C2 Approaches: Looking for the Sweet Spot

- Dr. David S. Alberts - IDA
- DR. Francois Bernier - DRDC
- Dr. Kevin Chan - ARL
- Marco Manso - Portugal
Outline

- Background
- C2 Approach Space and the “diagonal”
- Hypotheses
- Results of Experiment
C2 Approach Space

A C2 approach
The C2 Approach Space, taken at face value, only provides a taxonomy that allows us to describe significant differences between and among different approaches to C2.

It says nothing about the relative merits of the possible C2 Approaches contained within.

However, the very existence of more than one approach can be interpreted to mean that C2 Approaches:

- located in certain parts of this space are ‘better’ than those located in other parts of this space and/or,
- located in different regions are more appropriate for different organizations, missions, and circumstances than others.
Why a “diagonal”?

- There is a long-recognized need for co-evolution that is required to maintain an appropriate balance with respect to the three C2 Approach dimensions.
- Thus, enabling those who have been delegated decision rights would seem to include a provision of an increased capability to interact as well as increased access to information.
- Thus, C2 Approaches that differ in the degree to which decision rights are allocated should differ in all three dimensions.
Hypotheses

This paper specifically addresses the following position-related hypotheses:

- The C2 Approach Space provides a useful way of characterizing and depicting the differences between and among C2 Approaches.
- The actual positions of a set of C2 Approaches may differ from their intended positions.
- For a given C2 Approach, those closest to the ‘diagonal’ are more effective.
- The dimensions of the C2 Approach Space are positively correlated to agility.
Hypotheses

- This paper specifically addresses the following position-related hypotheses:
  - The C2 Approach Space provides a useful way of characterizing and depicting the differences between and among C2 Approaches.
  - The actual locations of a set of C2 Approaches may differ from their intended positions.
  - For a given C2 Approach, those located closest to the ‘diagonal’ are more effective.
  - The dimensions of the C2 Approach Space are positively correlated to agility.
Where is the “diagonal” located

- The diagonal implied by the NATO NEC C2 Maturity Model graphic is only notional.
- This is because there are no scales specified for the dimensions.
- There is no reason to believe that the diagonal is linear.
- The location and shape of the diagonal depends upon:
  - Scales used.
  - Inter-dependencies between the dimensions.

Source: NATO NEC C2 Maturity Model
Locating the “diagonal”

- SAS-085 Campaign of Experiments defined scales for each of the dimensions of the C2 approach Space
- SAS-085 measured the actual locations of the entity in the C2 Approach Space under every circumstance simulated
- The diagonal implied by the NATO NEC C2 Maturity Model graphic is only notional. This is because no scales were specified for these dimensions
- Thus, there is no reason to believe that the diagonal is linear. The location and shape of the diagonal will depend upon
  - Scales used
  - Inter-dependencies between and among the three dimensions
### The scales employed

<table>
<thead>
<tr>
<th>C2 Approach Dimension</th>
<th>Nature of Measure</th>
<th>ELICIT Metric</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Allocation of Decision Rights</strong> (ADR)</td>
<td>degree to which decision rights are distributed; a measure of participation in decision making</td>
<td>ratio of the number of individuals exercising decision rights to the total number of individuals</td>
</tr>
<tr>
<td><strong>Pattern of Interactions</strong> (PoI)</td>
<td>density of interactions between and among individuals; a measure of quality, frequency, and reach</td>
<td>square root of the number of information-related transaction and scaling them between 0 and 1 based upon the maximum number of transactions observed</td>
</tr>
<tr>
<td><strong>Distribution of Information</strong> (DoI)</td>
<td>degree to which individuals have access to available information</td>
<td>average percent of available factoids received by an individual</td>
</tr>
</tbody>
</table>
C2 Approaches: actual positions
C2 Approaches: intended v. actual positions
C2 Approaches: positions where most / least effective
Where is the diagonal located?

- Do we use the ‘intended’ positions of the C2 Approaches as points along the diagonal?
- Do we use the location for each C2 approach that is most effective given the circumstances simulated?
- We chose to use the most effective location for two reasons:
  - It was an observed position rather than an aspiration
  - If they understood the relationship between the location and effectiveness, we assumed that this would be their intended position
Findings

- Location is related to effectiveness

- Locations that differ significantly from a co-evolved or balanced position suffer a loss of effectiveness

- Thus, there is a “sweet spot” that can be identified for a given C2 approach with respect to a given Endeavor Space