and Disrupt Adversary's Decision Cycle
  - New Operational Capabilities
    + Consistent Battlespace Understanding
    + Predictive Planning and Preemption
    + Incremental Force Projection
    + Precision Information Direction
    + Integrated Force Management
    + Adaptive Coordinated Defense

- A Quantum Improvement in Operational Performance* Without Quantum Cost Growth
  - Precision Throughout the Operational Spectrum Is Essential (Sensors, Intelligence, Plans, Execution)—PGMs Are Only a Small Part
  - Focus on the Objective and Leverage Resources
  - Right Asset—Right Place—Right Time

- New Operational Concepts Focus the Joint Science and Technology (S&T) Program
  - DTAPs (Defense Technology Area Plans)
  - DTOs (Defense Technology Objectives)
  - Seven Significant Technology Investment Areas
  - Information Fills the Voids

Early and Continuous Interaction Between Warfighters And Technologists (Battle Labs & Exercises) Must Be Maintained

* VADM Cebrowski's Charge to Working Group in First Off-Site
United States Changing the Prosecution of War

To fundamentally change the prosecution of modern wars, the United States is relying on the emerging information technology that will enable us to dominate the battlespace. This figure illustrates the top-level view of the results of the Battle Management Working Group. This effort presumed the presence of grid capabilities and incorporated the idea that the sensor-to-shooter working group efforts are a specialized case of battle management. Another, equally important underlying premise was that battle management would be scenario independent, that is, the techniques might vary, but the principal operational concepts would remain constant at all levels and for both offensive and defensive operations. Effective battle management is, therefore, essentially similar in both phases of combat, albeit with different operational objectives.

The working group began with the assertion that battle management for Vision 2010 required an unconstrained view and that operational concepts necessarily preceded the technology considerations. This approach enabled the warfighter rather than technology to be the focus. The study began with the system-of-systems vision, from which it developed a set of six major new operational concepts that would, if achieved, revolutionize the conduct of warfighting in the next century. These concepts are listed. The goal is to enable the commanders at each respective level to put the right asset at the right place at the right time, thereby enabling them to dominate the battle on their own terms.

Enabling technology was derived by looking first at the concept and its limits, and then determining what operational functional capabilities would overcome the limits. From these analyses, we assessed the technologies that would overcome the limitations.
Executive Summary...

Battle Management Operational Concept
Force Projection and the “Empty Battlespace”

- Force Projection Versus Force Deployment—Reachback, Splitbase, Optimal-Forward Footprint
- Teams and Force Packages Form and Reconstitute As Needed
- Precision Fire Support
- Responsive, Task-Synchronized Support by Rear-Echelon Information Providers
- Intuitive Command—Coordination Because of Common Understanding of Situation, Intent, and Strategy Rather Than Hierarchical Control
- Coherent Control—Dynamic Allocation and Scheduling of Selected Shared Assets and Critical Targets During Synchronized Engagements
- Operational Tempo Unconstrained by C2 or Systems
Executive Summary...

Battle Management Operational Concept

Operational concepts considered by the working group included the conflicting advantages/disadvantages of force projection rather than force deployment. To maintain a dominant warfighting posture in such an environment, the smaller U.S. force must be able to tailor and mass activities at the right place and right time, choosing opportunities where sensors, fires, and forces can be brought together for periods of dominant information and integrated action where required. Real-time, shared information and its clear understanding by coordinating forces replace traditional hierarchical controls in most cases and the provision of that information, be it preplanned or reactive. This flattens the command hierarchy, but it permits “intuitive” command style that can be assisted by the automated planning of “opportunities” and countermoves based on dynamic assessment of the adversary and the options to bring forces, time, space, spectrum, and support together within the window of opportunity.
Vision 2010 Battle Management

Mission
Central Strategy

Continuous Assessment

Consistent Battlespace Understanding
Vision 2010 Battle Management

A primary goal of battle management in the integrated system concept is to achieve synergy between individual systems to achieve a significant improvement in performance. General improvement consists of decreasing the decision timeline (or increasing the enemy’s) and increasing the quality of options assessment at any given decision point. Rather than merely looking for ways to accelerate the current process, the Battle Management Working Group developed reengineered processes to take advantage of advanced automated assistance and information access. This figure shows a very top-level example of process reengineering. A more detailed explanation of process changes will be included in the discussion of each important C2I capability. Process changes are, in many cases, enabled by technology (e.g., virtual deployment and collaboration between dispersed forces).

The current battle management process involves sequential planning cycles that are typically 24 to 72 hours. Because of the complexity of the problem space, information acquired or assumed during planning often changes before or during mission execution. ISR and other tasking, such as in intelligence preparation of the battlefield, generally are based on “requests” for information, which in turn are based on assumptions of conditions during the operation being planned. In many cases, the warfighter may not even have visibility into the status of his request. In the reengineered process, a set of core processes ensures visibility, prioritization, and deconfliction of requests on a highly dynamic and interactive basis that crosses between current ops, future ops, and future plans. Planning, sensor management, and operations execution are driven by total visibility into ongoing activities, planned activities, potential activities, and their relation to the commander’s strategy and constraints imposed by other planners. Using “command by prompting,” conflicts are elevated to higher decision makers for arbitration only when a conflict is detected. The important C2I capabilities, shown in the reengineered process, are distributed across the forces in a way that interacts seamlessly across missions, echelons, and services.
Important Operational Capabilities

• **Consistent Battlespace Understanding**
  — Elevate the Level of Cognitive Understanding of the Enemy, Friendly and Geo-Spatial Situation; and Maintain Consistency in That View Across Tactical and Supporting Forces.

• **Predictive Planning and Preemption**
  — “Lean Forward” in the Planning Process To Avoid Direct Confrontation (by Employing Alternative Means); Be Prepared To React and Exploit Opportunities When Direct Confrontation Must Occur, and To Shape the Expected Actions To Stay Within the Enemy’s Decision Cycle and Keep Him Out of Ours.
  — **Incremental Force Projection**
    » Be Prepared To Fight From Any State of In-Theater Joint Force Projection, Using Flexible Combinations of Tailored Early-Entry Force Packages, Tactical Force Reconstitution, Global Reach Accelerated Deployment, Virtual Deployment, and Reachback

• **Precision Information Direction**
  — Enable the On-Scene Commander To Exploit and Shape the Battlespace by Dynamically Directing and Integrating (in Accordance With Operation, Battle and Mission Priorities) Tactical and Supporting ISR Resources for Targeting, Weaponeering, Mission Preview, BDA and Combat Assessment (To Facilitate the Application of Precision Weapons, Precision Forces, and Rapid Response)

• **Integrated Force Management**
  — Dynamically Synchronize Force Operations by Collaborative Execution Monitoring, Repair, and Retasking of Shared Assets Across Echelons, Missions, Components, and Coalition Forces (Control of “Coherent” Joint/Simultaneous Operations To Optimize Dynamic Use of Resources Without Preempting “Initiative”)
  — **Adaptive, Coordinated Defense**
    » Integrate Defensive Systems Across Services Into a Collaborative Capability That Exploits Realtime Retasking To Optimize Resources and Coverage and Takes Advantage of Distributed “Empowerment”
Executive Summary...

Battle Management System Attributes

Flexible, Tailorable Information Environment
- Near Complete Understanding
- NRT Collaboration and Planning
- 4D Visualization

Enables New Force Employment Concepts
- Incremental Force Projection
- Optimal Forward Footprint
- Reachback
- Virtual Staff
Battle Management System Attributes

The system attributes for battle management were defined as a set of distributed warfighting forces, command staffs, and support activities that can exist anywhere. In the best circumstances, minimal combat-essential forces would be deployed in a dispersed manner in the operational area, with the remaining support forces in safe enclaves (airborne, offshore, rear-echelon, or CONUS) at distances that depend on their required-on-scene presence at critical times. Dependency on a long-communications tether creates a critical vulnerability (loss of communications), and alternate means of command must be available (e.g., prepositioning of information, plans, and contingency doctrine during periods of good communications). In cases where we cannot supply the required information, we need mass to achieve adequate combat power, enabled through rapid force projection.

The “architecture” for the battle management system assumes a shared, dynamic, consistent information base supported by grid capabilities. Forces would access a network of distributed, interacting servers to implement battle management coordination. Key among these services is the shared understanding of the battlespace and of own and enemy options supporting the continuous RT planning process. As shown, distributed processes generate, access, and utilize this information for synchronizing joint plans and operations. In general, there are processes for planning ISR direction and theater/force-level mission execution, but they are all connected to the central, dynamic representation of operations strategy distributed via the grid.
Executive Summary...

Technology Demonstration Roadmap—Situation Assessment

**Consistent Battlespace Understanding**
- Knowledge-Based Information Presentation
  - Collaborative MC&G and Environment
  - Fused Red Picture
  - Fused Blue Picture With Force Status, Capabilities, Uncertainty
  - Situation/COA Projection (Blue, Red, Environment, Political)
- Cognitive Mission Support to the Warfighter
  - Tailored Visualization and Knowledge-Based Presentation at Varying Levels of Aggregation
  - Common Representation for Battlespace "Understanding"
  - Collaboration and Dissemination of Understanding to All Warfighters

**Precision Information Direction**
- End-to-End, Task-Synchronized Mission Support Products to the Warfighter
  - Dynamic, Distributed, Joint Target/ODA Strategy
  - Distributed Auto Aids (ATR, Target Assessment, Weaponing, BDA/Combat Assessment)
  - Virtually Deploy Analysts
  - ISR Responsiveness and Awareness at Tactical Level
  - Direct Dissemination
  - Mission Materials Visibility

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**JTF Battlespace Awareness and Visualization Capability**

<table>
<thead>
<tr>
<th>Year</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>By 2000</td>
<td>Consistent, Accurate, Timely, Comprehensive Battlespace Picture With Quality/Uncertainty Representation (Red/Blue, 2D/3D, Selectable Resolution) Collaborative Situation Assessment and MC&amp;G</td>
</tr>
<tr>
<td>By 2005</td>
<td>Intelligent Agents for Information Retrieval Filtering, Deconfliction, Situation Inference, Pattern Recognition, I&amp;W</td>
</tr>
<tr>
<td>By 2010</td>
<td>Automated Analysis and Forecasting of Information (Including Red/Blue Projection)</td>
</tr>
<tr>
<td></td>
<td>Consistent, Accurate, Timely, Mission-Tailored Picture (Current Ops, Future Ops, Future Plans, Log, and the Like)</td>
</tr>
<tr>
<td></td>
<td>Intelligent Agents for Mission/Task-Tailored Portrayal Based on Commander's Intent, Situation Recognition, and Mission Execution Status. Plan Reasoning With Intelligent MC&amp;G</td>
</tr>
<tr>
<td></td>
<td>Intelligent Agents for Consistency Management in Dissemination and Recovery Using Advanced Compression and Sanitization</td>
</tr>
<tr>
<td></td>
<td>Consistent, Accurate, Timely, Comprehensive Battlespace Picture (Links From Mission/Tasks to Information Requirements for Distributed Multimedia ISR Management (C2, Intelligence, Weather))</td>
</tr>
<tr>
<td></td>
<td>ISR Responsiveness to Real-Time Retasking Autoprepositioning and &quot;Just-in-Time&quot; Delivery of Mission Support Materials (e.g., Target Folders) IAW Predictive Planning Intelligent Agents to Slave ISR to Force Tasks</td>
</tr>
<tr>
<td></td>
<td>Auto Analysis and Forecasting of Information (Including BDA, ATR, Target Assessment, Weaponing)</td>
</tr>
</tbody>
</table>
Executive Summary...

Technology Demonstration Roadmap—Situation Assessment

Consistent battlespace understanding, when combined with precision information direction, enables the warfighter to have common understanding to support collaborative planning and operations well within the adversary’s timeline. Moreover, it enables the warfighter to focus on the enemy while concurrently sharpening his view of his own forces (improved Blue knowledge). Technology Assessment includes two key battle management components—consistent battlespace understanding and precision information direction.
Executive Summary...

Technology Demonstration Roadmap—Forecasting, Planning, and Resource Allocation

**Predictive Planning and Preemption**
- Theater Joint Information and Spectrum Dominance
  - Ability to Monitor Information and Frequency Space
  - Predictive Control of IW/C2W Options
  - Real-Time Cross-Cueing Between Offense, Defense, IW

**Incremental Force Projection**
- Distributed Battlespace Opportunity Planning
  - Continuous, Collaboration, Crisis Assessment, Target Selection, and Plan Generation
  - Collaborative Plan Refinement, Deconfliction, and Evaluation
  - Precision Attrition Planning and Evaluation

**Management of Dynamic Force Configurations**
- Virtually Deployed Teams
- Employment of Enroute and "In-Reach" Forces
- Robust Planning for Reconstituted Teams

**Adaptive Force Package Tailoring, Reconstitution, and Force-Flow Management From the Tactical Level**
- High-Resolution Tactical Force Package Tailoring
- Reduction of Force Movement and Supply Backlog During Reconstitution

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**Advanced Joint Predictive Planning Capability**

**By 2000**
- Integrated Joint Force Spectrum Monitoring C2W/IW Effects Prediction

**By 2005**
- Advanced C2W/IW Techniques; Opportunity Planning for C2W/IW Options
- Distribute Agents for Spectrum Deconfliction

**By 2010**
- C2W/IW BDA Incorporated Into Predictive Planning and Preemption Process

<table>
<thead>
<tr>
<th>Strategy-to-Task Planning Across Force Continuous, Distributed Replanning, Plan Repair and Variable Fidelity Plan Simulation Across Spectrum of Battle Considerations Interaction Between Current and Future Ops</th>
</tr>
</thead>
<tbody>
<tr>
<td>Autocritical Node Analysis and &quot;Empty Battlespace&quot; Opportunity Recognition Autoplan/Counterplan Generation Intelligent Agents for Distributed Plan Deconfliction and Target Selection</td>
</tr>
<tr>
<td>Full Integration of Staffed and Automated Anchor Desks to Support Reachback and Split-Base Operations End-to-End Rapid Deployment Planning for Adaptive Joint Force Packages</td>
</tr>
<tr>
<td>Dynamic Dispersion, Mission-Reconstitution, Retraining, Rehearsal, and Redeployment</td>
</tr>
</tbody>
</table>

* Draft FY96-02 DTAPS
Executive Summary...

Forecasting, Planning, and Resource Allocation

Predictive planning and preemption, two other battle management components, combine with incremental force projection to enable more efficient forecasting, planning, and resource allocation.
Technology Demonstration Roadmap–Force Management

**Integrated Force Management**
- Retasking, Rehearsal for Coordinated Ops Enroute and On-the-Move
  - Near-Real-Time Dissemination of Coordinated Task Changes
  - Coordinated, Multi-Mission, Multiechelon Preview and Rehearsal of Synchronized Operations Engagements
- Distributed Empowerment
  - Dynamic Tasking Linked to Central Strategy
  - Simultaneous Coordinated Operations
  - Simultaneous Engagement
  - C2W-Resistant, Rapid-Engagement Quality Picture
  - Cooperative Tactics, Uncertainty, and Complex Posture Depiction

**Adaptive, Coordinated Defense**
- Intelligent, Cooperative, Joint Force
- Automated Battle Doctrine
  - Integrated Offensive/Defensive Doctrine
  - Integrated With Synchronized Force Offense Management and Predictive Preemption
  - Cooperative, Intelligent ROEs
  - Integrated Hard/Soft Kill and Avoidance Options (Dispersion, Signature)
  - OTH, Cooperative Engagement

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**JTF Battlespace Awareness and Visualization Capability**

**By 2000**
- Multimission, Multiechelon Dynamic Mission Preview and Rehearsal Integration With Joint Simulation Centers

**By 2005**
- Dissemination of Retasking On-the-Fly, And Mission Rehearsal On-the-Move Automated Opposing Force Simulation

**By 2010**
- Continuous Combat Assessment Continuous Reassessment/Preview Of “What-If” Options for Predictive Replanning

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* Draft FY96-02 DTAPS
Executive Summary...

