THE SIMULATION OF SENSEMAKING AND KNOWLEDGE MANAGEMENT WITHIN A JOINT EFFECTS-BASED PLANNING SYSTEM

Paper #40
10th International Command and Control Research and Technology Symposium
Ritz-Carlton Hotel, McLean, VA
13-16 June, 2005

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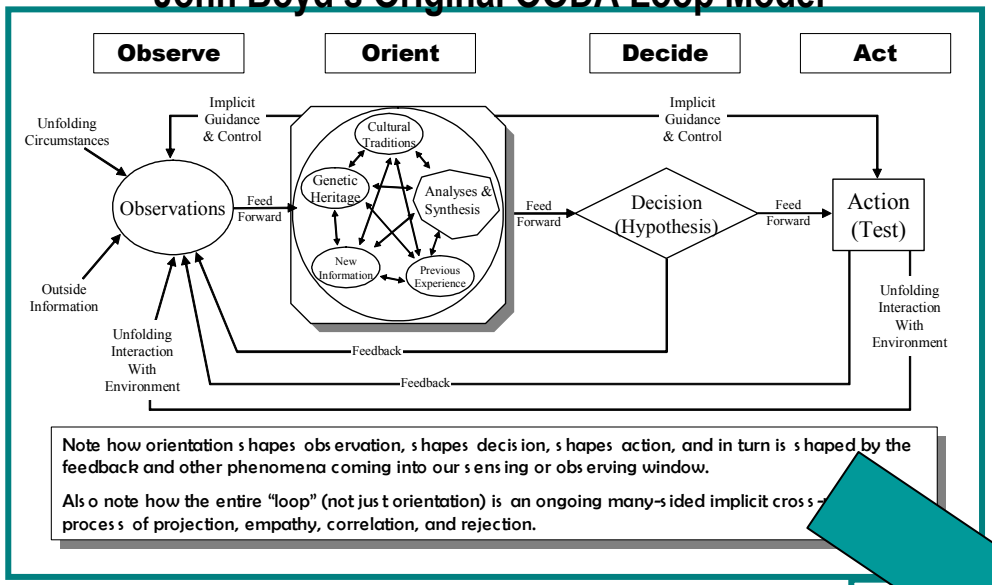
Research Goal: Explicit Simulation of Knowledge Creation within a Joint C2ISR System

John Boyd's Original OODA Loop Model



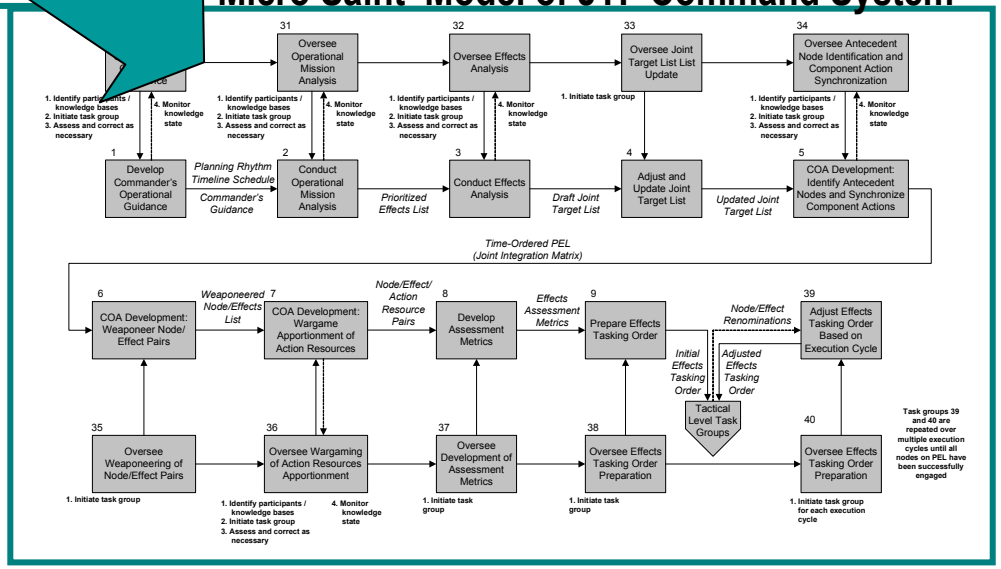
Knowledge Creation

- Represent joint operational planning in terms of a hierarchical framework of abstracted knowledge elements
- Represent the tacit knowledge and expertise of the staff in terms of associational input-output matrices

Staff Collaboration

- Link staff workflows and collaboration patterns with the development of specific knowledge products
- Reflect the influence of technology, training, leadership, and organizational design on collaboration effectiveness

Micro Saint Model of JTF Command System



4th-Generation Warfare

Mao Tse-Tung

Ho Chi Minh

FSLN / Sandinista

Intifada / PLO

Unique elements of 4th-generation warfare…

- Strategic goal: ***Defeat our political will*** to engage in a region
- Strategy: Pursue ***political, economic, and social actions***, engaging in limited military operations only when it furthers strategic interests *(create impression of intractable struggle)*

Hammes, T.X. (2004). 4th-generation warfare. *Armed Forces Journal*, November 2004

Implications for design of C2ISR functionality…

- Adversary is coalition of convergent interests, rather than single nation state
  →***Identify and disrupt critical linkages that hold coalition together***
- Adversary coalition consists of several tiers: leaders, supporters, civilian interests
  →***Employ different approach to disrupting or manipulating each tier***
- Multiple, overlapping networks exists across political, social, economic, religious, humanitarian, and military dimensions
  →***Understand the role, structure, and processes of each type of network***
- Strategic objectives are accomplished through direct C^2, economic/social disruption, intimidation of specific individuals/groups, and exploitation of emergent situations
  →***Identify and influence fitness conditions, rather than severing commo links***

