NEXT GENERATION
COMMON OPERATING
PICTURE

Dennis K. Leedom, Ph.D.
Evidence Based Research, Inc.
Introduction

- Current generation **Common Operating Picture** motivated by desire to improve situation awareness within a military command organization
  - **COP** consists of both geospatial displays of the battlespace and intranets that extend vertically through several levels
  - **COP** serves as common repository of information for decision makers
  - Hypothesis: COP will lead to faster and better synchronized planning and execution decisions

- Evidence of success seen in operational and tactical decision making exhibited in Operation Iraqi Freedom, as compared with Operation Desert Storm
  - Methodical and efficient destruction of elite Republican Guard Divisions
  - Quick-response, precision attack of high-value targets by theater assets
Future Challenges

- **Current generation COP built on outdated “information warehousing” paradigm**
  - Information poorly organized and validated
  - Information difficult to search
  - Much of the information is or marginal relevance to decision makers

- **Military decision making has increased in complexity**
  - Effects-based operations balance both lethal and non-lethal methods to defeat an adversary’s will to fight while minimizing collateral damage to populations whose support we ultimately desire
  - Asymmetric warfare presents new dimensions of goal complexity – e.g., military defeat of an adversary versus management of public opinion
  - Coalition operations, combined with humanitarian/relief operations bring many new participants and stakeholders to the table

- **Next Generation COP must help command organizations deal with:**
  - Ambiguous operational problems and tasks
  - New types of emergent threats and opportunities
  - Broad set of stakeholders and perspectives
Developing the Next Generation COP

- Requires solid theoretical models of critical organizational processes:
  - Information Management
  - Sensemaking
  - Knowledge Creation
  - Decision Making
- These models should be informed by relevant, empirical research from the behavioral and social sciences
- The challenge is to transform these often ethereal bodies of research into
  - Practical guidance for focusing technology development
  - Quantitative metrics for assessing ROI in new technologies
Information Management

- Information management provides the foundation for the successive stages of the information transformation process.
- **Current implementations focus on technical issues of**
  - Network connectivity / reliability
  - Network bandwidth
  - Information storage capacity
  - Information search / retrieval
- **The next generation COP should assist command organizations in managing both the “know what” and the “know how”**
  - “Know what” circulates with relative ease
  - “Know how” embedded within work practice and is often difficult to track, retrieve, and apply in moment-to-moment decision making.
Information Management Challenges

**Implicit / Tacit Expertise**
- Communities of Expertise
- Management of Informal Social Networks

**Explicit / Codified Information**
- Tactical Intranet
- Management of Technical Networks

**Key Decision Makers**
Sensemaking

- Sensemaking refers to a number of sociocognitive activities undertaken by an organization when it is faced with novelty or operational situations that do not conform with prior expectations.
- These expectations are based on a hierarchy of mental images developed from past experience and combined with ongoing assessments of the battlespace:
  - Participants and values
  - Goals and objectives
  - Course of action
  - Tactics
  - Critical events
  - Timing and flow
- Battlespace conditions, change, adversary intentions and strategy are not always fully understood.
- The fog and friction of war combine to produce novel situations and ambiguity.
- Emergent threats and opportunities often reflect a mixture of military, political, and diplomatic issues.
Sensemaking Should Be Tailored

WHAT COMMANDERS WANT
- Shared Understanding
- Identified Threats/Opportunities
- Integrated Perspectives
- Actionable Knowledge
- Tailored Decision Frameworks

WHAT COMMANDERS OFTEN RECEIVE
- Unprocessed Information Dump
- Endless PowerPoint Charts
- Unfiltered / Unfocused Awareness
- Decision Framing Left to Commander
Types of Organizational Ignorance

- **Situation Uncertainty**
  - Lacking sufficient information or confidence in available information

- **Information Glut**
  - Being overwhelmed by too much information that prevents focusing on important elements of the situation

- **Situation Ambiguity**
  - Lacking an appropriate, experience-based problem framework for interpreting available information and associating responses

- **Explanatory Equivocality**
  - Having multiple, competing problem frameworks for interpreting available information

- **Situation Emergence**
  - Having an experience-based problem framework that yields only limited insight into an evolving or emergent situation

Each type of organizational ignorance requires a different management strategy!
Which Way Is Best?

**ACTION**
- COA Development
- Means-Ends Models

**KNOWLEDGE**
- Objectives
- Multiple Goals & Constraints
- Projected Futures
- Doctrine & Experience
- Stakeholders

**INFORMATION**
- Mission
- Constraints
- Operational Context
- Technical Context

**DATA**

Inductive Reasoning

Critical Rational Reasoning
Knowledge Creation – Western Model

- The western model of knowledge creation sees the organization as a marketplace that supports transactions among
  - Sellers (experts, knowledge bases)
  - Buyers (problem solvers, decision makers)
  - Brokers (gatekeepers, boundary spanners)
- Factors influencing the effective transfer and use of knowledge within an organization include
  - Trust
  - Culture / vocabulary / frames of reference
  - Time / resource limitations
  - Status / social capital
  - Absorptive capacity
  - Knowledge ownership
  - Intolerance for error
- Information “tagging” enables flexible and reliable use of knowledge by multiple users
  - Tags provide contextual information needed for proper interpretation of knowledge products
  - Tags reflect “knowledge pedigree”
The eastern model of knowledge creation emphasizes the situational value of knowledge that has been organized and interpreted to meet the specific decision needs of the moment.