Force Management

Executive Summary...

Major Challenges

- Continued Warfighter–Technologist Interaction Over Time and Within the Development, Procurement Processes
- Integration of IW, ISR, and How to Better Integrate Information Providers With Operators
- Including Weapons and Sensors in Subsequent Efforts
- Focusing on Concepts at Varying Levels of Command, e.g., the Company Commander Problem Is Different From the Corps Commander or Battle Group Commander's Problem
- Continued Insertion Into Defense Technology Planning Processes and Acquisition Programs
Executive Summary...

Major Challenges

As indicated in the title, the Battle Management Working Group effort has yielded a definition of remaining challenges. These are cited in the following text and figures.
2. Results
The Battlespace
The Battlespace

We can view the operational and functional relationships of the six important C2I capabilities through the consistent battlespace understanding “window.” Each of the capabilities provides distributed functionality that adds layers of information to the common view. The battlespace starts with information on the physical environment, including terrain, climatology, and meteorological/oceanographic (METOC) conditions. A goal in understanding the basic environment is to have intelligent representations on which planning and decision-aiding systems can reason. For wide area operations management, the current products are generally adequate (e.g., 100-meter resolution terrain data and 1,000-meter environmental data), but for precision planning, resolutions of 3 to 10 meters are required. This necessitates the ability to rapidly generate this information on demand (both tactically and nationally), to store the huge files that are produced, and to transmit the appropriate portions of it around the grid.
The Battlespace Plus One

Heterogeneous Databases
Cognitive Understanding/Displays
Data Fusion
Reachback

Infrastructure
DMA/DIA/CIA/NSA
DMA/NOAA/AFGWS/NSA

National
The Battlespace Plus One

Moving up one layer in the understanding of the battlespace, the warfighter needs to know about cultural and other feature data, which is provided in part by rear echelon-mapping agencies. Using collaborative capabilities, the goal is to be able to intelligently generate and access the appropriate feature data at the appropriate resolution, to manipulate it in the field, and to modify it or fuse it with commercial and organic tactical sources.
The Battlespace Plus Two

Initial Battlespace Understanding

Incremental Force Deployment

Heterogeneous Databases
Cognitive Understanding/Displays
Data Fusion
Reachback

Friendly Forces
NCA/JTIDS/GCCS

Theater

Infrastructure
DMA/DIA/CIA/NSA
DMA/NOAA/AFGWS/NSA

National

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The Battlespace Plus Two

Positioned at two layers up, the battlespace is populated with friendly forces. This not only brings in the currently available “location of forces” information, but adds the requirement to understand what the capabilities, plans, and activities of those forces are. Products of two other important C2I capabilities are added at this point. Incremental force projection brings in the understanding of forces on the way, forces within tactical reach of the operation, and the ability to maintain supply lines and reconstitute those forces for other missions and tasks. Adaptive coordinated defense introduces the capability to understand (and thereby manage) the aggregate, combined defenses of the force to respond to potential threats.
The Battlespace Plus Three

Adaptive Coordinated Defense
Precision Information Direction

Initial Battlespace Understanding
Incremental Force Deployment

Sensor Tasking
Fusion
Nodal Analysis
ATR
Heterogeneous
Databases
Cognitive
Understanding/Displays
Data Fusion
Reachback

Enemy Forces
NCA/JTIDS/GCCS
NCA/JTIDS/GCCS

Infrastructure
DMA/DIA/CIA/NSA
DMA/NOAA/AFGWS/NSA

Theater
National

Results...
The Battlespace Plus Three

Moving three layers up, battlespace understanding brings in the enemy force picture. It is largely the product of our important C2I capability of precision information direction. Precision information direction is not only the ability to conduct dynamic sensor management between organic and nonorganic sensors, but also the capability to shape the battle into areas where better coverage is possible and to place the control of priorities for dynamic sensor management in the hands of the tactical commander to meet his real-time needs. The term “precision information direction” implies that the tactical commander wants information that is relevant to his tactical operations, without worrying about the peculiarities and internal processes of low-level sensor management. The goal is to direct and schedule, using distributed means, a variety of assets to maintain a near-perfect picture of critical activities (e.g., moving targets) in a relatively small portion of the empty battlespace, during a period of time when friendly or enemy forces will be operating in that area.
The Battlespace Plus Four

Predictive Planning
Consistent Battlespace Understanding

Adaptive Coordinated Defense
Precision Information Direction
Incremental Force Deployment

Automated Planning and Modeling
Sensor Tasking
Fusion
Nodal Analysis
ATR
Heterogeneous Databases
Cognitive Understanding/Display
Data Fusion
Reachback

Enemy Intent

CIA/DIA/NSA
DMA/DIA/CIA/NSA
DMA/NOAA/AFGWS/NSA

Enemy Forces
NCA/JTIDS/GCCS
NCA/JTIDS/GCCS

Theater
White

National

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The Battlespace Plus Four

Progressing four layers up, the intelligence (versus surveillance) process brings its value added to bear by projecting possible enemy intentions and options. This process is embedded in the important C2I capability of predictive planning and preemption, which would employ a variety of reasoning and simulation techniques to continuously estimate likely enemy courses of action and assess the critical events and nodes that are either indicators or choke points in those courses of action. From this predictive planning, the system can help the warfighter position his response options for quick execution when a course of action is verified.
The Battlespace Plus Five

Predictive Planning and Preemption
Integrated Force Management

Consistent Battlespace Understanding
Adaptive Coordinated Defense
Precision Information Direction
Incremental Force Deployment

Automated Planning and Modeling
Sensor Tasking
Fusion
Nodal Analysis
ATR
Heterogeneous Databases
Cognitive Understanding/Displays
Data Fusion
Reachback

Plan And Counter Plan
NCA/JTIDS/GCCS

White

Enemy Intent
CIA/DIA/NSA
DMA/DIA/CIA/NSA
DMA/NOAA/AFGWS/NSA

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Results...

The Battlespace Plus Five

The fifth layer up focuses on the anticipatory response by own forces. In the important C2I capability of predictive planning and preemption, options are sought that can avoid major combat confrontation with enemy forces. This involves a sequential set of actions to deceive, discourage, and reduce the number of enemy actions and options as they escalate toward a confrontation. In the important C2I capability of integrated force management, actual combat activities are coordinated in a way that preserves awareness of each task’s relationship to the overall commander’s strategy and that permits either intuitive, coordinated operations or tightly coupled synchronized engagements depending on the situation and command prerogative. Integrated force management is tied closely with adaptive coordinated defense so that offensive assets can be diverted to critical defensive tasks if the need arises.
Battle Management Operational Concept

Force Projection and the "Empty Battlespace"

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Operational concepts considered by the working group included the conflicting advantages/disadvantages of force projection rather than force deployment. To maintain a dominant warfighting posture in such an environment, the smaller U.S. Force must be able to tailor and mass activities at the right place and right time, choosing opportunities where sensors, fires, and forces can be brought together for periods of dominant information and integrated action where required. Real-time, shared information and its clear understanding by coordinating forces replace traditional hierarchical controls, in most cases, and the provision of that information, be it preplanned or reactive. This flattens the command hierarchy, but it permits intuitive command style that can be assisted by the automated planning of opportunities and countermoves based on dynamic assessment of the adversary and the options to bring forces, time, space, spectrum, and support together within the window of opportunity.
Past/Current

Crisis Assessment

ISR Management

Situation Assessment

Operations Planning

Force Management

Execution

Combat Assessment

Limitations:
- Sequential, 48- to 72-Hour Cycle
- Little Flexibility
- Missed Opportunities

Payoffs:
- Continuous Replanning and Reconstitution Across Missions, Echelons
- Look-Ahead, Counterplanning
- Synchronized Tasks and ISR to Achieve Desired End State

Mission

Central Strategy

Predictive Planning and Preemption

Incremental Force Projection

Integrated Force Management

Future Plans

Future Ops

Current Ops

Adaptive Coordinated Defense

Precision Information Direction

Continuous Assessment

Consistent Battlespace Understanding

REAL and VIRTUAL Deployment
Vision 2010 Reengineered Battle Management Process

A primary goal of battle management in the integrated system concept is to achieve synergy between individual systems to yield a significant improvement in performance. General improvement consists of decreasing the decision timeline (or increasing the enemy’s) and increasing the quality of options assessment at any given decision point. Rather than merely looking for ways to accelerate the current process, the Battle Management Working Group developed reengineered processes to maximize advanced automated assistance and information access. This shows a very top-level example of process reengineering. A more detailed explanation of process changes is included in the discussion of each important C2I capability. Process changes are, in many cases, enabled by technology (e.g., virtual deployment and collaboration between dispersed forces).

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Battle Management Group Methodology

Operational Vision

Operational Concept (Forces)

C2I Operational Concepts

Identify Current Process

Reengineered Process

Technology Demonstration Roadmap

Potential Metrics

Summary

CROSS-WALK
Current Limitation

Causes

Critical C2I Functional Capabilities

Technology Challenges
Battle Management Group Methodology

The Battle Management Working Group’s methodology undertaken for this study was essentially similar to that of the other working groups. We used the system-of-systems concept as a departure point and developed an operational vision of battle management in the year 2010, as regarding existing doctrine or technology. We refined that in terms of the operational force employment concepts and the necessary C2I operational concepts that would be required to enable the force concept(s). We examined current processes as a baseline and reengineered those processes to develop a picture of how the concepts would work. We performed a cross-walk from the concept in terms of limitations, causes, the critical functions, and then focused on the technology challenges to be overcome. This supported developing the technology roadmap and defining some possible metrics for assessing if a demonstration showed net gain in capability.
Consistent Battlespace Understanding

Goal:
Elevate the Level of Cognitive Understanding of the Enemy, Friendly, and Geospatial Situation, and Maintain Consistency in That View Across Tactical and Supporting Forces
Operational Concepts (Forces)

- Empower Decision Makers by Giving Them Access to Near-Perfect Battlespace Information in Lieu of Traditional Hierarchical Dissemination
  - Perfect Blue Force ID and Situation Awareness
  - Autotracking of Equipment and Personnel Assets
  - Dynamic Plan and Execution Status Awareness

- Shape the Battle Into Areas Where Consistent Understanding Exists and Provide Advantage
  - Communications and ISR Coverage
  - Focus ISR to Eliminate Ambiguity

- Over-the-Horizon Engagement

- Splitbase Operations (Reachback) for Intelligence, Personnel, Meteorology and Oceanography, MC&G, Logistics, Financial, Maintenance Information

- Collaborative Situation Assessment
C2I Operational Concepts

- Digitizing of the Battlefield
  - Situation, Plans, Execution Status
  - Precise Navigation, Combat ID

- End-User Crafting/Tailored Visualization
  - Knowledge-Based Information Presentation
  - Geospatial Information Dominance (MC&G)

- Integrated Sensor Tasking (Organic Through National)

- Sensor Cross-Cueing for Improved Battlespace Understanding
  - Track-From-Base on High-Value Threats
  - Dynamic, Continuous IPB On-the-Move

- Data, Information, and Knowledge Assurance

- Electronic Preparation and Distribution
  - Broadcast Dissemination Versus Hierarchical Retransmission
  - Automated Information Sanitization and Release
  - Direct Publishing Access

- Visualization of Battlespace Coordination Zones
  - Joint Engagement Zone Coordination of Fires/Electronic Attack
  - Joint Airspace Deconfliction With Fires

- Multilevel Security and Sanitization—Varying Degrees of Security With Coalition Force

- Shared Warplan Object and Goals Hierarchy
Reengineered Process—Intelligence, MC&G, METOC, Blue

Monitor Events/Update Anchor Desk Product
(Intel, METOC, Logistics, Transport, Forces, etc.)

NCA, SVCS
CINC
JIC
CJTF
JFACC/
JTF
Components
Wings/
Units
Support CINCs and Agencies
Allies

Shared Mission Support Information
Dynamic Event & Decision Support Template
Campaign
Battle
Mission

Coalition Decision Support Templates
<table>
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<tr>
<th>Current Limitations</th>
<th>Causes</th>
<th>Detailed Critical Functional Capabilities</th>
<th>Technology Challenges</th>
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<tr>
<td><strong>Common Operational Picture</strong></td>
<td>Combat ID and Blue Plans Not Well Integrated With Real-Time Picture</td>
<td>Integration of Blue Plans and Status Into Blue Picture</td>
<td>Fusion of Planning Information With Actual Reports</td>
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<tr>
<td>• Blue Knowledge</td>
<td>Plan Disseminated, Changed Only by Text Message; Execution Status Coordination Only in a Few Areas</td>
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<td>Improved Blue Force Pattern and ID Recognition</td>
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<tr>
<td>• Blue Plans</td>
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<td>Situation Projection For Own and Enemy COA Estimation</td>
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<td>• Blue Execution Status</td>
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<tr>
<td>Situation Projection</td>
<td>No Good Situation Projection Capability</td>
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<td>Real-Time Simulation and Projection Algorithms Automated Enemy Force Models</td>
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<td>Situation Projection in Presence of Uncertain Information</td>
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<td>Near Real-Time Complex COA Analysis</td>
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<td>Current Limitations</td>
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<tr>
<td><strong>Common Operational Picture (Continued)</strong></td>
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<tr>
<td>• Physical Transport of MC&amp;G Products</td>
<td>Huge Data Volume</td>
<td>Intelligent MC&amp;G (Geospatial Information Dominance)</td>
<td>Tailored Search, Retrieval, and Pull of MC&amp;G Products</td>
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<tr>
<td>• Uncoordinated Situation Assessment</td>
<td>Slow Updates Turnaround</td>
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<td>Intelligent Products To Support Reasoning and Decision Making Systems</td>
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<tr>
<td>• Inconsistent Information Across Echelons</td>
<td>Stovepipe and Compartmented Systems</td>
<td></td>
<td>Collaborative, On-line Mapping From the Field</td>
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<tr>
<td><strong>Intelligence Preparation of the Battlespace</strong></td>
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<td>Dissimilar Source Information Normalization</td>
</tr>
<tr>
<td><strong>Battlespace Degrades When Battle Begins</strong></td>
<td>IPB Process Is Manual and Dependent on Static Environment</td>
<td>Multisource Fusion/ Sensor Cross-Cueing and Improved Tracking for Red Force Picture</td>
<td>Cooperative, Multisource Fusion Algorithms and Cue/ Pattern Recognition</td>
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<td>Sensor Tasking</td>
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<td>Track Movers From Base</td>
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<td>Task Requests Subject to Scheduler’s Competing Priorities</td>
<td>Collaborative Situation and BDA Assessment Among Intelligent Centers</td>
<td>Common Representation Across Dissimilar Sources and Analysis Processes</td>
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<td>High-Performance Situation Knowledge Bases</td>
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<td>Increased Automation of Situation and BDA Analysis</td>
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<td>Current Limitations</td>
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<tr>
<td>Inadequate Information Support to Commander's Decision Needs</td>
<td>Too Much Information, No Quality Thresholds, Not Scaleable</td>
<td>Visibility of Mission, Centers of Gravity, Commander's Intent, and Information Requirements to Dynamically Drive Coordinated Operations at All Levels of Detail (Current Operations, Future Operations, Future Plans) Tailored Visualization and Knowledge-Based Presentation of Situation, Plan, and Execution Status at Various Levels of Aggregation</td>
<td>Forcewide &quot;Blackboard&quot; to Coordinate Interdependent Operations and Information Needs</td>
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<tr>
<td>Inadequate Dissemination of Understanding</td>
<td>Hierarchical Retransmission, Saturation</td>
<td>Common Representation for Battlespace &quot;Understanding&quot;</td>
<td>Intelligent Information Aggregation, Quality and Relevance Based</td>
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<td></td>
<td></td>
<td>Collaboration on and Dissemination of Understanding to All Warfighters</td>
<td>Multidimensional Information Visualization</td>
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<td>Tactical Information Display Agents and Inferencing</td>
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<td>High-Performance, High-Resolution Knowledge Bases</td>
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<td>Collaboration, Consistency, Uncertainty Management and Aggregation Via Broadcast Technology</td>
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</tbody>
</table>
Detailed Critical Functional Capabilities Summary