Multiple Dimensions of Knowledge Space

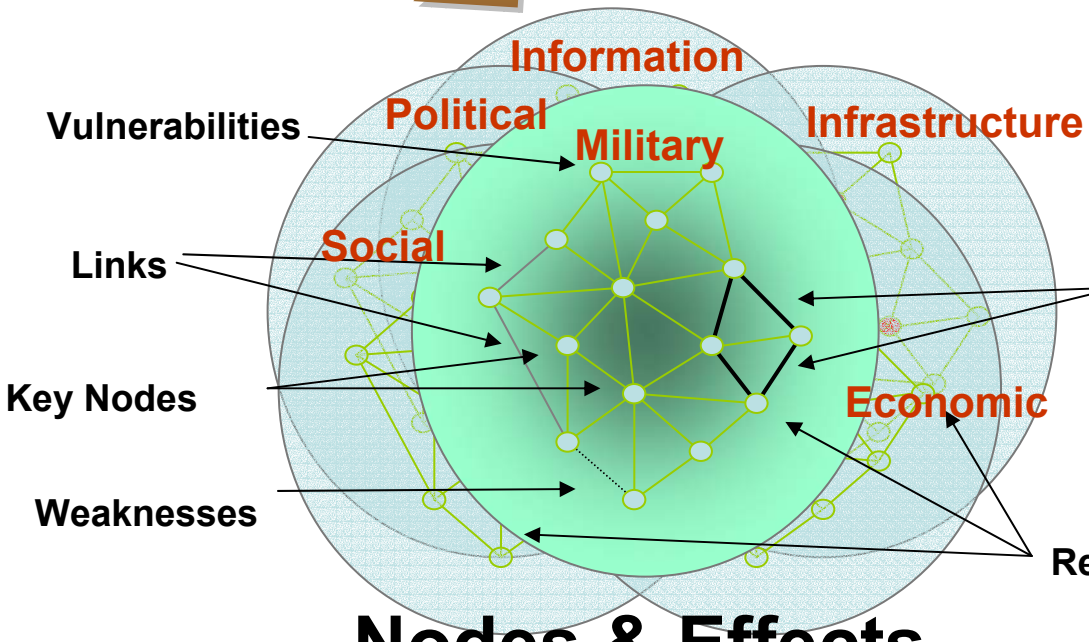
DIME Actions

- Diplomatic
- Information
- Military
- Economic

Effects-Based Operations

Functional Dimensions of the Battlespace

- **P** Political
- **M** Military
- **E** Economic
- **S** Social
- **I** Information
- **I** Infrastructure



Nodes & Effects

Enactment of a Wicked Environment

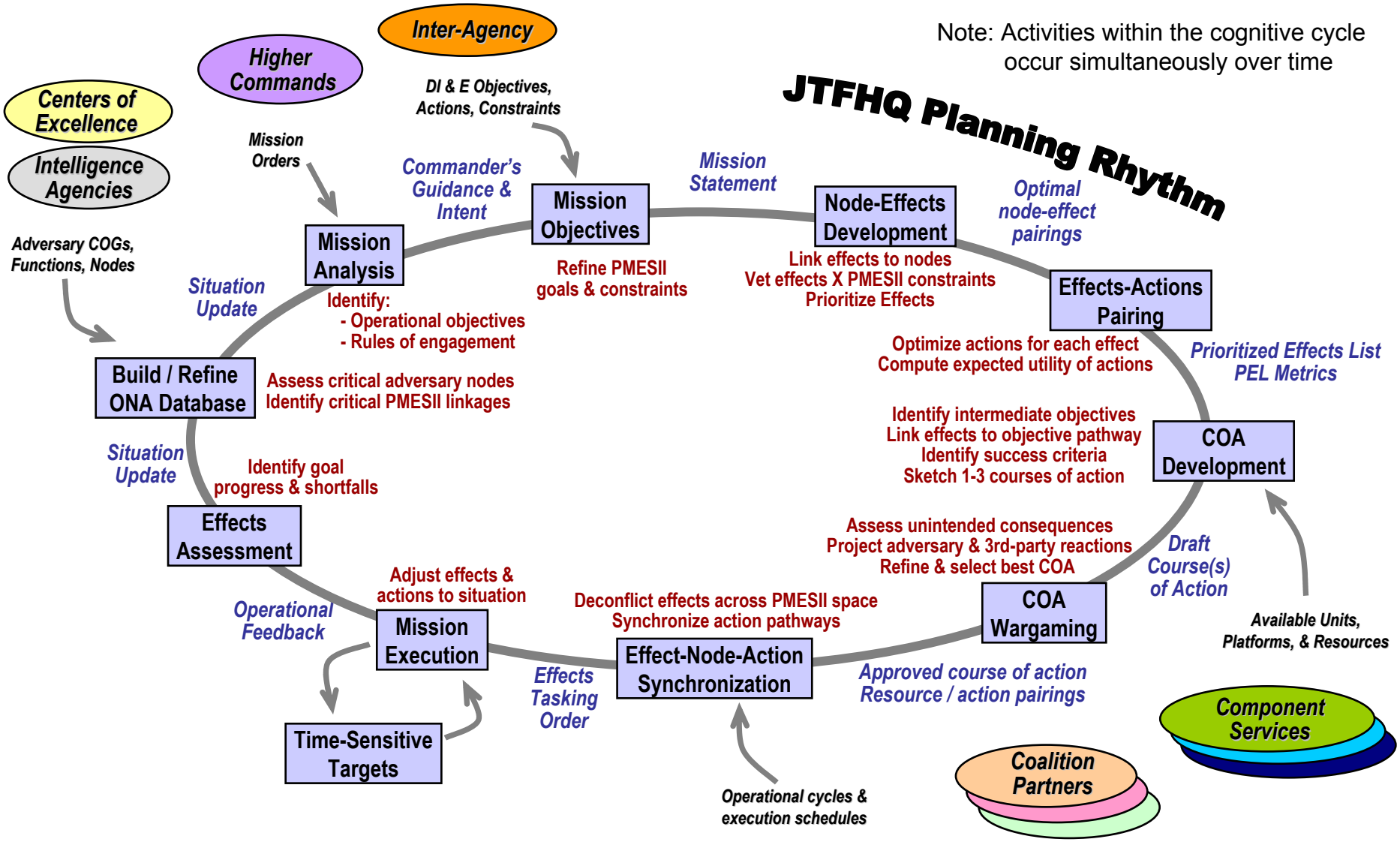
Wicked problem environment…

- Problem space is ill-structured
- No "right" solution, only "good enough"
- Problem-solving ends only when you run out of resources
- Unique/novel set of conditions and factors
- No second opportunities to do it again
- No obvious alternative solution

Sensemaking driven by action…

- Clarify/prioritize goals and constraints
- Characterize battlespace relative to these goals/constraints
- Identify key dimensions and variables predictive of cause/effect relationships
- Identify key obstacles to success
- Build solution paths to overcome obstacles

