Background

- A networked enabled approach to C2 is required to meet 21st Century mission challenges.

- NEC is a strategic vision, not an implementation plan.

- Progress has been inhibited by a lack of an ability to:
  - Characterize and understand current C2 approaches and capabilities;
  - Measure C2 “quality;” and
  - Identify milestones on the road to NEC.

- NATO RTO chartered a research group to remove these impediments to progress.
Agenda

• 21st Century Mission Challenges
• Implications for Command and Control
• C2 Approaches
• C2 Maturity
• C2 Agility

The Problem

*There is a fundamental disconnect between*

the state of the art and practice of Command and Control & 21st Century Mission challenges
The value chain is broken!

The Result

21st Century Missions

21st Century Missions are Complex Endeavors

Complexity in the Task and Environment

+ Complexity of ‘Self’

= Complex Endeavor
The success of 21st Century Missions requires a multi-dimensional effects space
- political, social, economic, military

The complexity of the mission is a result of the interactions between and among the effects particularly across dimensions and the uncertainties associated with a cascading effects chain.

Complexity of Self

Self = A large number of heterogeneous, independent entities that differ significantly with respect to:

- Culture, values and norms
- Laws, policies, rules, and regulations
- Practices and processes
- Levels of trust
- Language
- Information and communications capabilities
- Approach to organization and management

The complexity of ‘Self’ comes from the nature of the interactions between and among the participating entities and the dynamics of the situation that affect entity willingness, constraints, perceptions, and capabilities.
Agenda

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Implications for Command and Control

• There will not be a unified chain of command.
• Entities will each have their own intent.
• The situation will be, in part, unfamiliar to all entities.
• There will be multiple planning processes.
• Critical information and expertise necessary to understand the situation will be non-organic.
• Actions, to be effective, will require developing synergies between and among entity actions.

There is a difference between Entity Command and Control and Collective Command and Control
Key C2 Issues

Is Command and Control (in the traditional sense) for Complex Endeavors an Oxymoron?

Are there new approaches to accomplishing the functions we associate with traditional Command and Control that have a better chance of success?
Key C2 Issues

Is Command and Control (in the traditional sense) for Complex Endeavors an Oxymoron?

The Answer is YES!

Are there new approaches to accomplishing the functions we associate with traditional Command and Control that have a better chance of success?

21st Century C2

The Mission Space

• Virtually all endeavors will be complex
• Situations will be dynamic
• The more complex and dynamic the situation, the greater demands on C2

Approach to Command and Control

• There are many ways to accomplish the functions associated with Command and Control
• No one approach fits all missions or situations
• The most appropriate approach will be a function of the endeavor
• Entities will need to be able to utilize more than one C2 approach
• The Collective needs to be able to adopt an appropriate C2 approach
Agenda

- 21st Century Mission Challenges
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- C2 Agility

C2 Approach Space

- Allocation of Decision Rights to the Collective
- Patterns of Interaction Among Entities
- Distribution of Information Among Partners
C2 Approach Space

Allocation of Decision Rights to the Collective

Patterns of Interaction Among Entities

Distribution of Information Among Participants

Traditional Military Organizations

Edge Organizations

Allocation of Decision Rights to the Collective
### Archetype C2 Approaches

<table>
<thead>
<tr>
<th>C2 Approach</th>
<th>Allocation of Decision Rights to the Collective</th>
<th>Inter-Entity Information Sharing Behaviors</th>
<th>Distribution of Information (Entity Information Positions)</th>
</tr>
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<tbody>
<tr>
<td>Edge C2</td>
<td>Not Explicit, Self-Allocated (Emergent, Tailored, and Dynamic)</td>
<td>Unlimited Sharing as Required</td>
<td>All Available and Relevant Information Accessible</td>
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<tr>
<td>Collaborative C2</td>
<td>Collaborative Process and Shared Plan</td>
<td>Significant Broad Sharing</td>
<td>Additional Information Across Collaborative Areas/Functions</td>
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<td>Coordinated C2</td>
<td>Coordination Process and Linked Plans</td>
<td>Limited Focused Sharing</td>
<td>Additional Information About Coordinated Areas/Functions</td>
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<tr>
<td>Deconflicted C2</td>
<td>Establish Constraints</td>
<td>Very Limited Sharply Focused Sharing</td>
<td>Additional Information About Constraints and Seams</td>
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<tr>
<td>Conflicted C2</td>
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<td>No Sharing of Information</td>
<td>Organic Information</td>
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</table>

### C2 Approaches

- **Edge C2**: Not Explicit, Self-Allocated (Emergent, Tailored, and Dynamic)
- **Collaborative C2**: Collaborative Process and Shared Plan
- **Coordinated C2**: Coordination Process and Linked Plans
- **Deconflicted C2**: Establish Constraints
- **Conflicted C2**: None
- **Organic Information**: No Sharing of Information
Agenda

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C2 Maturity and C2 Approaches

- A Maturity Model has the following essential properties:
  - Identifies different levels of capability that are achievable;
  - Entities and Collectives, as they mature, will be able to achieve higher levels of capability;
  - Maturity levels must be measurable.

![C2 Maturity Levels Diagram]
## C2 Maturity

<table>
<thead>
<tr>
<th>Level 5</th>
<th>Content of C2 Toolkit</th>
<th>C2 Approach Decision Requirement</th>
<th>Transition Requirements</th>
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<tbody>
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<td>Coordinated C2</td>
<td>De-Conflicted C2</td>
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<tr>
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<td>De-Conflicted C2</td>
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## Agenda

- 21st Century Mission Challenges
- Implications for Command and Control
- C2 Approaches
- C2 Maturity
- C2 Agility
C2 Agility

- Agility is an umbrella concept that includes:
  - Responsiveness;
  - Robustness;
  - Resilience;
  - Flexibility;
  - Innovativeness;
  - Adaptability.

- C2 Agility is the ability to maintain effective C2 as a function of changing circumstances and stresses.

### C2 Agility Transition Requirements

<table>
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<th>C2 Approach Decision Requirement</th>
<th>Contents of C2 Toolkit</th>
<th>C2 Maturity Levels</th>
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C2 Agility

- C2 Agility involves more than being able to recognize the nature of the situation and adjust the C2 Approach.
- C2 Agility also involves being able to maintain an acceptable level of effectiveness in the face of:
  - Physical, Electronic, and Cyber attacks that destroy or degrade nodes and/or links;
  - Information attacks that result in a loss of information or the insertion of misinformation;
  - A loss of trust in information, services, or entities;
  - An austere environment that limits connectivity and services;
  - ... .

Summary

- The NATO NEC C2 Maturity Model enables entities and collectives to:
  - Characterize and understand current C2 approaches and capabilities;
  - Measure C2 “quality”;
  - Identify milestones on the road to NEC.

- For a given situation there are minimum levels of C2 Maturity and Agility required for success.
  (Requisite C2 Maturity and Requisite C2 Agility)

- Increased C2 Maturity is necessary, but not sufficient to achieve C2 Agility.
Homework Assignment

- Distribution of Information Among Participants
- Patterns of Interaction Among Entities
- Allocation of Decision Rights to the Collective
- Edge Organizations

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