- Visibility of Mission, Centers of Gravity, Commander's Intent and Information Requirements to Dynamically Drive Coordinated Operations at All Levels Over Time (Current Operations, Future Operations, Future Plans)

- Tailored Visualization and Knowledge-Based Presentation of Situation, Plan, and Execution Status at Varying Levels of Aggregation
  - Tailored, Knowledge-Based Presentation
  - Intelligent, Distributed MC&G
  - Improved Multisource Fusion
  - Collaborative Situation Assessment and BDA
  - Blue Plans/Status Understanding
  - Situation Projection

- Common Representation for Battleground Understanding

- Collaboration and Dissemination of Understanding to All Warfighters
Current and Needed Operational Demonstrations

**NEAR**
- Multiple Database Integration and Update
  Consistency and Real-Time Update of Multiple Geospatial Data Types (ATD)
- Collaborative Decision Support
  Standard Intel Client/Server Workstation Environment and Tools (ATD)
- Common Ground Station
  Fused Intel 15–30 Min Fused Targeting 1–2 Min (ATD)
- Robust Architecture
  For Adaptive Tracking
  Evolvable, Distributed, Modular MSI Process Architecture for AWACS (ATD)
- SIGINT Correlation
  Advanced SOF Tactical Process (ATD)
- Enhanced All-Source Fusion
  For EW Planning and Execution
  Advanced Algorithmic/Heuristic Fusion and Sensor Cross-Cueing (ATD)
- Hostile Target ID
  Advanced Multisource, Multispectral Algorithms for Target ID on AWACS (ATD)
- Combat ID
  Near-Term Consistent Blue ID (ACTD)

**MID**
- Remote Weather Station
  Miniature Air/Hand-Delivered Weather Station for SOF Ops (97 ACTD Candidate)
- Battlefield Visualization
  Rapid Generation and Visualization of 3D Terrain (97 ACTD Candidate)
- Humanitarian Tools
  "Police Net" to Collate, Associate, Search Humanitarian Interrogation Reports (97 ACTD Candidate)
- Operator/Intelligent Interface
  Improved Speed/Quality of Fusion, Tracking, Visualization of Intelligent Picture by Tactical Forces (97 ACTD Candidate)
- Real-Time Application of Intelligent
  Parallel Cognitive/Heuristic Processing of OTI Air Data (ATD)
- Hypermedia Integration
  Hypermedia Organization For Unit Intelligent Data (ATD)
- Text Exploitation
  Intelligent Natural Language Understanding (ATD)
- Automated Concept Generation
  Automated Text Message Search Profile Generation (ATD)
- Target ID for Tactical Application
  90 Percent Positive ID of Ground/Air Platforms Based on Communication Transmissions (ATD)
- Battlefield Combat ID
  99 Percent Blue ID at 1.5 Weapon Range (ATD)

**NEEDED**
- Collaborative MC&G and Environment
- Fused Red Picture
- Knowledge-Based Information Presentation
  Continuous Battlespace Projection and Understanding in Presence of Uncertainty
- Fused Blue Picture With Status, Capability, Plans, Uncertainty

**Situation Projection**
Current and Needed Operational Demonstrations

**NEAR**
- Navigation Warfare: Protection/Denial of GPS in ECM Environment (ACTD)
- Battlefield Awareness and Data Dissemination: Intelligent Broadcast Dissemination of Tactical Information to Brigade (ACTD)
- Combined Arms C2: Situation Dissemination and Force Synchronization, Brigade and Below (ATD)
- Reachback for the Warrior: U.S./Coalition Reachback Demonstration of Deployed Aircraft In-transit Visibility (ATD)

**MID**
- Expanded Situation Awareness Insertion: Aircrew Situation Awareness and Response Strategy (ATD)
- Armed Reconnaissance: Integration of Helicopter with Intelligent Net for Survivability (97 ACTD Candidate)
- Cellular Phone Demonstration: Assessment of Cellular for Deployed Forces (97 ACTD Candidate)

**NEEDED**
- Situation/COA Projection
- Tailored Visualization and Knowledge-Based Presentation at Varying Levels of Aggregation and Uncertainty
- Common Representation for Battlespace "Understanding"
- Collaboration on and Dissemination of Understanding to All Warfighters

**Additional Notes**
- Cognitive Mission Support to the Warfighter: Adaptive Situation/Deception Understanding Tailored to Dynamic COA and Task Assessment
Potential Metrics for Demonstration Areas

Continuous Battlespace Understanding in the Presence of Uncertainty

- Knowledge-Based Information Presentation
  - **On-line, Collaborative Access to Full Range of MC&G and Environmental Products Over 10,000’s of Sq Km**
    - 30-M Resolution “Smart Maps” in 10’s of Minutes for Situation/Plan Reasoning; Auto Feature Extraction for Rapid All-Source Production
    - 10M Resolution Maps in Minutes for Tactical and Targeting Situations
    - Collaborative Mapping To Merge Commercial, Imagery, and Reconnaissance in Minutes, With Automatic Downgrade/Release Capability

- **Fused, All-Source Picture Tailored to Required Level of Aggregation and Security Classification**
  - Enemy Forces Identified With Tactical Unit Association and Uncertainty
  - Automated Association of Dissimilar Products (Images, SIGINT, etc.)
  - 98 Percent Awareness of “Movers” Over 5,000 Sq Km Area
  - Releasable Coalition Picture With <1-Min Delay
  - Fusion and Access to Non-DoD Information at Specified “Quality of Service”

- **Fused Blue Picture That Reflects Status, Planned Events, Capabilities, and Uncertainty**

- **Situation Projection for Own and Enemy COA Estimation**
  - Continuous 1- to 5-Min Projection for Designated Targets, 20-Min to 1-Hour Projection for “Movers” and 6- to 24-Hour Projection for Major Forces
  - Uncertainty Projection and Management
Potential Metrics for Demonstration Areas (Continued)

Continuous Battlespace Understanding in the Presence of Hostile Activities and Deception

• Cognitive Mission Support to the Warfighter
  — Tailored Visualization and Knowledge-Based Presentation of Situation, Plan, and Execution Status at Varying Levels of Aggregation
    » Visibility of Mission, Centers of Gravity, Commander's Intent, and Information Requirements to Dynamically Drive Coordinated Operations at Levels of Detail (Crisis Action, Current Operations, Future Operations, Future Plans)
    » Mission Readiness Matched to Mission and Task Requirements
    » Mission Capabilities Projected Versus Weather, Terrain, and Logistics Constraints
  — Collaborative Situation and BDA Assessment Among Intelligent Centers
    » Resolution of Differing Assessments of Situation Within Decision Cycle (Minutes for Time-Critical Tactical Decisions and BDA, 10's of Minutes for Force Coordination Decisions)
    » Deception Recovery; Protection and Tolerance of GPS Degradation
  — Common Representation for Battlespace Understanding
    » Representation of Completeness, Uncertainty, and Deception Indicators
  — Collaboration on and Dissemination of Understanding to All Warfighters
Consistent Battlespace Understanding

Goal

Elevate the Level of Cognitive Understanding of the Enemy, Friendly, and Geospatial Situation; and Maintain Consistency in That View Across Tactical and Supporting Forces.

Critical New Functional Capabilities

- National and Theater Intelligence Processing for Broadcast
  - Sensor Fusion
- Force Status and Execution Following
- Intelligent, Distributed MC&G
- Collaborative Situation Assessment, BDA, ATR
  - Visualizing Centers of Gravity, Commander’s Intent, and Plans
- Common Understanding Representation Including Commander’s Intent With Access and Assimilation by Warfighters
- Situation Projection
- Parallel Dissemination of Intelligence/BDA to C2 and Shooters
- Rapid, Accurate Target Information (Target Location and Recognition, Situation Awareness in Target Area)

Needed Technology

- Real-time Distributed Object Management
- Intelligent Agents
- Cognitive Support and Automated Decision Aids, Including Text and Speech Recognition
- Cognitive Displays, Virtual Reality, and 4D Real-Time Presentation
- Automated Recognition, Routing, and Analysis of Information
- ATR, BDA
- Automatic Data Validation and Tagging
  - Heterogeneous Database/Information Search and Retrieval
- Distributed, Collaborative, Virtual Workspaces
- Multisensor and Information Fusion, Sensor Cross-Cueing
- Rapid Modeling and Simulation for Situation Assessment and COA Analysis, Including C3I
- Intelligent, Object-Oriented Maps
- Image Understanding and Pattern Recognition
- Uncertainty Management and Visualization
Predictive Planning and Preemption

Goal:
Lean Forward in the Planning Process To Avoid Direct Confrontation (by Employing Alternative Means), To Be Prepared To React and Exploit Opportunities When Direct Confrontation Must Occur, and Shape the Expected Actions To Stay Within the Enemy’s Decision Cycle and Keep Him Out of Ours. Includes Incremental Force Projection: Fight From Any State; Flexible Combination of Tailored Early Force Packages, Global Reach, Accelerated Deployment, Virtual Deployment, and Reachback.
Operational Concepts (Forces)

- Emerging "Extended Staff" Organizations
  - Current Operations, Future Operations, Future Plans (*Versus J-Codes*)

- Countermove Planning
  - Anticipate Enemy Moves and Shape the Battle To Deny Those Moves and Dominate the Decision Cycle
    » Exploit the "Empty Battlespace" — Manipulate the Space/Time/Spectrum/Resources Continuum
  - Precision Attrition as an Option
    » Delayed, Selective, Surgical Engagement
    » Attack Sensors, Communications, Command Posts To Disrupt Control of Weapons (*Versus Attacking Weapons*)

- Information As the Focus of Operations
  - Operations Unfold Before a Global Audience
  - Information Warfare as an Integrated Option
  - Spectrum Dominance: *Protect Friendly Information Systems While Denying Enemy Use of His Systems*

- Planning to Support Synchronized Operations in the Extended Battlespace
  - Widely Dispersed Forces (Inter- and Intratheater)
  - Nonlinear Actions

- Support NRT Feedback Replanning/Plan Repair

- Plan Analysis and Assessment/Preview/Rehearsal as Integral Part of Warfighter C4I
C2I Operational Concepts

- Continuous Replanning Cycle (Sliding Window)
  - Distributed, Dynamic Continuity of Campaign, Battle, Mission Planning, and Mission Support Requirements
  - Anticipatory Mission Plan Package Development To Reduce Response Cycle
    » Prepositioned Essential Information, Plans, and Analysis Packages
  - Distributed Continuity of Planning, Preview, and Rehearsal Across Echelons and Missions

- Dynamic Information Resources Management
  - Spectrum/Bandwidth Management
  - Defensive IW To Ensure Own Force Use of Resources
  - Offensive IW To Deny Enemy Use of Resources

- Rapid System Tailoring To Adapt to Threat
  - Modular, Distributed Systems; Over-the-Air System Updates

- Battle Command
  - Integrated Planning Across Warfare Areas (Horizontal)
  - Nonhierarchical Information Flow
  - Intuitive Plan Presentations
  - NRT Planning (Continuous Execution Feedback Loop)

- Distributed Interactive Simulation
  - Wargaming
  - Analysis
  - Rehearsal

- Coherent Situation Representation From Preconflict Through End of the Crisis
Empty Battlespace Opportunity Planning-Current
Empty Battlespace Opportunity Planning—Reengineered*

GATEWAY TO THE SYSTEM-OF-SYSTEMS
Managed Escalation—Ensured Executability

* U.S. Army AI Center
<table>
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<th>Technology Challenges</th>
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<tr>
<td>Automated Planning Systems Are Not Prepared to Continuously Exploit Follow-on Opportunities When They Arise</td>
<td>Inadequate Planning Capacity; No Effective, On-line COA Projection Capability</td>
<td>Shared, Dynamic Plan Representation Linked To Central Strategy (Intuitive Plan Representations)</td>
<td>Continuous, &quot;Sliding&quot; Planning Window Across Campaign, Battle, Mission</td>
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<tr>
<td>Integrated Wargaming Is Not Embedded in C2I and Cannot Be Used for On-line Plan Evaluation</td>
<td>Absence of Good Automated Countermove Planning or What-If Analysis</td>
<td>Precision Attrition Planning and Evaluation</td>
<td>Continuous Projection of COAs at All Levels</td>
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<td>Seamless, Cross-Echelon Plan Management</td>
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<td>Optimization of Time, Space, Forces, Spectrum Options on Empty Battlespace Windows of Opportunity</td>
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<td>Dynamic, Distributed Critical Node Analysis and Simulation of Complex COAs and Response Options</td>
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<td>Slower Than Real-Time Precision Aggregate Level Simulation</td>
<td>Collaborative Plan Refinement, Deconfliction and Evaluation</td>
<td>Deconfliction Across Mission Areas, C2I/Logistics Boundaries, Shared Objectives</td>
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<td>Lack of Distributed, Consistent Data at All Levels</td>
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<td>Integrated, Cooperative Decision Making and Simulation for Plan Refinement, Deconfliction, and Evaluation</td>
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<td>Current Limitations</td>
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<td>Information Warfare Not Integrated With Hard Kill as a Continuum of Tactical Options</td>
<td>No Accepted Soft Kill Effects Assessment</td>
<td>Information Warfare Planning Capability</td>
<td>Just-in-Time Composite Soft Kill Effects Assessment, Mission Package Construction and Delivery, Recursive Based on Adaptive Assessment and Prediction</td>
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<tr>
<td>Failure to Fully Exploit Frequency Spectrum As a Theater Weapon</td>
<td>No Joint Spectrum Coordination in Offensive and Defensive Operations</td>
<td>Spectrum Dominance Planning/Monitoring and Control Capability</td>
<td>Computation/Monitoring of Complex Spectrum Effects, and Dynamic Optimization of Own Force Spectrum Use</td>
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<tr>
<td>Lack of Distributed, Consistent Data at All Levels</td>
<td>Information Search and Retrieval Can “Choke” at Times of Peak Demand</td>
<td>Rapidly Tailorable Plans and Updates</td>
<td>Over-the-Air Updates</td>
</tr>
<tr>
<td>Sensor Tasking and Countermeasures Are “Reactive” to Emergent I&amp;W Rather Than Anticipatory</td>
<td>Sequential Planning Cycle</td>
<td>Collaborative, Combined-Arms Crisis Assessment, Target Selection And Plan Generation (Coherent Situation Representation)</td>
<td>“Just-in-Time” Mission Package Construction and Delivery, Recursive Based on Adaptive Assessment and Prediction, Tailorable Opposing Forces for Enemy COAs</td>
</tr>
</tbody>
</table>
Detailed Critical Functional Capabilities Summary