Future Joint Planning Rhythm (*Notional)

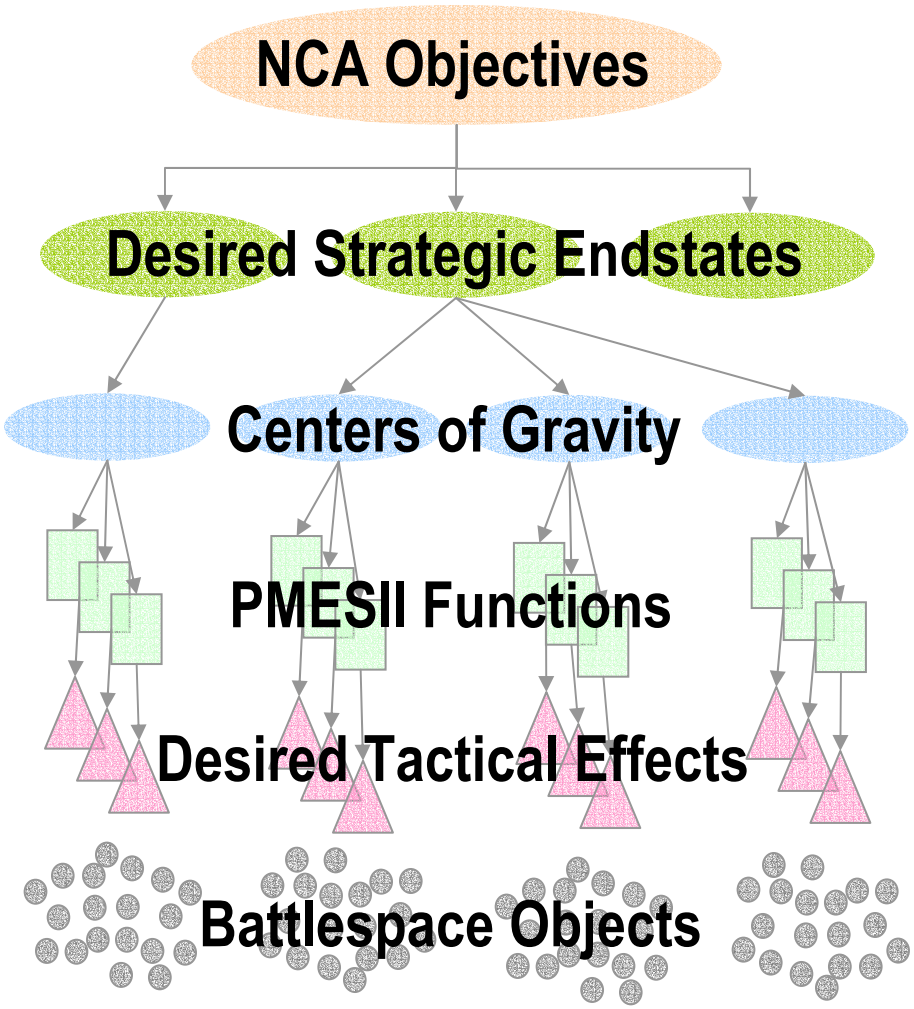


Modeling Challenges

1. **Representing the Sensemaking Framework of an Effects-Based Planning Process**
2. **Modeling the Collaborative Process of Knowledge Creation within an Effects-Based Planning Process**
3. **Defining the Relevant Dimensions of C2ISR System Performance**