This model sees the organization as being comprised of three layers:

- **Knowledge Base**:
  - Culture & Values
  - Military Staff Experience & Expertise
  - Common Operating Picture

- **Business System**:
  - Military Decision Making Process
  - Staff Battle Rhythm

- **Project Teams**:
  - Staff Collaboration Patterns
  - Self-Organizing Teams

Knowledge that is

- Interpreted by staff experience and expertise
- Synthesized across functional / organizational boundaries
- Organized to support goal-directed action decisions
Battle Rhythm

Common Operational Picture / Global Information Grid

<table>
<thead>
<tr>
<th>COMMAND INTENT / GUIDANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SITUATION ASSESSMENT</td>
</tr>
<tr>
<td>COURSE OF ACTION DEVELOPMENT</td>
</tr>
<tr>
<td>COA APPROVAL</td>
</tr>
<tr>
<td>MISSION REHEARSAL</td>
</tr>
<tr>
<td>ORDERS DEVELOPMENT</td>
</tr>
<tr>
<td>MONITORING AND ADJUSTMENT</td>
</tr>
</tbody>
</table>

| * DECISION BRIEFING       |
| COLLABORATION EVENT       |
| ** ADJUSTMENT DECISIONS & FRAGMENTARY ORDERS |

<table>
<thead>
<tr>
<th>LINEAR</th>
</tr>
</thead>
<tbody>
<tr>
<td>KNOWLEDGE PRODUCTS</td>
</tr>
<tr>
<td>INFORMATION INPUTS</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NONLINEAR</th>
</tr>
</thead>
<tbody>
<tr>
<td>KNOWLEDGE PRODUCTS</td>
</tr>
<tr>
<td>INFORMATION INPUTS</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SENSOR PRODUCTS &amp; UNIT REPORTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>BATTLESPACE</td>
</tr>
<tr>
<td>ORDERS</td>
</tr>
</tbody>
</table>
Collaboration Management

- Current generation collaboration tools
  - Assist participants in developing a common framework of understanding for exchanging ideas and information and engaging in collaborative problem solving
  - They include e-mail, instant messaging, shared whiteboards, chat rooms, multimedia auditoriums, and shared workspaces

- However, the current generation of tools do not address the fundamental sociocognitive issue: when is it appropriate and necessary for specific sets of experts to engage in collaboration?

- Collaboration management is needed to tailor an efficient organizational response to each class of operational problem
  - Simple Problems → Centralized authority directs implementation of agreed solution; collaboration is unnecessary
  - Complex Problems → Central authority adjudicates competing proposals from different stakeholders; collaboration is limited
  - Wicked Problems → Collaboration among experts and stakeholders is essential for developing an organizational response
While decision making cannot be separated from the activities of sensemaking and knowledge creation, research in this area provides insight into two additional issues:

- Different decision making responsibility exist at each level within a command organization
- Different decision making modes are employed as a function of situation ambiguity and time stress
Decision Making Responsibilities

**COMMAND**
- Create vision and set goals to shape ill-defined problem space
- Focus and motivate the staff
- Scan for decision opportunities
- Adjudicate conflicting perspectives
- Approve courses of action and operational adjustments
- Monitor functional areas to identify emerging threats / opportunities
- Develop common understanding
- Assist commander with shaping of decision opportunities
- Adjust / improvise / synchronize plans in each functional area

**PRINCIPAL ADVISORS**
- Build COP within specific areas of responsibility
- Track operations / conduct specific analyses as directed by advisors
- Develop detailed courses of action
- Build / transmit plans, orders, and directives for subordinate units

**SUPPORT STAFF**
- Task Execution Role
- Adaptation / Improvisation Role
- Creative / Motivational Role
Modes of Decision Making

- Recognition-Primed Decision Making
- Incremental Decision Making
- Deliberate Decision Making

Severe / High Time Stress

Low / Moderate Time Stress

Situational Clarity and Understanding

Situation Ambiguity and Uncertainty
Key Technology Areas

- **Flexible Knowledge Codification and Management**
  - Knowledge mapping language that supports flexible meaning and application
  - Management systems for tracking acquisition and status of newly generated knowledge
  - Systems for tracking key variables, events, and situations that alert staff to overlapping stakeholder interests
  - Templated knowledge structures for communicating narrative experiences
  - Personnel tracking systems for maintaining awareness of available expertise

- **Collaborative Sensemaking**
  - Systems that allow depiction and mapping of held beliefs / assumptions onto the COP
  - Visualization technologies for characterizing different forms of situational ignorance in each part of the COP
  - Wargaming methods that allow projected futures to be viewed from multiple perspectives
  - Methods for continuously comparing projections against a framework of held expectations
  - Information display architectures that facilitate rapid incorporation of new problem dimensions and key variables

- **Multi-Perspective Knowledge Creation**
  - Architectures for brokering available information against the specific needs of different consumers
  - Dynamic “information tagging” that provides users with situationally-relevant context for interpretation
  - Architectures that enable dynamic creation of as hoc “project teams” or communities of interest
  - Methods that facilitate the filtering, interpretation, and organization of information into actionable knowledge

- **Multi-Level Decision Making**
  - Information architectures that support multiple levels of decision making tasks within a command organization
  - Information management tools that support the structuring, articulation, and correlation of information in support rapid transition among different decision making modes
Summary

- Current COP designs reflect an inductive reasoning process that works reasonably well for tactical (engagement) decision making.
- Future COP designs must solve a different problem: how to dynamically collect and situationally organize information in a way that is relevant to the commander’s decision process.
- Hence, future COP designs will be “concept-driven” as much as they are “data-driven.”
- Future COP designs must account for the increased complexity of military operations and the presence of multiple stakeholders.
- Hence, the functionality of the information technology supporting the COP must account for critical cognitive and social factors that govern the operation of a military headquarters.