- Shared, Dynamic Plan Representation Linked to Central Strategy
  - Current Operations, Future Operations, Future Plans
  - Continuous, Sliding Plan Window

- Collaborative Crisis Assessment and Plan Generation
  - Exploit Time/Space/Force/Spectrum Options
  - Seamless Across Echelons, Missions, Services
  - Anticipatory Countermove Planning (Reactive, Exploitive)

- Collaborative Plan Refinement, Deconfliction, Evaluation

- Precision Attrition Planning and Evaluation
  - Attack Ability to Control Weapons Versus Attacking Weapons

- Information Warfare Planning Capability
  - Protect Own, Deny Enemy’s

- Spectrum Dominance Planning/Monitoring and Control Capability

- Rapidly Tailorable Systems and Updates
Current and Needed Operational Demonstrations

**NEAR**
- Advanced Joint Planning
  - CINC Response Planning Tools for Increased Speed, Accuracy (ACTD)
- Portable C4I for the JTF
  - Advanced Distributed Client/Server Campaign Planning Architecture (ATD)
- Distributed Air Operations Center
  - Advanced Distributed Client/Server Campaign Planning Architecture (ATD)
- Real-Time Support to Joint Power Projection
  - Advanced Air Mission Planning, Force and In-Cockpit Preview (ATD)
- Joint Countermine
  - Horizontal Integration of Countermine Systems (ACTD)
- Counterproliferation
  - Predictable WMD Strikes With Controlled Collateral Effects (ACTD)

**MID**
- Transcom Planning Tools
  - Integrated Planning and Scheduling Tools for Transportation (ATD)
- Joint Execution and Targeting Tools/JFACC
  - Integrate JSTARS Picture, LAC and Ground Battle Control for Time-Critical Targets (97 ACTD Candidate)
- Off-Road Smart Mine Clearance
  - Vehicle Protection From Top/Sidemine Attacks (ATD)
- Special Targets Defeat
  - Combat Planning Tools to Assess Options, Timing, and Uncertainty and Collect, Evaluate BDA for Special, High-Value Targets (97 ACTD Candidate)

**NEEDED**
- Continuous Collaborative, Crisis Assessment, Target Selection and Plan Generation
- Collaborative Plan Refinement, Deconfliction and Evaluation
- Distributed Battlespace Opportunity Planning
  - Lookahead Precision Attrition and Counter-Move Planning Tied to a Central Strategy
- Precision Attrition Planning and Evaluation

*Results...Predictive Planning and Preemption...*
Current and Needed Operational Demonstrations (Continued)

**NEAR**
- Littoral Warfare
  - Real-Time EMI Monitoring To Support Force Spectrum Management (ACTD)

**MID**
- IW Early Warning (IW NORAD)
  - Integrated Means For Base-Level Detection of Coordinated IW Attacks (97 ACTD Candidate)
- HPM Weapon
  - IW Suppression of Enemy Electronic Systems (97 ACTD Candidate)

**NEEDED**
- Ability to Monitor Information and Frequency Space (Including BDA)
- Theater Joint Information and Spectrum Dominance
  - Dynamic Control of Offensive and Defensive Information and Frequency Battlespace

**Ground-Based KE ASAT**
- Army Antisatellite Missile for Deterrence, Dissuasion, Denial (97 ACTD Candidate)

**Defensive Planning**
- Integrated Defense Planning for Attack Operations, Air/Ground Surveillance and Air Defense Assets (ATD)
- Collaborative Plan Refinement, Deconfliction, and Evaluation
- Real-Time Cross-Cueing Between Offense, Defense, IW
Potential Metrics for Demonstration Areas

- **Distributed Battlespace Opportunity Planning (Look-Ahead, Multioption Optimization to a Central Offensive and Defensive Strategy Across Time, Space, Resources, Spectrum)**
  - **Collaborative, Combined-Arms Crisis Assessment, Target Selection, and Plan Generation on a Continuous Basis**
    - Continuous, Dynamic Critical Node Analysis on Projected Enemy Situation of 1,000’s of Units To Determine Decisive Options (100’s) on 10’s of Centers of Gravity
    - Countermove Planning To Generate 2–6 Sequences of Options for Countering Anticipated and High-Possibility Moves for Moving Units and Critical Nodes, Including Dispersion/Signature Management

- **Collaborative Plan Refinement, Deconfliction, and Evaluation**
  - Local Tactical Simulation of Plan/Countermeasures Options in Minutes; Remote, Multimission, High-Fidelity Plan or Countermeasure Simulation and Assessment Within 1–6 Hours Depending on Fidelity

- **Rapidly Tailorable Systems and Updates**
  - 90 Percent Reprogrammability of Threat Response Options/Techniques
  - Transparency/Relocatability of Predictive Models and Tactics/Techniques/Threat-Dependent Software Over the Air in Hours
Potential Metrics for Demonstration Areas *(Continued)*

- **Distributed Battlespace Opportunity Planning (Continued)**
  (Look-Ahead, Multioption Optimization to a Central Offensive and Defensive Strategy Across Time, Space, Resources, Spectrum)
  - *Precision Attrition Planning and Evaluation*
    » Integrated IW, C2W, Hard-Kill Options Generated and Evaluated in 10’s of Minutes for 10’s of Critical Targets
    » Stealth and Enhanced Penetration/Minimum Collateral Damage/WMD Options Planning in <1 Hour for Hardened Facilities and Well-Defended Sites

- **Theaterwide Joint Information and Spectrum Dominance**
  - *Ability To Monitor Information and Frequency Space*
    » IW/C2W BDA Assessment Capability for Critical Nodes, Events
  - *Predictive Control of IW and C2W Options*
    » Distributed, High-Fidelity Simulation of Effects Versus “Cost” of IW and C2W Options From Rear-Echelon Anchor Desks in Hours
    » Prepositioning of IW and C2W Countermeasures Parametric Data and Coordination Information in 10’s of Minutes
Predictive Planning and Preemption

**Goal**

Lean Forward in the Planning Process to Avoid Direct Confrontation (by Employing Alternative Means); Be Prepared to React and Exploit Opportunities When Direct Confrontation Must Occur, and to Shape the Expected Actions to Stay Inside the Enemy's Decision Cycle and Keep Him Out of Ours.

Incremental Force Projection—Fight From Any State and Flexible Combination of Tailored Early Force Packages, Global Reach, Accelerated Deployment, Virtual Deployment, and Reachback

**Limitations**

- Automated Planning Systems Are Not Dynamic and Robust
- Wargaming Not Integrated in C2I and Cannot Be Used for On-line Planning Evaluation
- Sensor Tasking and Countermeasures Are Reactive to Emergent IW
- IW Not Integrated With Hard-Kill as a Continuum of Tactical Options
- Failure to Exploit Frequency Spectrum as a Theater Weapon
- Lack of Distributed, Consistent Data at All Levels
- Full-Up Planning Requires Large Vulnerable Footprint in Theater
- Inadequate Support for Operations Using Tailored Forces
- Planning With Coalition and Humanitarian Forces Is Inadequate

**Critical Functional Capabilities**

- Collaborative Situation Assessment, BDA, ATR, and Planning
  - Precision Attrition Planning and Evaluation
- Situation and Command Projection
- IW and Spectrum Dominance Monitoring, Planning, and Execution
- Dynamic Tasking Tied to Central Strategy Throughout the Joint Force
- Repair and Consumables Management
- Shared, Dynamic, Distributed, Continuous Collaborative Planning
  - Rapidly Tailorable
  - Crises
  - Incremental Force Projection Requirements
- Automated Mission-to-Target and Weapon-to-Target Pairing

**Needed Technologies**

- Rapid C3I Modeling and Simulation
  - Spectrum Dominance and IW
  - Situation Projection
  - Red, Blue, White COA Assessments
  - Fault-Tolerant M&S for Mission, Rehearsal, Preview, Training
- Distributed, Collaborative, Continuous Dynamic Planning
  - Plug-and-Play Architecture
  - Automated Weapon Target Pairings
- Virtual Anchor Desk Analysis
  - Heterogeneous Information Fusion
  - Automated Nodal Analysis
Precision Information Direction

Goal:
Enable the On-scene Commander to Exploit and Shape the
Battlespace by Dynamically Directing and Integrating (in Accordance
With Operation, Battle, and Mission Priorities) Both Tactical and
Supporting ISR Resources for Targeting, Weaponing, Mission
Preview, BDA, and Combat Assessment (to Facilitate the Application
of Precision Weapons, Precision Forces, and Rapid Response)
Operational Concepts (Forces)

- Flexible Application of Force To Shape and Set Tempo of the Battle Into Areas Where Adequate ISR Coverage Can Be Maintained

- High-Value Targets at Risk Throughout the Battlespace (Align Targeting to Campaign Goals)

- Tight Integration of Real-Time, Directed BDA, and Retasking Between the Forward Echelon and Supporting Assets
  - Close Integration of Offense With Defense
  - Synchronization of Surveillance and Strike Assets To Facilitate Shoot-Look-Shoot
  - Raise the Combination of UAVs and Nonorganic Assets to the Level of Performance of TAC RECCE
C2I Operational Concepts

- Dynamic, Central Targeting Strategy Tied to Mission Priorities and ISR Coverage ("Maneuver to ISR")
  - Direct Support Assets Under Local Control
  - Conflicting Requirements, Excess Capability Subject to Joint Scheduling (e.g., Plan Repair, Air/Fire Support Target Handoff)
  - Visibility of Real-Time Mission Support Tasking Requirements and Priorities by Intelligence/RECCE/Analysis Providers

- Automated, Near Real-Time Location, ID, Assessment, and Weaponing of Critical Threats and Targets Consistent With Dynamic, Integrated Priorities
  - Dynamic Critical Node Analysis
  - Automated Target Exploitation, Targeteering, Weaponing, BDA Interpretation, and Retargeting

- Distributed Analysis for Target Development, Weaponing, BDA, Combat Assessment (Distributed Mission Folders)

- Just-in-Time Retargeting and Mission Materials, Visual Aids, and Previews to the Cockpit or Mission Team
  - Real-Time, Direct Broadcast to the Warfighter
System Concept—Current

Intel Preparation of the Battlefield

Assess → Disseminate Product

Process

Collect

Request Collection Assets

Schedule Organic Surveillance Assets

ID Essential Elements of Information

Battle Damage Assessment

Request BDA Collection

Collect

Process

Schedule Surveillance Assets

Combat Assessment

Disseminate Product

Request Coverage To Match Operations
System Concept—Reengineered

Shape Battlespace and Coverage Dynamically To Optimize Strategic Advantage

IWARCE Intel Collections C2W BDA RECCE BDA

Military Morale Avenues of Approach Counter Targeting Location, Speed, Composition Restrike Assessment

Theater/Tactical Collection and Surveillance Template

Current Operations Future Operations Future Plans

Critical Objectives and Targets Timeline

Battle Damage Assessment Target Prioritization Crisis/Combat Assessment Critical Node Analysis

Targeteering/Weaponing

Mission Folders Hard/Soft Kill Response Options Centers of Gravity

Volume III 2-52
Reengineered RECCE/Collection Nomination Process

Monitor Situation

NCA
Collect Data

Process Data

Generate Intelligence

Disseminate Intelligence

Mission Support

Monitor Events/Update Products

Collect Data

Perform Analysis and Disseminate

Process Commander's Information Requirements

Campaign Plan

Battle Plan

Mission Plan

Support Plan

DMA, DLA

CINC

JIC

CJTF

JFACC/
JTF Components

Wings and Units

Support CINCs and Agencies

Allies

Plan Understanding

Volume III

2-53
Reengineered Target Development/BDA Process

NCA/JCS/Svcs
- Issue Warning Order

CINC and Components
- Establish Guidance
- Provide JFC Guidance

CJTF
- Coordinate JIPTL

JFACC
- Apportionment

JTF Components

Wings and Units
- Develop Direct Air Support Plan
- Collaborate on Target Nom
- Collaborate on Weaponing

Support CINCs and Agencies
- Air Support and Alloc Request
- Develop Joint Air Oplan, MAAP, ITO

BDA
- Theater BDA
- Cue BDA
- Cue RECCE
- Develop Aerospace Control Plan
- Prepare Combat Assessment
- ACO SPIN
- Execute ITO, Direct Support and BDA
- Plan and Coordinate Mission
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<td>Limited Ability To Keep Stressing Targets at Risk</td>
<td>Limited Ability To Focus on High Value Targets</td>
<td>Automated Aids for Location, ID, Target Assessment, Weaponing, BDA, and Combat Assessment</td>
<td>Distributed, Predictive Sensor Coverage Assessment&lt;br&gt;Dynamic Critical Node Analysis and Target Prioritization&lt;br&gt;Image/Signal ATR, Interpretation</td>
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<td>Campaign Impacts</td>
<td>Lack of Responsive Targeting Information</td>
<td>Distributed Analysis for Target Development, Weaponing, BDA, Combat Assessment</td>
<td>Integrated, Shared Tasking for Shared Assets&lt;br&gt;Distributed Mission Folders and Collaboration</td>
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<td>Sortie Impacts</td>
<td>Operations Loosely Coupled to Campaign Objectives</td>
<td>Just-in-Time Retargeting and Dissemination of Mission Materials, Visualization Aids, Previews, BDA to Cockpit, Mission Team</td>
<td>Adaptive HCI for Mission Preview, Cueing&lt;br&gt;Compression for High-Quality, Low Data Rate Transmission</td>
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<td></td>
<td>Poor and Slow BDA</td>
<td>Direct Broadcast to and From the Warfighter</td>
<td>Downlink of ISR Data and Tasking; Uplink of Sensor Data and Tasks Information Requirements</td>
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</table>
Detailed Critical Functional Capabilities Summary

- Dynamic Targeting Strategy Tied to ISR Coverage and Mission Support Package Availability
  - Distributed Visibility of Sensor Tasking, Information Availability
  - Distributed, Predictive Sensor Coverage Assessment
  - Integrated, Shared Tasking for Shared Assets

- Automated Near-Real-Time Aids for Location, ID, Target Assessment, Weaponering, BDA, and Combat Assessment

- Distributed Analysis for Target Development, Weaponering, BDA, and Combat Assessment
  - Distributed Mission Folders

- Just-in-Time Retargeting and Dissemination of Mission Materials, Visual Aids, Previews, and BDA to Cockpit/Mission Team

- Direct Broadcast to the Warfighter
  - Dissemination of Data and Tasking Status
  - Uplink of Sensors and Collaborative Tasking Requirements
Current and Needed Operational Demonstrations

**NEAR**
- Active Systems Exploitation
  - Cross-Discipline Cueing of Sensor Assets To Assist Air Target Identification (ATD)

- Bistatic Radar for Weapons Location
  - Artillery Trajectory Analysis
  - To Locate 100 Weapons/Min (ATD)

- LPI Sensors/Radiant Outlaw
  - Long-Range LIDAR/IR Detection of Noncooperative Air/Surface Targets (ATD)