Decomposition of an Effects-Based Knowledge Space

Abstraction Hierarchy



Abstract Knowledge

Analytic Knowledge

Concrete Knowledge

Corresponding Knowledge Products

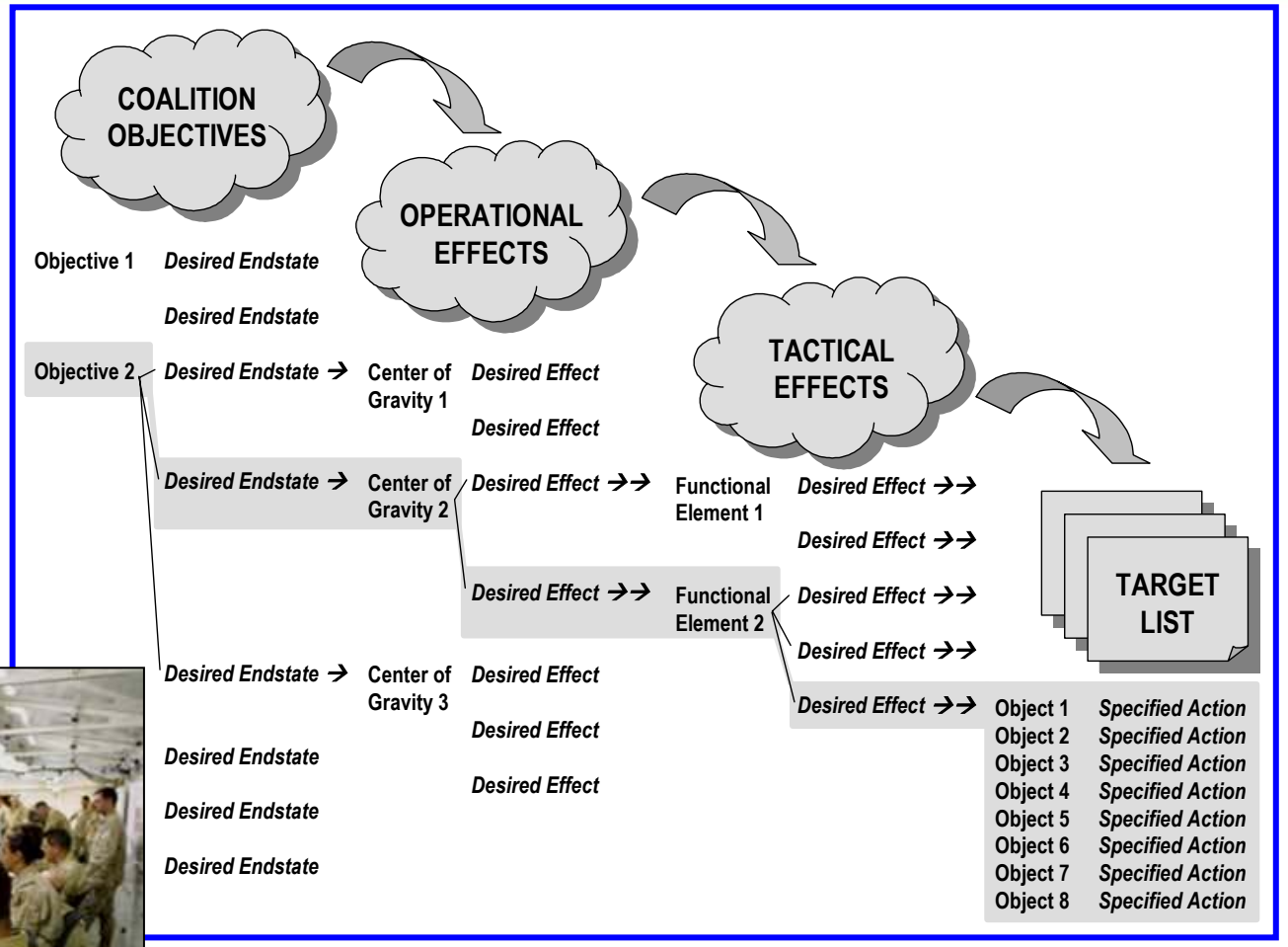
Commander's Guidance & Intent

Mission Statement

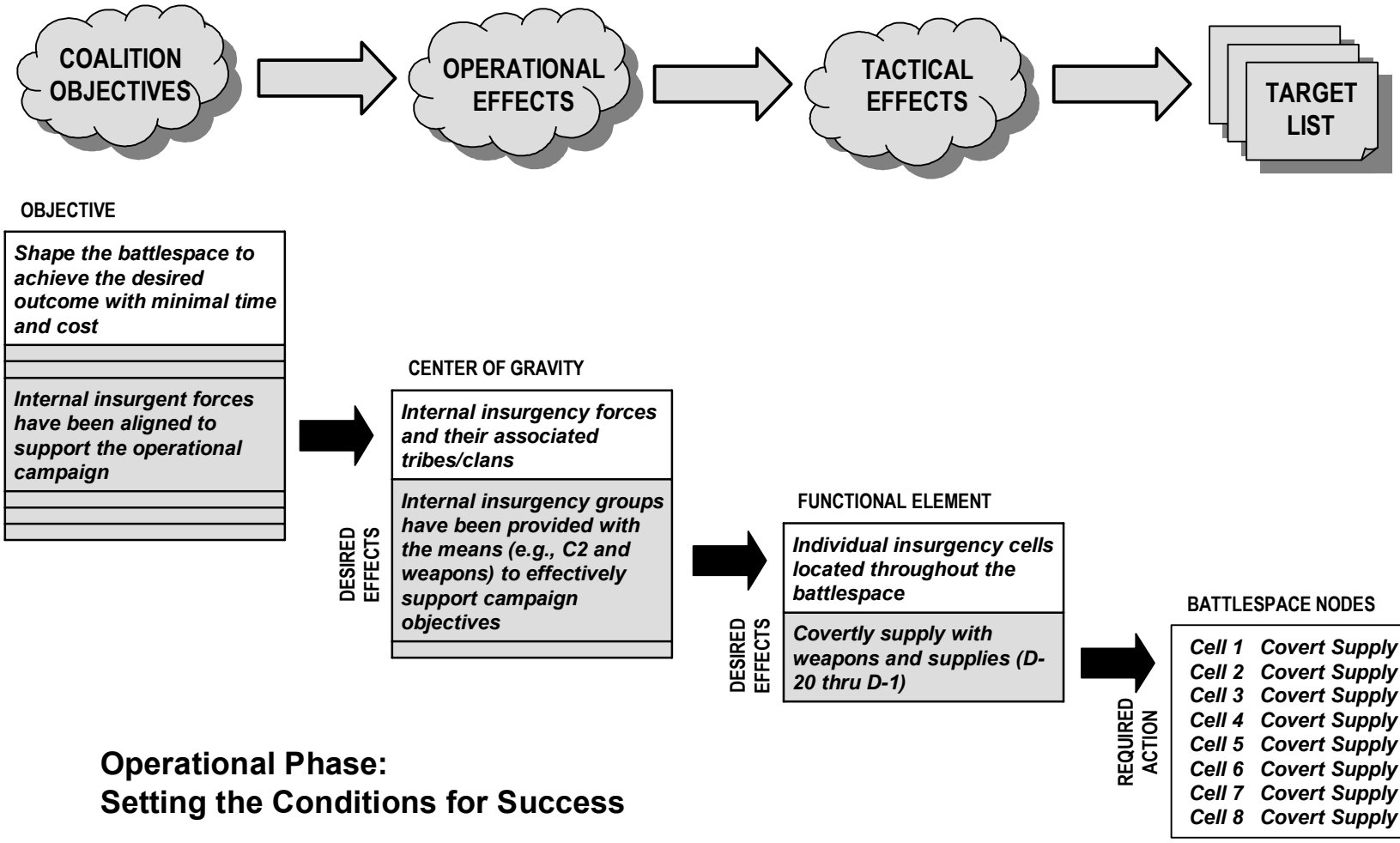
Prioritized Effects List

Joint Target List

Knowledge Elements within an Effects-Based Operational Plan

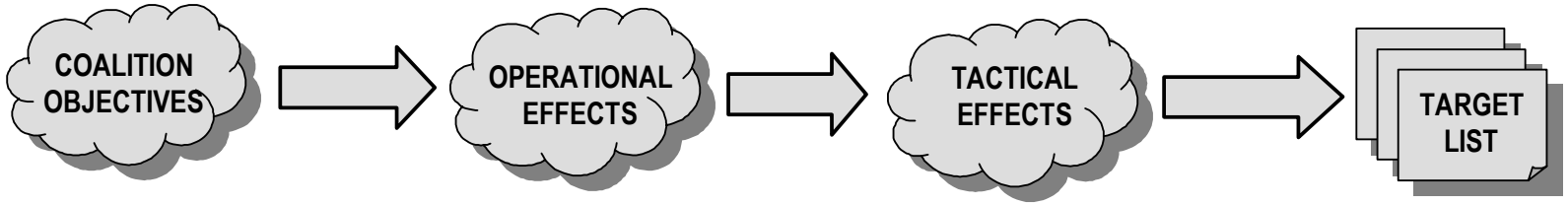


Example #1: Setting Conditions



Operational Phase:
Setting the Conditions for Success

Example #2: Stability and Reconstruction



OBJECTIVE

DESIRED ENDSTATES
Establish interim conditions for "next state" in the stability process
Civil administration and civil police functions are effectively restored and able to assume responsibility for internal public order