- Target Acquisition
  - Integrated Sensors for Long-Range ATR and Vehicle Tracking (ATD)

- Remote Sentry
  - Unattended Personnel and Vehicle Detection to 1-2 km (ATD)

- Advanced Image Intensification
  - Night Vision Goggles With Embled Pilot/Foot Soldier Display (ATD)

**MID**
- Integrated Sensor Tasking
  - Integrated CINC Control of SIGINT and IMINT Tasking and Distributed Requirements Tracking/Reporting (97 ACTD Candidate)

- Precision ID Suite
  - Airborne ESM/Laser/EO For Precision Ground Platform ID (97 ACTD Candidate)

- Counter CC&D
  - Airborne Foliage Penetration LF Radars and Hyperspectral Imaging (97 ACTD Candidate)

- Sniper Detect/Neutralization
  - Multiple Techniques for Close Weapons Detection/Location (97 ACTD Candidate)

- Wide Area Tracking System
  - Nuclear Materials Detection in Vehicles (97 ACTD Candidate)

- Unattended Ground Sensors
  - Multiple Means for Delivery and Use of UGSs (97 ACTD Candidate)

- Multisensor-Aided Targeting
  - Integrated Suite for Aircraft (ATD)

**NEEDED**
- Dynamic, Distributed Targeting and BDA Coordination IAW Central Strategy

- End-to-End, Task-Synchronized, Mission Support Products to the Warfighter
- Integrated, Responsive Coordination of Tactical and Supporting Nonorganic Sensors by the Tactical Commander With Just-in-Time Delivery of Processed Mission Support Products

- Virtually Deployed Analysts
- ISIR Responsiveness
- Direct Dissemination
- Materials Visibility

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Current and Needed Operational Demonstration (Continued)

NEAR

Joint Precision Strike
All Weather, Day-Night Precision Strike for Short Dwell Targets (ATD)

Semiautomated Imagery Processing
Increased Quality, Quantity and Speed of Analyst Support (ACTD)

Satellite Control/Data Via ATM
Free DSCS Bandwidth Now Used for Satellite Control (97 ACTD Candidate)

High Altitude Endurance Unmanned Air Vehicles
Theater/JTF Long-Endurance Surveillance and Targeting (ACTD)

Medium Altitude Endurance Unmanned Air Vehicles
24-Hr Optical/Radar Surveillance (ACTD)

Precision SIGINT Targeting
Increased Precision and Speed of Enemy and SAR Location (ACTD)

MID

Reduced Target Location Error
Multiple Means for CEP Reduction to 3D Over Battlefield (97 ACTD Candidate)

Near-Shore Tactical Recon
ASW/MCM Tool Kit for Planning Combinations of Sensors Based on Environmental Conditions, Systems, and So on for ASW, MCM (97 ACTD Candidate)

JSTARS Cueing and Correlation
Offboard Cueing To Improve Mobile Critical Target Acquisition (ATD)

Integrated Sensor Tasking
Integrated CINC Control of SIGINT and IMINT Tasking and Distributed Requirements Tracking/Reporting (97 ACTD Candidate)

Smallsat SAR
CJTF-Controllable Space SR Radar for Imagery Via BADD (97 ACTD Candidate)

Aerostats for Command
Long-Range Surveillance and Targeting Sensors With Surface/Air Target Link (97 ACTD Candidate)

NEEDED

Dynamic, Distributed Target and BDA Coordination IAW Central Strategy Distributed Auto Aids

End-to-End, Task-Synchronized, Mission Support Products to the Warfighter
Integrated, Responsive Coordination of Tactical and Supporting Nonorganic Sensors by the Tactical Commander With Just-in-Time Delivery of Processed Mission Support Products

ISR Responsiveness

Distributed Deployed Analysis

Direct Dissemination

Mission Materials Visibility
Potential Metrics for Demonstration Areas

  — *Dynamic, Distributed Joint Target/BDA Coordination Strategy for 1000’s of Targets Across Theater of Operations*
    » Near Real-Time Tactical Visibility of Multimission Target Priorities and Strategy (or Center of Gravity)-to-Task-to-Target Relationship
    » Near Real-Time Tactical Visibility of Mission Support Package Available
    » Near Real-Time Visibility of ISR Coverage at Tactical Level
    » Near Real-Time Visibility of ISR Tasking/Availability

— *Distributed, Automated Aids for Time-Critical, Man-Intensive Processes*
  » Automated Target Recognition to Locate/ID 1000’s of Targets/Hour
  » Automated Target Assessment/Targeteering to 1000’s Targets/Hour
  » Automated Weaponeering of 100’s of Targets/Hour
  » Automated BDA/Combat Assessment of 100’s of Targets/Hour

— *On-line, Collaborative Access to Distributed Deployed Analysis for Target Assessment, Weaponeering, BDA, Combat Assessment at 10’s of Sites*
Potential Metrics for Demonstration Areas (Continued)

• End-to-End, Task-Synchronized, Multimission Support Products to the Warfighter
  — **ISR Responsiveness and Awareness at the Tactical Level**
    » Tactical Control of Prioritization of Organic/Nonorganic Sensors Over a 5,000-Sq Km Area
    » Critical Target Assessment “Tippers” Within Minutes for 10's of Mobile Critical Targets, Air Defense Targets, Stealth Platforms, BDA
    » Real-time Fusion/Cross-Cueing of Organic Surveillance and Nonorganic Assets To Achieve High Precision

  — **Direct Dissemination of Just-in-Time Mission Materials to and From the Warfighter**
    » Distributed “Mission Folders” and “Target Folders” Accessible Via Tactical Internet Uplink and GBS Downlink
    » High-Capacity Injection Uplinks From Primary Deployed Tactical Mission Support Centers, With Fully Interoperable Tactical Relay to Unit, Foot Soldier

  — **Mission Materials Change Visualization and Preview by the Warfighter on-the-Move**
    » Adaptive Pilot/Foot Soldier Decision Aids To Preview Target/Objective Area Changes With Minimal Distraction From Ongoing Tasks
Precision Information Direction

**Goal**

Enable the On-scene Commander to exploit and shape the battlespace by dynamically directing and integrating (in accordance with operation, battle and mission priorities) both tactical and supporting C4ISR resources for targeting, weaponizing, mission preview, BDA, and combat assessment (to facilitate the application of precision weapons, precision forces, and rapid response).

**Critical New Functional Capabilities**

- National and Theater Intelligence Processing and Broadcast
- IW and Spectrum Dominance Monitoring, Planning, and Execution
- ISR and C3 System Management
  - Automated Aids
- Shared, Dynamic, Distributed, Continuous Collaborative Planning
- Collaborative Situation Assessment and BDA
- Rapid Accurate BDA
- Rapid Accurate Targeting
  - Just in Time
  - Dynamic Strategy Ties to ISR
- Mission Rehearsal/Embedded Training
- Command Projection

**Current Limitations**

- Limited response to rapid battlespace changes; rigid ISR, lack of visibility into sensor tasking and coverage
- Limited ability to keep stressing targets at risk
- Limited comprehensive sensor tracking and sharing/coupling of operations to support campaign missions
- No just-in-time retargeting capability
- Sortie impact limitations; poor/slow BDA

**Needed Technology**

- Rapid Modeling and Simulation
  - Sensor Coverage Analysis
  - Spectrum Dominance and IW
- Dynamic Execution Management
  - Virtual Workspaces
  - Intelligent Agents for C4ISR Tasking Plans
  - Sensor Fusion
- System of Systems Performance Optimization
  - Plug-and-Play Architecture
  - Improved Data and Uncertainty Visualization and Management
- ATR, BDA
- Virtual Anchor Desk
- Nodal Analysis
Integrated Force Management

Goal:
Dynamically Synchronizing Force Operations by Collaborative Execution
Monitoring, Repair, and Retasking of Shared Assets Across Echelons, Missions,
Components, and Coalition Forces (Control of "Coherent" Joint/Simultaneous
Operations to Optimize Dynamic Use of Resources Without Preempting "Initiative")
Operational Concepts (Forces)

- Extended Battlespace Depth, Breadth, and Height With Fewer Forces (Empty Battlespace)
  - More Dispersed Formations (Units, Key Nodes, Leaders)
  - Fewer Operational Pauses—Condensed Time, i.e., Rapid Succession of Action With Little Pause

- Simultaneous Operations to Achieve Multiple Objectives Throughout Theater of Operations Produce Overwhelming, Decisive Combat Power

- Simultaneous Engagement by Variety of Joint Warfighting Systems

- Substitution of Situational Knowledge for More Traditional Physical Control Measures

- Dynamic Battlespace Management
  - Capable of Adjusting Quickly to Temporal and Spatial Variations
  - Rehearsal and Retasking Enroute and on-the-Move

- Near Real-Time Collaborative Tasking, Retasking, Mission Assessment, and Replanning
  - Cross-Mission Tasking of Multimission Capable Assets
  - Concurrent Mission Assessment
  - Seamless Connection Between Battle Management and Sensor/Shooter (Mission Monitoring and Dynamic Deconfliction, Reactive Repair and Replanning)

- Information as Focus of Operations
  - Protect Friendly Information Systems While Denying Enemy Use of His Systems
C2I Operational Concepts

- Battle Command
  - Horizontal Integration of Battlefield Functions
  - Capable of Adjusting Quickly to Temporal/Spatial Variations
  - Must Aid Commanders in Tailoring and Arranging Forces

- Force Coherence and Application of Combat Power Achieved Through Shared Knowledge of Battlefield Vice Traditional Controls
  - Common Knowledge Holds Force Together
  - Substitution of Situational Knowledge for More Traditional Physical Control
  - Implies Changes in Dynamics of Leadership

- Continual Accurate and Timely Shared Perceptions of the Battlespace
  - Nonhierarchical Dissemination of Intelligence, Targeting, and Other Data at All Levels
  - Dynamic Battlespace Management

Collect Intel...Predict Opposing Force Behavior...Assess Enemy Behavior...Act Quickly
C2I Operational Concepts (Continued)

- Common View and Understanding of What Needs to Be Done (Strategy, Commander’s Intent)

- Shared Real-Time Awareness of Force Disposition in the Battlespace Tailored to Requestor’s Needs, Not Just Geographic

- Common, Relevant Picture of Battlespace Tailored to Needs of Individual Users
  - Pull-Down Information on Demand
  - Available to Deciders, Shooters, and Supporters

- Dynamic, Fast-Paced, Simultaneous, Collaborative Planning, Tasking, and Replanning
  - Allocation of Assets to Objectives; Allocations of Weapon Systems to Target
  - Coping Simultaneously and at Multiple Levels Concurrently
  - Mission Execution Package Construction
  - Recursive, Adaptive Planning Based on Mission Assessment and Prediction
  - On-Line Monitoring of High-Value System Status During Simultaneous Attack Execution
  - Continual Dynamic Reallocation of Shared Assets to the Highest Collaborators and Execution Level
Simultaneous, Coordinated Operations—Current

Decision Support
- Mission
  - Mission Analysis
  - Courses of Action
  - Campaign Plan

Selection
- Feasibility Assessment
- Refinement, Apportionment
- Generation, Strategy

Evaluation
- Next Planning Cycle
  - Missions, Strategy, Commander's Intent
  - Combat Assessment

Task Force A
- Battle Plan
  - Air Plan
  - Ground Plan
  - Naval Plan
  - Allocation, Deconfliction, Evaluation
  - Mission Plans and Execution

Task Force B
- Battle Plan
  - Air Plan
  - Ground Plan
  - Naval Plan
  - Allocation, Deconfliction, Evaluation
  - Mission Plans and Execution

Task Force C
- Battle Plan
  - Air Plan
  - Ground Plan
  - Naval Plan
  - Allocation, Deconfliction, Evaluation
  - Mission Plans and Execution

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Simultaneous, Coordinated Operations—Reengineered

Threat

Mission Plan

Assessment and COAs

Campaign, Battle Plans

Shared Support Assets (Strike, Transport, Logistics)

Distributed Across JTF Components

Direct Support Assets

Synchronized Operations Visualization

Area Defense Targets

Direct Support Targets

IW/C2W Targets

Joint Targets

Task Timeline

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Synchronized Engagement—Current

Decision Support

Selection

Feasibility Assessment

Development

Evaluation

Refinement, Apportionment

Generation, Strategy

Evaluation

Deconfliction

Allocation

Next Planning Cycle

Mission

Mission Analysis

Courses of Action

Campaign Plan

Battle Plan

Combat Assessment

JTF Component Tasking

Naval and Littoral

Mission Plan

Mission Execution

Strike

Air and Space

Mission Plan

Mission Execution

Ground Combat

strike

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Synchronized Engagement—Reengineered

- Mission Plan
- Campaign/Battle Plan
- +12 hr Assets
  +2 hr Assets
  Ready Assets
  Enroute Assets
- Direct Support Assets
- Distributed Across JTF Components
- Task Timeline
  - Current Operations
  - Time Critical Targets
    - BDA Tasks
    - Restrike Targets
    - Priority Targets
    - IW/C2W Targets
- Synchronized Operations Visualization
  - Command by Negation
    - Defensive Targets
    - Direct Support Targets
    - Other Targets
- Crisis/Combat Assessment
- Critical Node Analysis
- Critical Node Attik
- Precision Attrition
- Contingency Maneuver
- Threat

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<th>Detailed Critical Functional Capabilities</th>
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<tr>
<td>Limited Common Understanding of Needed Changes and Relationship of Individual Tasks to Overall Campaign Objectives</td>
<td>No Mechanism To Disseminate and Comprehend Impact of Changes</td>
<td>Dynamic Tasking Tied to Central Strategy, and Commander's Intent and Task/Target/Time/Space Relationship to Strategy</td>
<td>Dynamic Shared Warplan, Multidimensional Data and Uncertainty Visualization</td>
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<tr>
<td>Coordination of Operations Through Rigid Framework of Battlefield Geometry</td>
<td>No Mechanism for Real-Time Resource Tasking, Coordination, and Deconfliction</td>
<td>Support to Simultaneous Engagement</td>
<td>Multidimensional Reasoning on Support Constraints</td>
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<td>Concurrent Mission/Operation/ Campaign Assessment</td>
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<td>Real-Time Mission/Task Monitoring, Repair, Retask</td>
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<td>Dynamic Scheduling/Coordination of Assets for Interdependent Tasks</td>
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<td>On-line Monitoring of Expenditure, Consumables</td>
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<td>Embedded Mission Preview, On-the-Move Broadcast Commission to Support 500-Node Distribution Rehearsal</td>
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Detailed Critical Functional Capabilities Summary

- Continual and Dynamic Planning and Tasking, Always Tied to a *Central Strategy*
  - **Common View** of What Needs To Be Done *(Commander's Intent, End States, Task/Target/Time/Space Relationships to Strategy)*

  — **Simultaneous Coordinated Operations**: Battle Management Support for Intuitive Command of Dedicated Assets *(Centralized Coordination, Distributed Execution)*
    - Continual Collaborative Reallocation of Shared Assets *(Surveillance, Strike, Fire Support, Maneuver)* to the Strategic Attack of Highest Priority Objectives
    - Cross-Mission Tasking, Multimission Capable Force Packages
    - Concurrent Mission/Operation/Campaign Assessment

  — **Simultaneous Engagement**: Seamlessness Between Battle Management and Sensor/Shooter; Near Real-Time Cooperative Retasking
    - Coordination of Assets for Supporting Fires, Supporting Tasks
    - Real-Time Mission Monitoring and Dynamic Deconfliction
    - Reactive Mission/Task Repair and Replanning
    - On-line Monitoring of Systems Status and Consumables

- Retasking and Rehearsal for Coordinated Operations Enroute and On-the-Move
Current and Needed Operational Demonstrations

NEAR

Rapid Force Projection/
Enhanced Fiber-Optic
Rapid, Automated C2
Precision Munitions for
Highly Mobile Operations
(ACTD)

Real-Time Support to Joint
Power Projection
Advanced Air Mission Planning,
Force, and In-Cockpit Preview
(ACTD)

Military Operations in
Buildup Areas
Awareness, Rehearsal,
Simulation Aids, and
Weapons for MOBA
(ACTD)

MID

Local Attack Controller
Near Real-Time Retasking
of Pop-up Strike Missions
(ATD)

Pilot Fish/CM UUV/Flounder
Unmanned Underwater Vehicle
for Mine Detection and Clearance
(97 ACTD Candidate)

Joint Suppression of
Enemy Air Defenses
Joint Airborne Jammers Evaluation
(97 ACTD Candidate)

Miniature Air
Launched Decoy
Low-Cost Decoy for SEAD
(ATD)

NEEDED

Dynamic
Tasking Tied to
Central Strategy

Simultaneous
Coordinated
Operations

Simultaneous
Engagement

Distributed
Empowerment

Intuitive
Command
Based on Shared
Information

Understanding in Lieu
of Hierarchical
Command Orders

C2W-
Resistant,
Engagement-
Quality
Picture

Cooperative
Tactics,
Uncertain and
Complex
Posture
Depiction
Current and Needed Operational Demonstrations (Continued)

NEAR

- Crewman’s Associate
  Tank Crew Adaptive Aids for Work Management and Rehearsal (ATD)

- Rotorcraft Pilot’s Associate
  Helicopter Crew Adaptive Aids for Work Management (ATD)

- Real-Time Support to Joint Power Projection
  Advanced Air Mission Planning, Force, and In-Cockpit Preview (ATD)

- Advanced Embedded Training for Shipboard Systems
  Individual/Team Performance Enhancements From HCI/Training (ATD)

- Helmet-Mounted Mission Rehearsal Simulation
  Tactical Aircraft Mission Rehearsal (ATD)

MID

- Dissemination Of Retasking

NEEDED

- Retasking and Rehearsal for Coordinated Operations Enroute and On-the-Move

- Coordinate Multimission, Multiechelon Rehearsal of Synchronized Operations

- Warfighter Cognitive Aids for Retasking

Synthetic Theater of War 97
Synthetic Environment for Integrated Training, Rehearsal (ACTD)
Potential Metrics for Demonstration Areas

- Dispersed/Distributed "Empowerment" Using Mission-Oriented, Higher Level Cognitive Understanding Across the Force (in the Presence of Imperfect or Deceptive Information)
  - **Dynamic Tasking Tied to Central Strategy**
    - Distributed Real-Time Database Consistent With "Strategy-to-Task" Hierarchy of Predictive Battlespace Opportunity Planning
    - Dynamic Database Updates to Critical Node Hierarchy and Strategic Attack Priorities
    - Continuous, Distributed Posting and Deconfliction of Task/Target/Time/Space/Spectrum Allocations
    - Concurrent Assessment of Task Progress

- **Support to 10's of Simultaneous Coordinated Operations**
  - Distributed Real-Time Database To Update 5,000 Task-to-Task Dependencies, Assumptions, and Temporal/Geographic/Resource Constraints; Involving 100's of Participating Units
  - Dynamic, Distributed Reallocation of Shared and Excess Assets (Aircraft Sorties, Surveillance, Weapons, C3, and Processing) to Most Critical Tasks and Targets in Accordance With Central Strategy
  - Automated, Distributed Coordination of Supporting Tasks (e.g., Massed Fire Support) and Allocation of Multi-mission-Capable Assets
Potential Metrics for Demonstration Areas (Continued)

- Dispersed/Distributed Empowerment Using Mission-Oriented, Higher Level Cognitive Understanding Across the Force (in the Presence of Imperfect or Deceptive Information) (Continued)
  - Support to Real-time, Simultaneous Engagement Involving 10’s of Units/Event (Can Have Several Concurrent Events)
    » Automated, Collaborative Route Optimization
    » Time on Target and Support Mission/BDA Scheduling
    » Mission Coordination Information Generation
    » BDA Analysis and Reattack
    » Plan Repair, Consumables Monitoring, and Retasking of Excess Mission Assets

  - Integrated Offensive and Defensive Rules of Engagement To Support Diversion of Offensive Assets to Time-Critical Defensive Tasks or To Disperse for Signature Reduction/Survivability
Potential Metrics for Demonstration Areas (Continued)

- Retasking and Rehearsal for Coordinated Operations Enroute and on-the-Move
  - Dissemination of Enroute Coordinated Task Changes to 10’s of Units in Minutes
    » Retargeting/Weaponizing Information and Mission Folders
    » Mission Route, Timing, and Coordination Information
    » Dissemination and Preview of Alternative Targets, Contingency Threat Sets, and Contingency Tasks
    » Dissemination and Preview of Countermeasures Options, Response Libraries, and Effects
    » Mission Preview
  - Coordinated Multimission, Multiechelon Rehearsal of Coordinated Operations and Simultaneous Engagements (10’s)
    » Force-to-Force Combat Task and Logistics Simulation
    » Synchronized Sensor-to-Shooter-to-Shooter Walkthrough
    » Constructive, Simulated Threats and “Virtual Own Force Presence”; Simulated IW/C2W; Tactical or Rear Echelon “Red Team” Anchor Desk
    » Mission Critique
Integrated Force Management

**Goal**

Dynamically Synchronize Force Operations by Collaborative Execution Monitoring, Repair, and Retasking of Shared Assets Across Echelons, Missions, Components, and Coalition Forces (Control of Coherent Joint/Simultaneous Operations To Optimize Dynamic Use of Resources Without Preempting Initiative)

**Adaptive Coordinated Defense**—Integrate Defensive Systems Across Services Into a Collaborative Capability That Exploits Real-Time Retasking to Optimize Resources and Still Take Advantage of Distributed Empowerment

**Critical New Functional Capabilities**

- Mission Rehearsal and Embedded Training
- Command Projection
- Dynamic Tasking Tied to Central Strategy Throughout the Joint Force
- Repair and Consumables Management
- Joint Force Automated ROE
- Rapid, Accurate Targeting
  - Integrated Air Defense, Strike, and C2W
- Rapid, Accurate Battle Damage Assessment
- Force Status and Execution Following
  - Close Coordination, Detection, ID
- Shared, Distributed, Continuous Collaborative Planning
- JW and Spectrum Dominance Monitoring, Planning, and Execution

**Current Limitations**

- Limited Common Situation Understanding and Perceiving What Needs To Be Done (Strategy, Commander’s Intent) and the Relationship of Individual Tasks to Overall Campaign Objectives
- Limited Real-Time Insight Into Plan Execution
- Present Coordination Via Rigid Framework of Battlefield Geometry
- No Responsive Way to Dynamically Retask High-Value Assets Across Missions and Services in Response to Changing Situations, Opportunities
- Inadequate Ability To Translate Data Into Full Situation Understanding
- Limited Ability To Apply All Assets to Formulate and Support Coherent Defense
- Planning Is Manually Intensive

**Needed Technology**

- Continuous Dynamic Planning/Scheduling
- System of System Optimization and Management
  - Distributed, Collaborative, Virtual Work Spaces
  - Sensor Information Fusion
  - Anchor Desks
    - Nodal Analysis
    - ATR, BDA
- Cognitive Support
  - Data and Uncertainty Visualization and Management
  - Speech and Text Understanding
- Rapid M&S, Including C3I
Adaptive Coordinated Defense

Goal:
Integrate Defensive Systems Across Services Into a Collaborative Capability That Exploits Real-Time Retasking to Optimize Resources and Coverage While Still Taking Advantage of Distributed Empowerment

Defensive Planning
Dynamic Sector Control
Battlespace Deconfliction
Joint Doctrine Management
Reengagement
Dynamic Rules of Engagement
Doctrine Repair
Definition—Bounding the Subject

- Defense Against Flying Objects
  - Against Threats That Include Cruise Missiles, Ballistic Missiles, Manned Missile-Launch Aircraft, Antipersonnel Aircraft and Helos, Airborne Surveillance and Command Units, Airborne Jammers, Remotely Piloted Vehicles (RPVs) and So on.
  - Protection of Troops, Ships, Strategic and Tactical Assets, Population
  - Using Defenses That Include Manned Interceptors, Missiles, ECM Deception and Other C2W Techniques, Likely New Detect and Kill Mechanisms, Calls for Preemptive Strike Against Enemy Air Assets and Support

- Focus on Improved Warfighting Performance Achievable Through Coordination and Close Cooperation
Operational Vision

CINC/Global
Shared Situation Picture

Collaborative Planning

Minutes

Operational Situation

Theaterwide
Shared Coherent Air Picture

Seconds

Tactical Situation, Battle Status

Coordinated ROE and Deployment

Assets, Operational Doctrine, Authorization, ISR Information

Cooperative Detection, Tracking, Combat Identification and Engagement

Contact Sharing, Coordinated Weapons Assignment Scheduling and Engagement

Split Seconds
Operational Concepts (Forces)

- Forcewide Coordination of Scheduling, Placement, and Tasking of Detection and Engagement Assets

- Forcewide, Coherent, Mutually Supporting Defensive Doctrine

- Attrition/Mitigation of Air Threat Through Prelaunch Preemptive Attack
  - Integration of Air Defense and Strike Planning
  - Integration of Air Defense and C2W

- Shared, Coherent, Complete Air Picture

- Shared, Positive Precise Position Reporting by Friendly and Noncombatant Air Traffic

- Application of All-Source Information to Enemy Identification Problem

- Protection of the Air Picture From Enemy Corruption

- Forcewide Coordination of Active (Hard and Soft) and Passive Defensive Measures

- Diversion/Reallocation of Assets in Reaction to Evolving Threat

- Closely Coordinated Detection, Tracking, and Identification Among Mutually Supporting Units

- Extension of Battle Horizon and Increased Depth of Fire Through Detection Sharing and Cooperative Engagement Modes
  - Forward Pass, Over-the-Horizon Cruise Missile Defense, Remote Data Engage, Remote Magazine Launch
C2I Operational Concepts

- Integrated Planning
  - Cross-Mission, Cross-Echelon, Collaborative
  - Integrating of Plan Into Tactical Picture
  - Reactive ROE Modification

- Intuitive Visualization
  - Real-Time Picture, Environment, and Less Certain Indicators (What Do We Know Now?)
  - Exposure (What Does the Enemy Probably Know About Us?)
  - Detection Posture (What Threats Could We See, and Where?)
  - Defensive Posture (What Threats Could We Shoot, and Where?)

- Centralized Coordination/Distributed Execution
  - Forcewide Automated Threat Assessment/Weapon Assignment
  - Automated Control-by-Negation
  - Preemptive Asset Retasking

- Air Situation Picture Traffic Flowrate Control
Long-Range, Active/Passive Defense—Indepth—Reengineered

Situation: Overland Cruise Missile Attack on Land-Based Friendly Forces, in Mountainous Terrain

Illustrative Example

Strategy:
Sensor Netting for Continuous Track and ID
Precision Cueing for Extended Detection Range
Radar Resource Management
Coordinated Scheduling of Engagement Assets
Engage on Remote Data
Remote Launch Engagement
Forward Pass Engagement

Benefits:
Early Warning and Detection
More Intercept Opportunities/Depth of Fire (Perhaps 10:1)
Ability To Optimize Engagement Sequence, End-Game Geometry
Close-In, Pop-Up Threat—Reengineered

Situation: Offshore Operations in Support of Friendly Nation Situation Cluttered by Neutral/Suspect Boats and Aircraft Unexpected Close-In Attack by Boat-Launched CM, Concealed Shore CM Battery, TBM.

Illustrative Example

Strategy:
Integrated I&W to Focus Radar Resources, Search Sectors
Sensor Netting for Continual Track and ID of Both Friendly and Neutral Units
Precision Cueing for Extended Detection Range
Sensor Deployment To Avoid Terrain Masking
Continuous Reporting of Position and ID by Friendly and Cooperating Neutral Units
Automated Threat Reaction Doctrine Coordinated Across Joint Force Units

Benefits:
Battlefield Preparation
Ability to React; Mutual Support
Exploitation of All Defensive Assets
Safety of Friends and Neutrals
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<th>Causes</th>
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<td>Precise Position Reporting, and Close Coordination of Detection, ID, Tracking, Among Units</td>
<td>Visualizing Complex and Fastmoving Situation, Posture, Exposure, ROE, and Response Options</td>
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<td>Limited Threat Reaction Time</td>
<td>Dynamic Joint Force Automated Rules of Engagement</td>
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<td>Limited Automation of Reaction</td>
<td>Forcewide Coordination of Schedule, Placement, Tasking, Retasking of Detection/Engagement Assets</td>
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<td>Integrated Air Defense, Strike, and C2W to Attack, Threats Prior to Lauch</td>
<td>Visualization of Joint Capability Grids and Tasking</td>
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<td>Inability To Apply All Assets to Formulation of Shared Coherent Defensive Air Picture</td>
<td>Inadequate Knowledge of Combined Detect-Engage Capabilities Throughout Battlespace</td>
<td>Forcewide Hard/Soft Engagement Coordination and Passive Tactics (Dispersion, Deception)</td>
<td>Rapid, Coordinated Response From On-Station Assets</td>
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<td>Limited Ability To Apply/Allocate Multiservice Assets in Shared Battlespace</td>
<td>Over-the-Horizon Engagement Coordination (Extension of Battle Horizon and Increased Depth of Fire Through Detection Sharing and Cooperative Engagement, Forward Pass)</td>
<td>Simulation of Countermeasures Effects, and Signature Reduction</td>
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<td>Inadequate Support for Deceptive, Dispersive Tactics</td>
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<td>Real-Time Linking of Engagement Coordinated Information Across Force</td>
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</tbody>
</table>
Detailed Critical Functional Capabilities Summary

- Precise Position Reporting, C2W-Resistance, and Close Coordination of Detection, ID, and Tracking Among Units
- Joint Force Automated Rules of Engagement
- Integrated Air Defense, Strike, and C2W to Attack Threats Prior to Launch
- Forcewide Hard/Soft/Passive Engagement Coordination
- Over-the-Horizon Engagement Coordination
- Real-Time Sensor Data Exchange for Forcewide Coordination of Scheduling, Placement, and Tasking
Current and Needed Operational Demonstrations

**NEAR**
- Precision Rapid Counter-MRL
  Survivable Targeting, Precision Munitions and BDA for Hardened Launcher Sites (ACTD)
- High-Frequency Shipboard Surface Wave Radar
  OTH Cruise Missile and LOS Ballistic Missile Detection (ATD)
- Cruise Missile Defense (Mountain Top)
  Elevated Platform Handoff to AEGIS and Patriot (ACTD)
- Kinetic Energy Boost Phase Intercept
  Integrated Sensor, Kinetic Weapon, Launch/Boost Demonstration (ACTD)