CENTER OF GRAVITY

DESIRED EFFECTS
Local city, town, and village civil administration
Local civil administration functions are restored to effective functioning

FUNCTIONAL ELEMENT

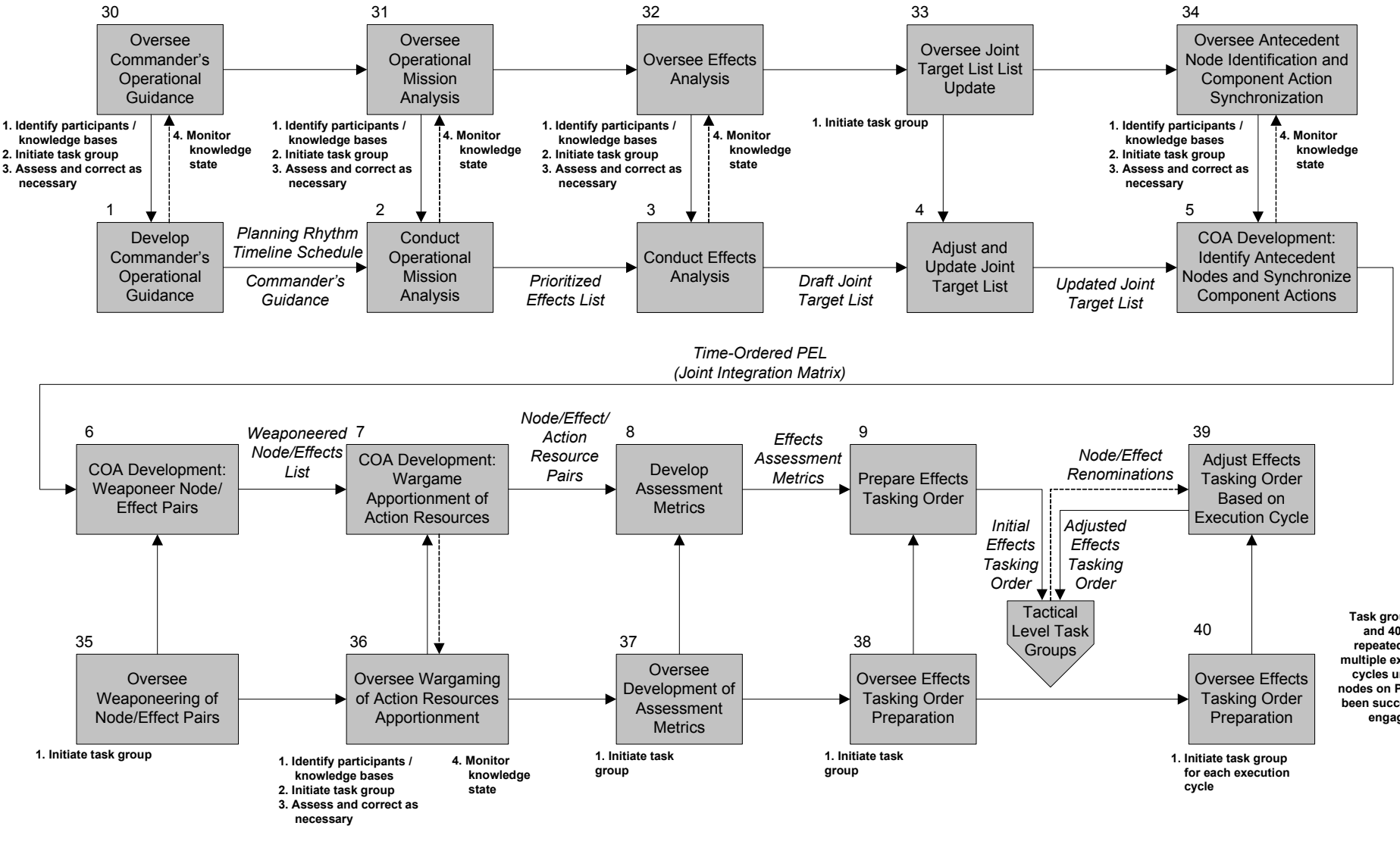
DESIRED EFFECTS
TV/radio/newspaper media
Positive reporting to promote sense of optimism and normalcy, weekly (D+150 thru D+300)

BATTLESPACE NODES

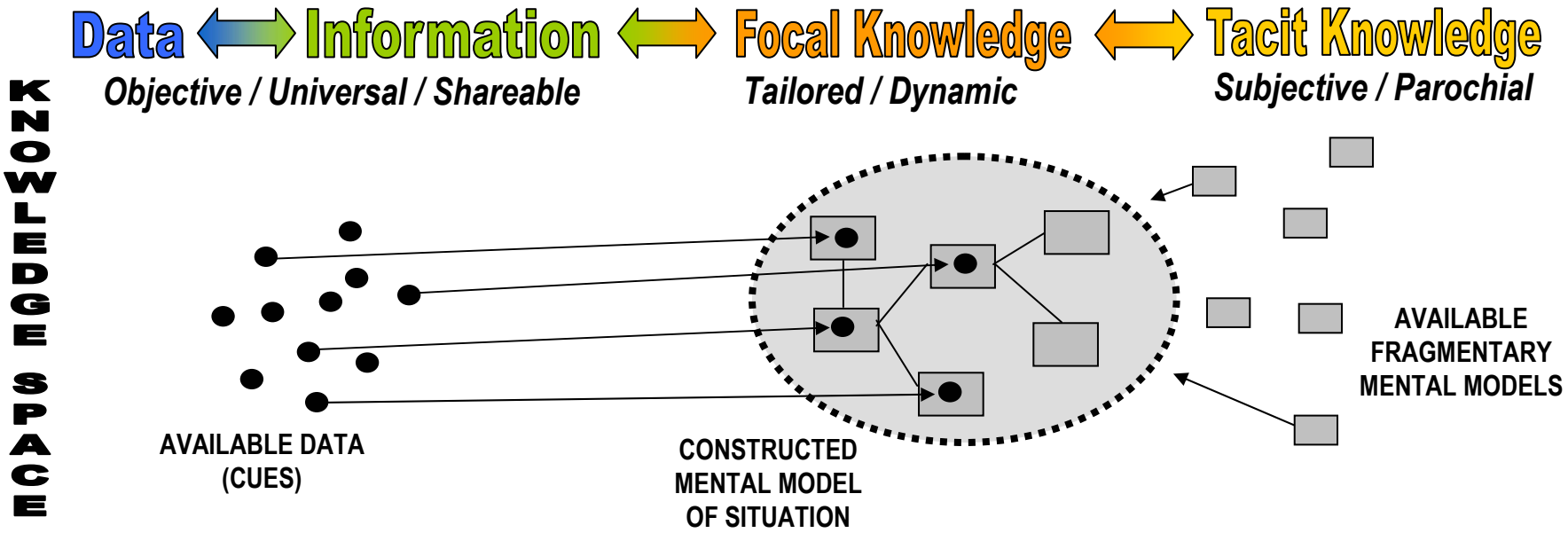
REQUIRED ACTION	
TV 1	*Info Campaign*
TV 2	*Info Campaign*
Radio 1	*Info Campaign*
Radio 2	*Info Campaign*
Radio 3	*Info Campaign*
Radio 4	*Info Campaign*
Newspaper 1	*Info Campaign*
Newspaper 2	*Info Campaign*