**MID**
- Dynamic Tasking Tied to Central Strategy
- Simultaneous Coordinated Operations
- Simultaneous Engagement

**NEEDED**
- Distributed Empowerment
  "Intuitive" Command Based on Shared Information Understanding in Lieu of Hierarchical Command Orders
- C2W-Resistant, Engagement-Quality Picture
- Chemical, Biological Detection and Defense for Air Bases/Ports
  Attack Warning Countermeasures, All-Clear (ACTD)
- Anti-CM/Antihelicopter Mine
  Autonomous Means to Force Low-Flyers Above Nap-of-Earth Santuary (97 ACTD Candidate)
- Cooperative Tactics, Uncertain and Complex Posture Depiction
Current and Needed Operational Demonstrations *(Continued)*

**NEAR**  
- Ship Defense Against Imaging IR Missiles  
  Optical Laser Countermeasures for ASCM (ACTD)
- Radar Deception And Jamming  
  Integrated Aircraft ECM and Power Management System (ATD)

**MID**  
- Advanced ECM Transmitter for Ship Defense  
  Improved ASCM Performance (ATD)
- Tactical Aircraft Directed IR Countermeasures  
  Aircraft IR ASCM Detection and Jamming (ATD)
- Hit Avoidance  
  Combat Vehicle Auto-ECM Defense From Smart Weapons (ATD)

**NEEDED**  
- Integrated Offensive/Defensive Doctrine
- Integrated With Synchronized Force Management and Predictive Preemption
- Cooperative, Intelligent ROE

- Intelligent, Joint Force Automated Rules of Engagement  
  Integrated Offensive and Defensive Hard Kill/Soft Kill Doctrine
- Hard/Soft Kill and Avoidance Options
- OTH, Cooperative Engagement Coordination

*Non-LOS Antihelicopter Weapon*  
Elevated Sensors Linked to Ground Force for OTH Engagement of Pop-Up Helicopter Threat (97 ACTD Candidate)
Potential Metrics for Demonstration Areas

• Dispersed/Distributed Empowerment Using Mission-Oriented, Higher Level Cognitive Understanding Across the Force (in the Presence of Imperfect or Deceptive Information)
  — Real-Time, C2W-Resistant Forcewide Tactical Depiction of Detection, ID, and Tracking of 100's of Threats at 2 Updates/Second
    » Joint, Composite ID Capability and Uncertainty Built Into Picture
    » Dwell-by-Dwell Integration of Joint-Force Sensors for Continuous Tracking and Characterization of Difficult Targets in Difficult Environments
    » 4D Visualization of Complex and Fast Moving Situation, Posture, Exposure, ROEs, and Response Options
  — Forcewide Coordination and Visualization of Scheduling, Placement, Tasking, Retasking of Detection, and Engagement Assets

• Theaterwide Joint Information Warfare and Spectrum Dominance
  — Real-Time Integration/Cross-Cueing Between Defense, Offense (Integrated Force Management), and C2W (Predictive Planning and Preemption) to Attack Threats Prior to Launch
    » 5-Minute Response Time To Determine and Assess Offensive/C2W Response to Detected Threat by Enroute/On-Station Assets
Potential Metrics for Demonstration Areas (Continued)

  - Distributed, Cooperative ROE Generation Intelligent Enough To Provide “Legal”-Quality Cues for Rules of Engagement on Evasive and Deceptive Tracks
    » Checklist of ROE Options, Deferral of Response Decision as Long as Practical
    » Recognizing Enemy Cooperative Tactics and Similar Patterns
    » Automated Provision for Managing Uncertainty

- Integrate Soft Kill and Avoidance Into Automated Response Recommendations
  » Determine and Rank C2W, Signature/Spectrum Management, Dispersion Options Within 1 Minute
  » Simulate Countermeasures Effects and Signature Reduction in 2 Minutes With Medium Confidence, 5 Minutes With High Confidence
  » Develop and Disseminate Automated Unit Tasking in Seconds Following Option Selection
Potential Metrics for Demonstration Areas (Continued)

- Intelligent, Distributed, Automated ROE Management for Joint Force Integrated Offense, Defense, and Survivability
  — Over-the-Horizon Engagement Coordination (Extending Battle Horizon and Depth of Fire)
    » Detection Sharing on a Contact-by-Contact Basis
    » Real-Time Linking of Contact Engagement and Engageability Information Across the Force
    » Cooperative Engagement and Forward Pass
Adaptive Coordinated Defense

**Goal**

Dynamically Synchronize Force Operations by Collaborative Execution Monitoring, Repair, and Retasking of Shared Assets Across Echelons, Missions, Components, and Coalition Forces (Control of Coherent Joint/Simultaneous Operations To Optimize Dynamic Use of Resources Without Preempting Initiative)

Adaptive Coordinated Defense—Integrate Defensive Systems Across Services Into a Collaborative Capability That Exploits Real-time Retasking To Optimize Resources and Still Maximize Distributed Empowerment

**Critical New Functional Capabilities**

- Mission Rehearsal and Embedded Training
- Command Projection
- Support Simultaneous Engagement and Coordinated Operations
  - OTH
  - Force Allocation
  - Forcewide Hard/Soft Target Engagement Coordination
- Dynamic Tasking Tied to Central Strategy Throughout the Joint Force
- Repair and Consumables Management
- Joint Force Automated ROE
- Rapid, Accurate Targeting
  - Integrated Air Defense, Strike, and C2W
- Rapid, Accurate Battle Damage Assessment
- Force Status and Execution Following
  - Close Coordination, Detection, ID
- Shared, Dynamic Distributed, Continuous Collaborative Planning
- IW and Spectrum-Dominance Monitoring, Planning, and Execution

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**Needed Technology**

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- System-of-Systems, Optimization and Management
  - Distributed, Collaborative, Virtual WorkSpaces
  - Sensor Information Fusion
  - Anchor Desks
    - Nodal Analysis
    - ATR, BDA
- Cognitive Support
  - Data and Uncertainty Visualization and Management
  - Speech and Text Understanding
- Rapid M&S, Including C3I
Incremental Force Projection

Goal:
Be Prepared To Fight From Any State of In-Theater Joint Force Projection, Using Flexible Combinations of Tailored Early-Entry Force Packages, Tactical Force Reconstitution, Global Reach, Accelerated Deployment, Virtual Deployment, and Reachback

Coalition Forces

Combat Requirement

Potential 2,000 Sorties/Day Versus 400 Fixed Sites
Potential Threat Forces—1,300,000
Major Weapons—3,800 Tanks, 600 Aircraft, 600 SCUD

Forces in Theater

8,000
1 Month

70,000
2 Months

110,000
3 Months

220,000
4 Months

400,000
5 Months

Timeline

Long-Range Air Strike
Mobile Strike / SOF Force
Accelerated Delivery

Anchor Desks / Reachback
Operational Concepts (Forces)

- Managing Windows of Combat and Support Opportunity
  - Dynamic Force Package Tailoring and Reconstitution in the Field
    » Mobile Strike Force, Early Entry Force, Rapid Force Projection
    » Global Reach Strike, SOF, and Special Assets Missions
  - Adaptive Force Package Tailoring and Redeployment of Global Reserves

- Total Asset and Requirements Visibility and Flow Control Dynamically Integrated Into Combat Planning Windows of Opportunity

- Splitbase Operations to Minimize On-scene Footprint
  - Intelligence, METOC, MC&G, Logistics, Personnel, Finance, Maintenance, Special Operations Planning
  - Rear Area May Be CONUS
  - Use of Nondeployed Reserve Units

- Integrated Coalition Operations
C2I Operational Concepts

- High-Resolution Joint Force Package Tasking and Tracking Tailored to Mission at Hand
  - Selection, Mobilization, Deployment, Sustainment
  - Resolution to Mission, Unit, and Equipment Levels
  - Conflict Resolution May Extend Upward to Joint Staff
  - Dispersed, Cross-Functional Virtual Teams

- Dynamic Pipeline and Readiness Management
  - Optimized Pipeline Reconfiguration and Scheduling
  - Real-Time Flow Control Tailored to Attrition and Dynamic Consumption
  - Offload Data Acquisition and Tracking Tasks From Humans

- Robust Planning and Assessment
  - Concurrent, Interactive Operational and Logistics Courses of Action (COA) Assessment
  - Cross-Echelon Mission Interaction, Collaboration, and Deconfliction
  - Sensitivity to Changes and User Skills
  - On-the-Move Replanning
  - Plan and Train on Equipment and Technology Designated for Deployment in Garrison to Foxhole

- Coalition, Humanitarian, Early-Entry Force Options for Collaborative Planning and Execution
No-Plan Crisis Deployment—Current

No-Plan Crisis Deployment—Current

**Supported CINC**
- Select National Combat Forces
- Employment Feasibility Assessment
- Deployment Feasibility Assessment
- Mobilization Feasibility Assessment
- Sustainment Feasibility Assessment

**Components, Supporting CINC**
- Source Combat and CS/CSS Forces

**TRANSCOM, Services**
- Preposition
- In-Theater Transport and Movement (Road, Rail, Air, Boat)
- Build Deployment Plan
- Mobilization Plan
- Sustainment Plan

- Mobilize
- Mobilization

- Deploy (Sealift)
- Deploy (Airlift)

- Redeploy (Sealift)
- Redeploy (Airlift)

- Sustain

- Employ
- Reconstitute
No-Plan Crisis Deployment—Reengineered

CONUS Support

Predefined Adaptive Joint Force Packages and Early-Entry Packages

Use Automation to Compute, Evaluate and Rank Sustainment, Mobilization, Deployment Options Versus Cost, Time, OPTEMPO, Etc.

Automated Mobilization, Sustainment, Deployment Plan Construction

Dynamic Deployment Database

Total Asset Visibility

"Means-Based" Flow Monitoring

Use Automation to Compute, Evaluate, and Rank Sustainment, Mobilization, Deployment Options Versus Cost, Time, OPTEMPO, Etc.

"Ends-Based" Flow Monitoring

Approve Rapid Deployment and In-Theater, Long-Range Support Missions

Total Asset Visibility

In-transit Visibility

Strategic "Ends/Means" Flow Monitoring

Tactical "Ends-Based" Flow Monitoring

Request Rapid Deployment Changes Based On Predictive Planning

Theater Support

Select National Combat Forces

Autobuild and Source Tailored Force Packages and Force Mod Replacements

Prepositioned CS/SS

Prepositioned, Stocks, Equipment, and Tailored Reinforcements

Tactical Commander

Refine National Combat Forces for Tailored Tactical Requirements

Tactical MSF Reconstitution
Long Range, Just-in-Time Force Employment—Reengineered
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<td>Full-Up Planning Requires Large, Vulnerable Footprint in Theater</td>
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<td>Elevate Efficiency and Responsiveness of Anchor Desks to Tactical Support</td>
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<td>Planning With Coalition and Humanitarian Forces and Agencies Is Limited in Automation, Security, and Frames of Reference for Planning</td>
<td>Planning Tools Tend to Focus on Means Rather Than “Ends”</td>
<td>Plan and Train on Equipment Deployed With; Tactical Focus on Ends-Based Planning</td>
<td>Embedded Training With Distributed, Intelligent Agents To Translate Ends to Means</td>
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<td>Coordination and Scheduling of Coalition Assets Only Loosely Coordinated</td>
<td>Coalition, Humanitarian, Low-Data Rate, Early-Entry Options for Collaborative Planning and Execution</td>
<td>Low-Data Rate Collaboration Across Security Boundaries Using Automated Sanitization</td>
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</table>
Detailed Critical Functional Capabilities Summary

- Dispersed Cross-Functional Virtual Teams
- High-Resolution Joint Force Package Tailoring, Tasking, and Tracking
- Robust Planning/Assessment
  - Cross-Echelon, Cross-Mission Collaboration Deconfliction
  - User Skill Sensitivity
  - On-the-Move Replanning
- Plan/Train on Equipment Designated for Deployment
- Coalition, Humanitarian, Low-Data Rate, Early-Entry Options for Collaborative Planning and Execution
Current and Needed Operational Demonstrations

**NEAR**
- Airdrop Ballistic Winds/Strat Mobility
- Advanced Airdrop For Land Combat
  100-M Precision Delivery Of Heavy Equipment (ATD)
- Low-life Cycle Cost, Medium-lift Helicopter
  COTS Helicopter for Mobile Sealift Ships (ACTD)
- Joint Logistics
  Logistic Anchor Desks To Connect Logisticians Across Missions/Echelons and Provide CINC/JTF C4I/Logistic Improvement in Response, Efficiency (ACTD)

**MID**
- Total Distribution
  Distributed Logistic Planning and Execution at All Echelons for 2 MRCs (ATD)
- Air Vehicle Diagnostics
  Helicopter Onboard “Health Monitoring” (ATD)
- Helicopter Advance Health and Use Monitoring
  Army/Navy In-Flight Diagnostics for Safety and Maintenance Reduction (97 ACTD Candidate)
- Logistics Survivability
  Speedup of Supply Movement Pipeline, Power Projection of Supplies from Sea and Air Direct to Early Entry Forces (97 ACTD Candidate)

**NEEDED**
- High Resolution Tactical Force Package Tailoring
- Adaptive Force Package Tailoring, Reconstitution and Force Flow Management From the Tactical Level
- Reduction of Force Movement and Supply Backlog During Reconstitution
Current and Needed Operational Demonstrations (*Continued*)

**NEAR**
- High-Precision GPS Weapon
  - X2 or X4 Hills Per Sortie for Aircraft with SM CEP JDAM (97 ACTD Candidate)
- Arsenal Ship
  - Merchant Ship as Massive Launcher Platform for Cooperative Engagement for Strike and Defense (97 ACTD Candidate)
- Rapid Force Projection/
  - Enhanced Fiber Optic
  - Guided Missile
    - Lightweight, Precision Force With Extended Battlespace (10-15 Km) Capability and Mobility (ACTD)
- Precision-Guided Mortar Munition
  - High-Lethality Weapon (ATD)

**MID**
- Precision Global Reach
  - BAT Weapon Clusters in B-2s To Defeat Large Arrays of Vehicles (97 ACTD Candidate)
- Conventional ICBM
  - Global-Reach, Precision Deep-Strike Capability for Fast Reaction (97 ACTD Candidate)
- Self-Mobile UGS/Ugws
  - Air-Dropped Unmanned Vehicle and Weapons to Attack Vehicles and Snipers (97 ACTD Candidate)
- Unmanned Tactical Aircraft
  - Small Automated “Wingman” Aircraft for Dangerous Deception and Attack Operations (97 ACTD Candidate)
- Hunter Sensor Suite
  - Light, Low- Observable Sensor Vehicle With Link to Standoff Killer (ATD)
- Enhanced Fiber Optic
  - Guided Missile
    - Standoff Killer Weapon for Rapid Projection (ATD)

**NEEDED**
- Virtually Deployed Teams
- Employment of Enroute and “In-Reach” Forces
- Management of Dynamic Force Configurations
- Robust Planning for Reconstituted Teams
- Competent Munitions for 5 Inch Gun
  - Low-Cost, High-Lethality Weapon (ATD)
Potential Metrics for Demonstration Areas

- Management of Dynamic Force Configurations
- Real-Time, Continuous Access to and Between Cross-Functional Virtual Teams
  - Ability to Deploy Core Staff and Leave 75 Percent in Safe Enclaves
  - Real-Time Tailored Support to Tactical Execution (Brigade and Below, Naval Units) by Anchor Desks (Intelligence, METOC, Logistic, Personnel, Maintenance, Medical, Pol/Mil) in a Corps-Sized Force
  - Compatibility of Collaboration With 10's of Coalition, SOF, Civilian Teams Using 2.4-56 Kbps Periodic Networks
- Employment of In-Route and Within Reach Assets
  - Ability to Monitor Mission Capability and Availability and To Task Out-of-Area Shared Assets Within Organic Planning Cycle
- Ability To Conduct Standoff Command From Airborne or Sea-Based Headquarters
Potential Metrics for Demonstration Areas (Continued)