Operational Phase:
Stability and Reconstruction

Linking Knowledge Products with Staff Workflow

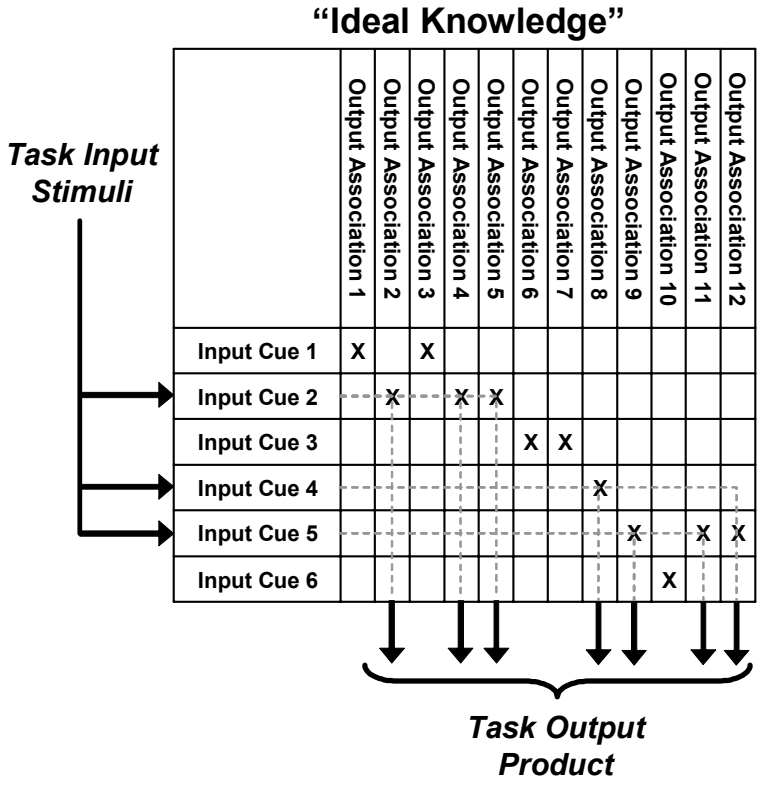


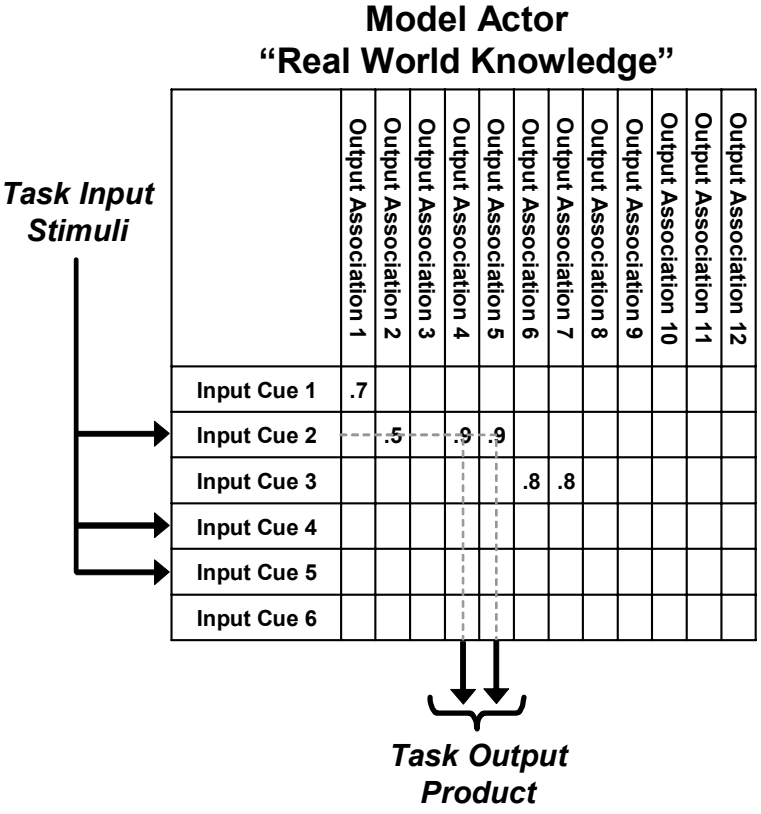
Data/Frame Model of Individual Sensemaking



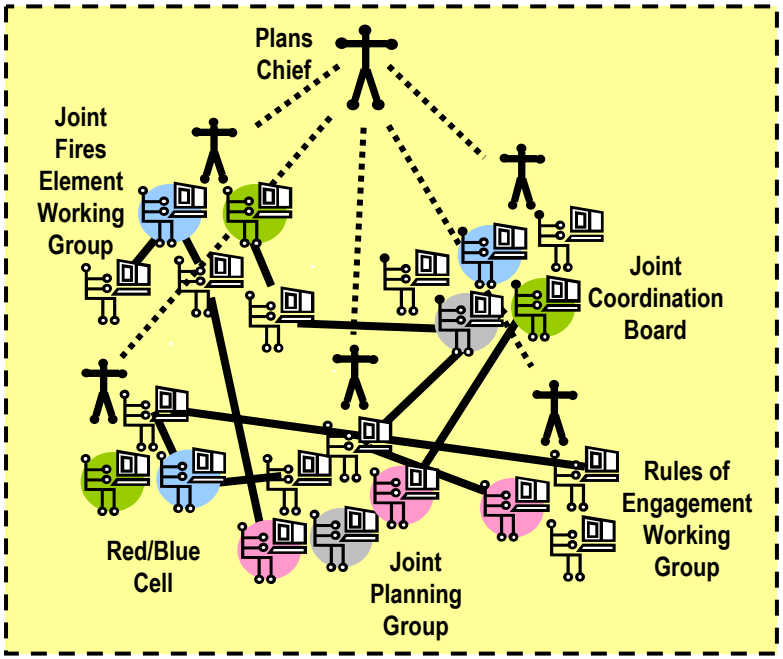
Sieck, W.R.; Klein, G.; Peluso, D.A.; Smith, J.L. & Harris-Thompson, D. (2004). *FOCUS: A Model of Sensemaking*. Fairborn, OH: Klein Associates, Inc.

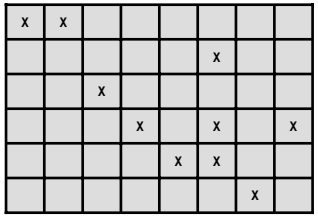
Representing Individual Tacit Knowledge



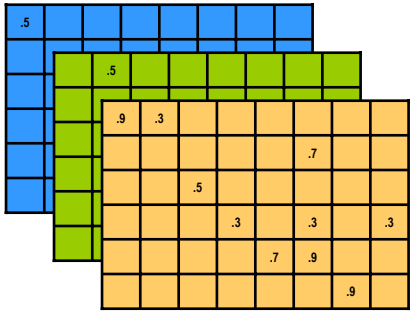


Collaborative Integration of Tacit Knowledge

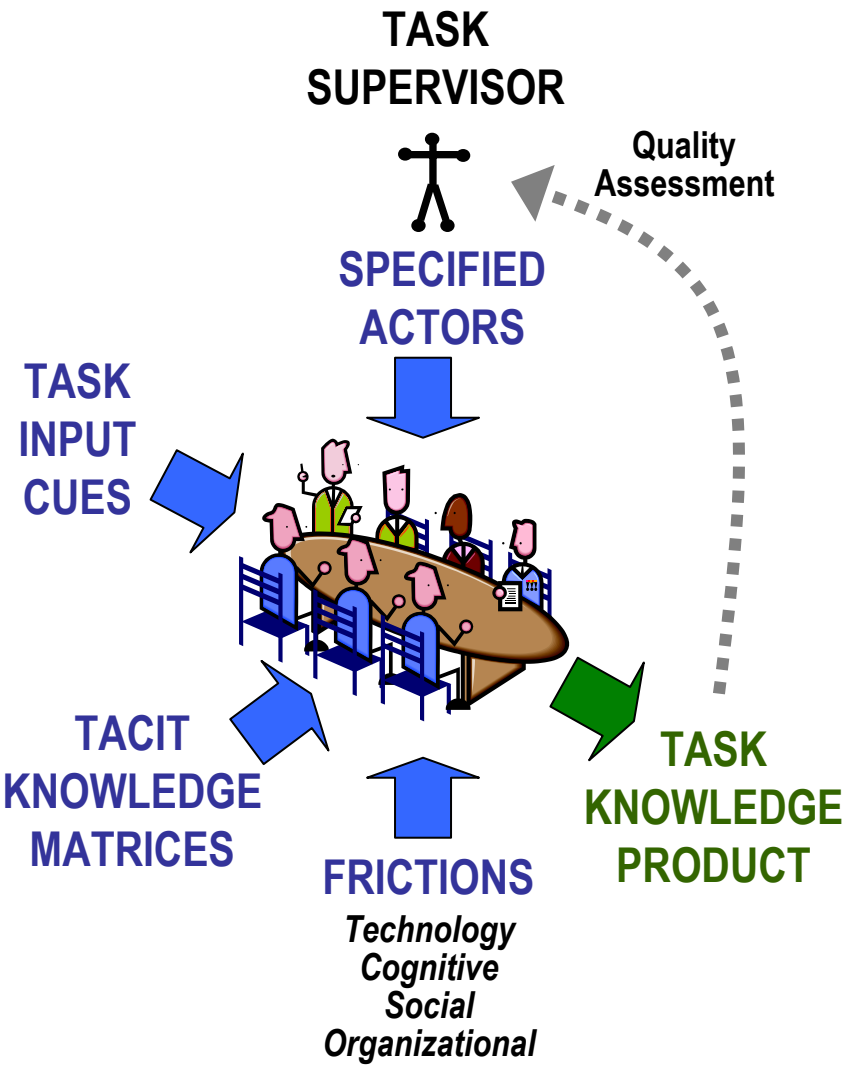




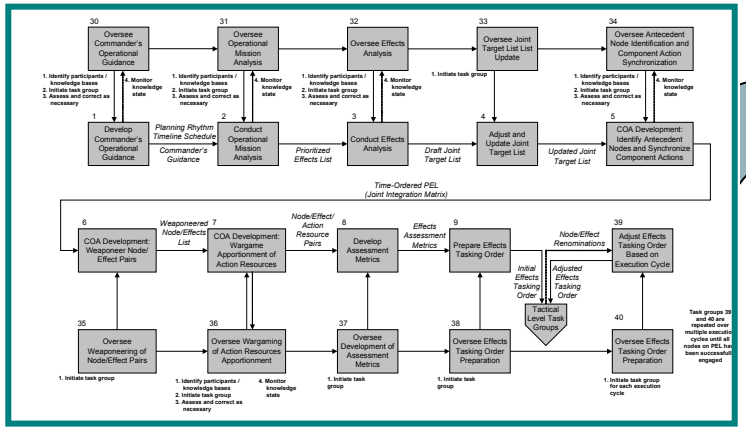
Reference "Ideal World" Knowledge Matrix