- **Management of Dynamic Force Configurations**
  - *Robust Planning and Assessment by Dynamically Changing Teams On-the-Move*
    » Automated Deconfliction of Logistics To Enable Planner to Concentrate on Ends (Combat Forces, Missions) and Not Means (Support Forces, Logistics)
    » Insensitivity to User Skill Level for 90 Percent of Planning Tasks
    » Ability to Conduct End-to-End, Simulation-Based Training of Logistics Perturbations Using Actual Tactical C2 Planning Systems

- **Adaptive Force Package Tailoring, Reconstitution, and Force Flow Management From the Tactical Level**
  - *High Resolution Tactical Joint Force-Package Tailoring*
    » Ability To Modify National Forces Database in <1 Hour
    » Ability To Plan Major Force Reconstitution Based on Casualty Assessments and New Missions Within 15 Minutes
    » Ability To Rearrange Support Logistics for Rapid Unit-Level Relocation Within 2 Hours
    » Ability To Detach, Reassign, and Realign Support Tail for Brigade-Level Forces Within 3 Hours
Potential Metrics for Demonstration Areas (Continued)

- **Adaptive Force Package Tailoring, Reconstitution, and Force-Flow Management From the Tactical Level**
  - *Reduction of Force Movement and Supply Backlog During Dynamic Reconstitution, and Redeployment*
    - Reduction in Total Lift Time To Redeploy for In-Theater Reconstitution, Lightweight Forces, and Increased Lethality (Less Munitions) and Survivability (High Mobility, Signature Reduction)—1 to 4 Days in Theater and 7 Days From CONUS
    - A 50 Percent Reduction in Logistics Response Time From CONUS to Overseas
    - Reduction in Total CONUS and Intermediate Support Base Backlog by 30 Percent Due to Tactical Reconstitution and Better Tracking of Mission Requirements and Flow
    - A 10 Percent Reduction of Basing and Distribution Costs To Manage Flow of Units and Materials Arriving To Support Current Missions Without Backlogs or Shortfalls to Critical Operations
    - A 50 Percent Reduction in Global Contingency Inventory and Storage
Incremental Force Projection

Goal

Lean Forward in the Planning Process To Avoid Direct Confrontation (by Employing Alternative Means); Be Prepared To React and Exploit Opportunities When Direct Confrontation Must Occur, and To Shape the Expected Actions To Stay Inside the Enemy's Decision Cycle and Keep Him Out of Ours.

**Incremental Force Projection**—Fight From Any State and Flexible Combination of Tailored Early Force Packages, Global Reach, Accelerated Deployment, Virtual Deployment, and Reachback

Critical New Functional Capabilities

- Collaborative Situation Assessment, BDA, ATR, and Planning
  - Precision Attrition Planning and Evaluation
- Situation and Command Projection
- IW and Spectrum Dominance Monitoring, Planning, and Execution
- Dynamic Tasking Tied to Central Strategy Throughout the Joint Force
- Repair and Consumables Management
- Shared, Dynamic, Distributed, Continuous Collaborative Planning
  - Rapidly Tailorable
  - Crises
  - Incremental Force-Projection Requirements
- Automated Mission-to-Target and Weapon-to-Target Pairing

Needed Technology

- Rapid C3I Modeling and Simulation
  - Spectrum Dominance and IW
  - Situation Projection
  - Red, Blue, White COA Assessments
  - Fault-Tolerant M&S for Mission, Rehearsal, Preview, Training
- Distributed, Collaborative, Continuous Dynamic Planning
  - Plug-and-Play Architecture
  - Automated Weapon Target Pairings
- Virtual Anchor Desk Analysis
  - Heterogeneous Information Fusion
  - Automated Nodal Analysis

Current Limitations

- Automated Planning Systems Are Not Dynamic and Robust
- Wargaming Is Not Integrated in C2I and Cannot Be Used for On-line Planning Evaluation
- Sensor Tasking and Countermeasures Are Reactive to Emergent IW
- IW Is Not Integrated With Hard Kill as a Continuum of Tactical Options
- Failure to Exploit Frequency Spectrum as a Theater Weapon
- Lack of Distributed, Consistent Data at All Levels
- Fullup Planning Requires Large Vulnerable Footprint in Theater
- Inadequate Support for Operations Using Tailored Forces
- Planning With Coalition and Humanitarian Forces Is Inadequate
3. Conclusions
# Key Opportunities for Battle Management in Planned Demonstrations

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>Consistent Battlespace Understanding</td>
<td>Distributed Situation Assessment Realtime Cognition Aiding Displays</td>
<td>Knowledge-based Information Presentation Cognitive Mission Support to the Warfighter</td>
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<tr>
<td>Precision Information Direction</td>
<td>Integrated Sensor Tasking Multisensor Automatic Target Recognition Integrated Target Tracking</td>
<td>End-to-end, Task-synchronized, Mission Support Products to the Warfighter</td>
</tr>
</tbody>
</table>
Priority Technology Areas

Consistent Battlespace Understanding

• Cognitive Support and Decision Aids
  – Tactical Anchor Desks
  – Distributed Agents for Automated Plan and Spectrum Deconfliction
  – Dynamic Optimization of “Opportunity Planning” Within the Constraints of a Multidimensional Battlespace
  – Integrated Task, System, Terrain, Weather, Logistics, and Capabilities Reasoning Using Intelligent MC&G Representations
  – Advanced Human-Computer Interface
  – Uncertainty Management With Error-Tolerant and Deception-Tolerant Decision Support
  – Hard Kill/Soft Kill Decision Support

• Visualization
  – Projection, Quality Measures, and Uncertainty
  – Scaleability and Tailored Presentations
  – Intuitive Portrayal of Relative Advantages (e.g., Posture)
  – Rapidly Adaptive Interfaces Tailored to Mission Context
  – Virtual Reality and Multidimensional Data Visualization Applied to Complex Mission Interdependencies
Conclusions...

Priority Technology Areas (Continued)

**Consistent Battlespace Understanding (Continued)**

- Automated Recognition, Entry, and Analysis of Information
  - Critical Node Analysis and BDA
  - Targeteering and Weaponizing
  - Seamless Interface to Heterogeneous Databases, Analyses, etc.
  - Automated Entry and Interpretation (Image, Text, Speaker-Independent Speech/Language Understanding)
  - Increased Attention to Large Scale Fusion (1000's of Sensors Fused in Minutes With Uncertainty/Error Handling and Multisource, Cooperative Tracking, Deceptive Threats)
  - Automated Pattern Recognition
  - Intelligent Inference To Extrapolate Known Behaviors and Defaults
  - Foreign Language Translation

**Predictive Planning and Preemption**

- Advanced C4I Modeling, Simulation, and Planning
  - Situation Projection
  - Rapid Model Generation With Changing Scenarios
  - Dynamic, Complex COA Evaluation, and Replanning Options
  - IW/C2W Countermeasures Effects/BDA; Multiplatform EMI
  - Predictive Counter-Moves and Countermeasures Effects
  - Continuous, Model-Based Assessment of Full-Spectrum of Battle Considerations (Logistics, Weather, etc.) Using Real-World, Incomplete Data
  - Tailorable Opposing Force and Deception
  - Variable Fidelity and Resolution, Validated Models for Progressive Refinement
  - Advanced Knowledge Representation
Priority Technology Areas (Continued)

Integrated Force Management/Precision Information Direction

- Dynamic Execution Management
  - Intelligent Agents for ISR Tasking Visibility, Deconfliction of Distributed Responses, Constraint-Based Plan Repair Options
  - Continuous, Dynamic Replanning and Rescheduling
  - High Performance Knowledge Bases for Dynamic Force Reconstitution Management
  - Intelligent, Cooperative, Distributed Battle Doctrine
  - Extension of Cooperative Defense to Mobility, Deception, etc
  - Doctrine/Constraints "Learning" by Autonomous Vehicles and Decision Aids

- System of Systems Performance Optimization
  - Easily Evolvable/Scaleable Architecture and Product
  - Realtime Diagnosis and Proactive Maintenance of Complex Distributed Systems; Fault-Tolerant Distributed Info Support

Consistent Battlespace Understanding

- Robust Collaboration and Dissemination of Understanding to Warfighter
  - Realtime Database Consistency, Dispersed Battle Management and Collaboration Using Heterogeneous Sources Including Broadcast and Low Data Rate
  - Common Representation for Battlespace Understanding (Situation, Plan, Execution Status, Distributed Mission Folders)
  - Enroute Understanding of Situation and Tasking Changes
  - Intelligent, Adaptive Compression
  - Distributed Software Libraries, Repositories, and Adaptively Prepositioned Products in Distributed Mass Storage
4. Glossary
<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>ABCC</td>
<td>Airborne Command and Control</td>
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<tr>
<td>ABCCC</td>
<td>Airborne Command and Control Communications</td>
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<td>ABIS</td>
<td>Advanced Battlespace Information System</td>
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<tr>
<td>ACTD</td>
<td>Advanced Concept Technology Demonstration</td>
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<tr>
<td>AD</td>
<td>Air Defense</td>
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<td>AOC</td>
<td>Air Operations Center</td>
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<tr>
<td>AOR</td>
<td>Area of Responsibility</td>
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<tr>
<td>App</td>
<td>Application (usually refers to automated applications)</td>
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<td>ARPA</td>
<td>Advanced Research Projects Agency</td>
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<td>ATACMS</td>
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<td>ATD</td>
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<td>ATM</td>
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<td>AWACS</td>
<td>Airborne Warning and Control System</td>
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<tr>
<td>B-ISDN</td>
<td>Broadband Integrated Services Digital Network</td>
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<tr>
<td>BADD</td>
<td>Battlefield Awareness and Data Dissemination</td>
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<td>CEC</td>
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<tr>
<td>CINC</td>
<td>Commander-in-Chief</td>
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<td>CJTF</td>
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<td>CMA</td>
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<td>CMW</td>
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<tr>
<td>COA</td>
<td>Course(s) of Action</td>
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<td>COE</td>
<td>Common Operating Environment</td>
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<td>CONOPS</td>
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<td>DCE</td>
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<td>FST</td>
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<td>ID</td>
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<td>ISAR</td>
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<td>ISDN</td>
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<td>IT</td>
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<td>JCPMS</td>
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<td>JIT</td>
<td>Just in Time</td>
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<td>JPEG</td>
<td>Joint Photographic Experts Group (Standard)</td>
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<td>JROC</td>
<td>Joint Requirements Oversight Council</td>
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<td>JSTARS</td>
<td>Joint Surveillance and Target Acquisition Radar System</td>
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<td>KCOIC</td>
<td>Korean Command Operations/Intelligence Center</td>
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<td>LRC</td>
<td>Lesser Regional Conflict</td>
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<td>M&amp;S</td>
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<td>MASINT</td>
<td>Measurements and Signatures Intelligence</td>
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<td>MILSATCOM</td>
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<td>MLRS</td>
<td>Multiple Launch Rocket System</td>
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<td>MLS</td>
<td>Multilevel Security</td>
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<td>MMW</td>
<td>Millimeter Wave</td>
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<tr>
<td>MOE</td>
<td>Measure of Effectiveness</td>
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<td>MRC</td>
<td>Major Regional Conflict</td>
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<td>MRL</td>
<td>Multiple Rocket Launcher</td>
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<td>MTI</td>
<td>Moving Target Indicator</td>
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<tr>
<td>NRT</td>
<td>Near Real-Time</td>
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<td>NTM</td>
<td>National Technical Means</td>
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<td>O&amp;M</td>
<td>Operations and Maintenance</td>
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<td>OPLAN</td>
<td>Operation Plan</td>
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<td>OPSEC</td>
<td>Operations Security</td>
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<tr>
<td>OTAR</td>
<td>Over-the-Air Rekeying</td>
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<td>OTH</td>
<td>Over the Horizon</td>
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<td>PGM</td>
<td>Precision Guided Weapon</td>
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<td>POM</td>
<td>Program Objective Memorandum</td>
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<td>RDT&amp;E</td>
<td>Research, Development, Test, and Engineering</td>
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<td>Description</td>
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<td>REECE</td>
<td>Reconnaissance</td>
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<td>Revolution in Military Affairs</td>
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<td>RT</td>
<td>Real-Time</td>
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<td>S&amp;T</td>
<td>Science and Technology</td>
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<td>SONET</td>
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<td>SSCN</td>
<td>Secure, Survivable Communications Network</td>
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<td>STS</td>
<td>Sensor-to-Shooter</td>
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<td>TAC</td>
<td>Tactical Air Controller</td>
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<td>TAP</td>
<td>Technology Area Plan</td>
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<tr>
<td>TBM</td>
<td>Theater Ballistic Missile</td>
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<tr>
<td>TCP</td>
<td>Transaction Communications Protocol (used with IP)</td>
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<td>TCT</td>
<td>Time-Critical Target</td>
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<tr>
<td>TEL</td>
<td>Transportable Erectable Launcher</td>
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<td>TFCC</td>
<td>Task Force Command and Control</td>
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<td>TOC</td>
<td>Tactical Operations Center</td>
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<td>TOT</td>
<td>Time Over (or On) Target</td>
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<td>UAV</td>
<td>Unmanned Aerial Vehicle</td>
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<tr>
<td>VCJCS</td>
<td>Vice Chairman Joint Chiefs of Staff</td>
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<tr>
<td>VTC</td>
<td>Video Teleconference</td>
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5. Working Group Membership
**Co-Chairmen**

Mr. Don Eddington  
COL Ron Fly

Mr. NCCOSC  
Joint Staff/J38

<table>
<thead>
<tr>
<th>Participant</th>
<th>Organization</th>
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<tr>
<td>Dr. David Alberts</td>
<td>NDU</td>
<td>Mr. Mark Kaczmarek</td>
<td>PRC</td>
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<td>CDR Pat Allen</td>
<td>JCS/J38</td>
<td>Mr. Dave La Rochelle</td>
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<td>HQAF/XOOC</td>
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<td>Mr. Ed Ashley</td>
<td>SAIC</td>
<td>COL Robert L. A. Lossius</td>
<td>Battle Command</td>
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<td>COL Del Atkinson</td>
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<td>CAPT Jenny McGee</td>
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<td>COL Martin Moakler</td>
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<td>Mr. Gary Barringer</td>
<td>Rome Labs</td>
<td>LTC Ray Monroe</td>
<td>DFSP/DNA</td>
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<td>Richard F. Brown</td>
<td>Battle Lab</td>
<td>Mr. Dick Moore</td>
<td>DIA/CI-3</td>
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<td>Mr. Sam Brown</td>
<td>JHU/APL</td>
<td>CDR Chuck Norwood</td>
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<td>Mr. John Palermo</td>
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<td>MAJ Dave Payne</td>
<td>JSC/J8</td>
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<tr>
<td>Mr. Stu Draper</td>
<td>MITRE</td>
<td>Mr. Frank Perry</td>
<td>Army AI Center</td>
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<td>CAPT Joe Pridotkas</td>
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<td>LDCR Andy York</td>
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<td>SAIC</td>
<td>CAPT James Young</td>
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* Subteam Leader