Individual Actor Area & Level Of Expertise



Command Intent → Joint Prioritized Target List



ACTIONABLE KNOWLEDGE STATE

COALITION OBJECTIVES

DESIRED ENDSTATES

CENTERS OF GRAVITY

FUNCTIONAL ELEMENTS

NODES / MISSION PACKAGES

1110101

Collaborative Output of Knowledge Association Task

1111100110011

Collaborative Output of Knowledge Association Task

11111110011100011

Collaborative Output of Knowledge Association and Vetting Tasks

1101111111011100000111111000000001111010101

Collaborative Output of Knowledge Association, Vetting, 2nd-Order Effects, and Antecedent Tasks

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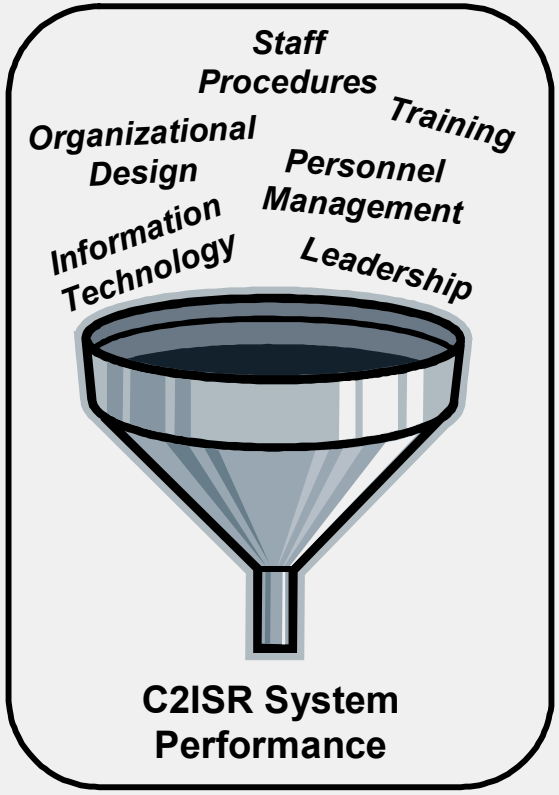
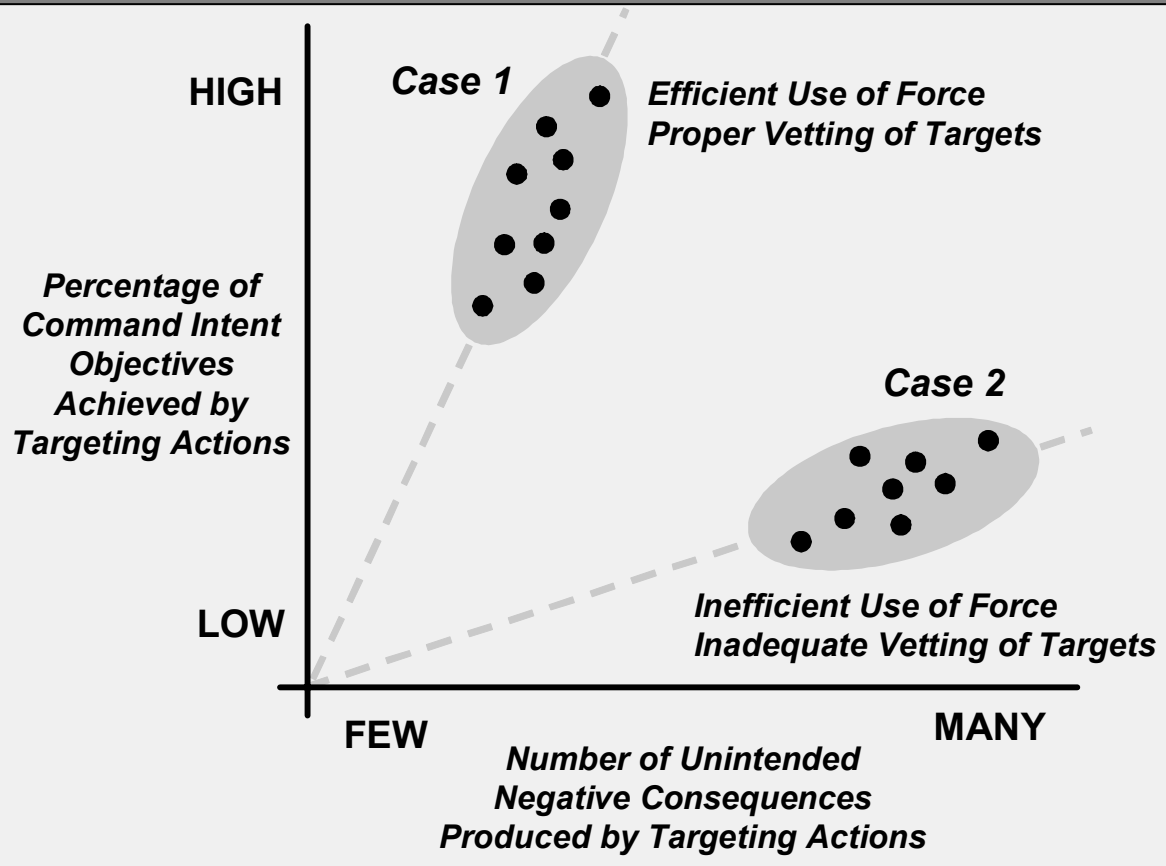
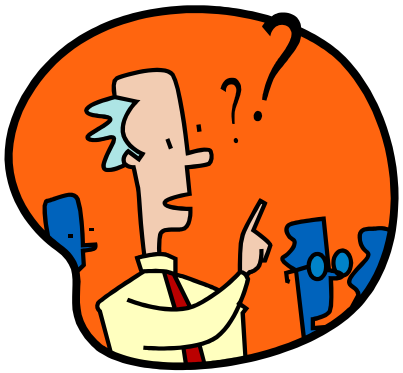
C2ISR System Performance





Summary

- This AFRL-funded project shifts the focus of C2ISR modeling from information collection / management to sensemaking and knowledge creation
- This shift of modeling focus is motivated by the advent of 4th generation warfare and effects-based operations
- The approach is well-grounded in the socio-cognitive literature
- Key aspects of this modeling approach include
  - The explicit representation of knowledge elements that reflect the decomposition of command intent into prioritized targeting actions
  - The linkage of cognitive work flow and collaboration patterns with the effective (or ineffective) creation of these knowledge elements



QUESTIONS ?