Meeting Critical Complex Endeavor Assessment Challenges

Dr. David S. Alberts
Institute for Defense Analyses
Alexandria, VA, USA
davidsalberts@gmail.com

IDA

Agenda

- Objectives
- Summary
- Key Concepts
- Feasibility
- Way Ahead

Objectives

- Military Objectives:
  - Improve commanders' ability to ensure that command and control arrangements are appropriate for a given mission and circumstances and are being executed as envisioned
- Research Objectives:
  - Demonstrate the applicability of C2 Theory to Operations Assessment
  - Identify next steps in moving theory to practice

IDA

Summary

- Complex Endeavors present a unique set of Operations Assessment challenges (highly dynamic, multi-dimension effects space, require a complex enterprise)
- Commanders need to not only know if an operation is not proceeding to plan, but also why and what to do if not
- C2-related failures are often the root cause of mission difficulties / failures; fixing C2 would improve mission outcomes.
- Therefore, the “state of C2” needs to be monitored and analyzed
- C2 Theory provides an empirically-derived basis to observe the state of C2, diagnose problems, and suggest remedies
- Case studies and experiments have successfully employed the metrics needed
- Thus, OA could be more effective in identifying when operations are going off plan and correct the situation, if they incorporate C2-related assessments.

Key Concepts

- Operations Assessments
- Complex Endeavors
- C2 Approach
- C2 Agility

Operations Assessment

- OA seeks to provide real-time answers to the following questions:
  - Where are we (in all relevant dimensions)?
  - Is this an acceptable place to be?
  - If so, what to we need to do to continue on this path?
  - If not, where do we want to be? Why do we think it turned out this way? How can we change things to get back on course?
- Currently OA is focused almost exclusively on mission-related MoE
- OA practice assumes that if things are not going well, we need to do different things not the same things employing a different approach to C2.

Complex Endeavors

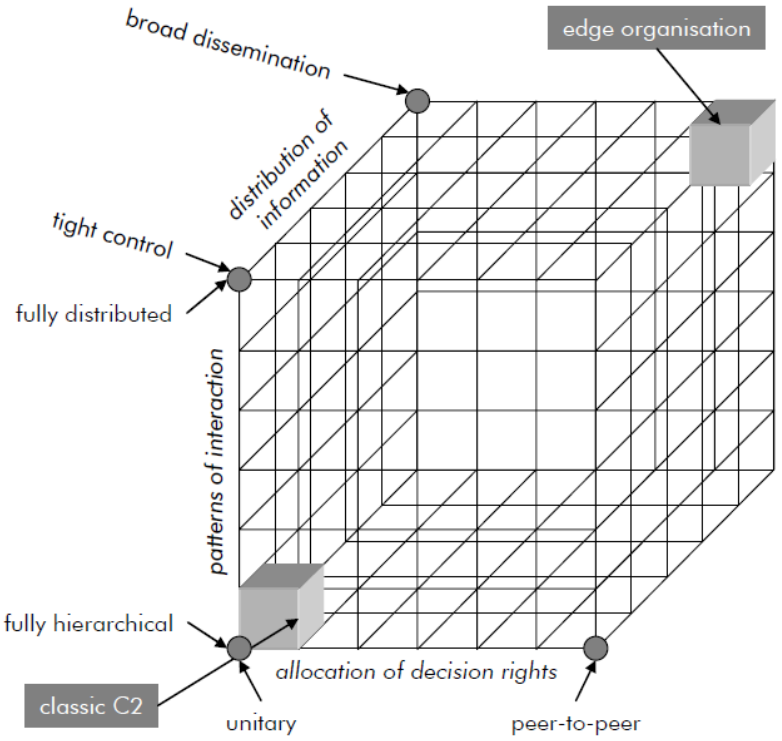
- The term *Complex Endeavors* is used here to refer to undertakings that have one or more of the following characteristics:
  - The number and diversity of the participants is such that
    - there are multiple interdependent "chains of command"
    - the objective functions of the participants conflict with one another or their components have significantly different weights
    - the participants' perceptions of the situation differ in important ways
  - The effects space spans multiple domains and there is
    - a lack of understanding of networked cause and effect relationships
    - an inability to predict effects that are likely to arise from alternative courses of action
    - the situation is dynamic

Complex Endeavors

- The term *Complex Endeavors* is used here to refer to undertakings that have one or more of the following characteristics:
  - The number and diversity of the participants is such that
    - there are multiple interdependent "chains of command"
    - the objective functions of the participants conflict with one another or their components have significantly different weights
    - the participants' perceptions of the situation differ in important ways
  - The effects space spans multiple domains and there is
    - a lack of understanding of networked cause and effect relationships
    - an inability to predict effects that are likely to arise from alternative courses of action
    - the situation is dynamic

C2 Approach

- There is more than one way to accomplish the functions associated with Command and Control
- The differences between and among C2 Approaches have been found to be related to
  - Decision rights allocation
  - Patterns of Interactions
  - Distribution of Information



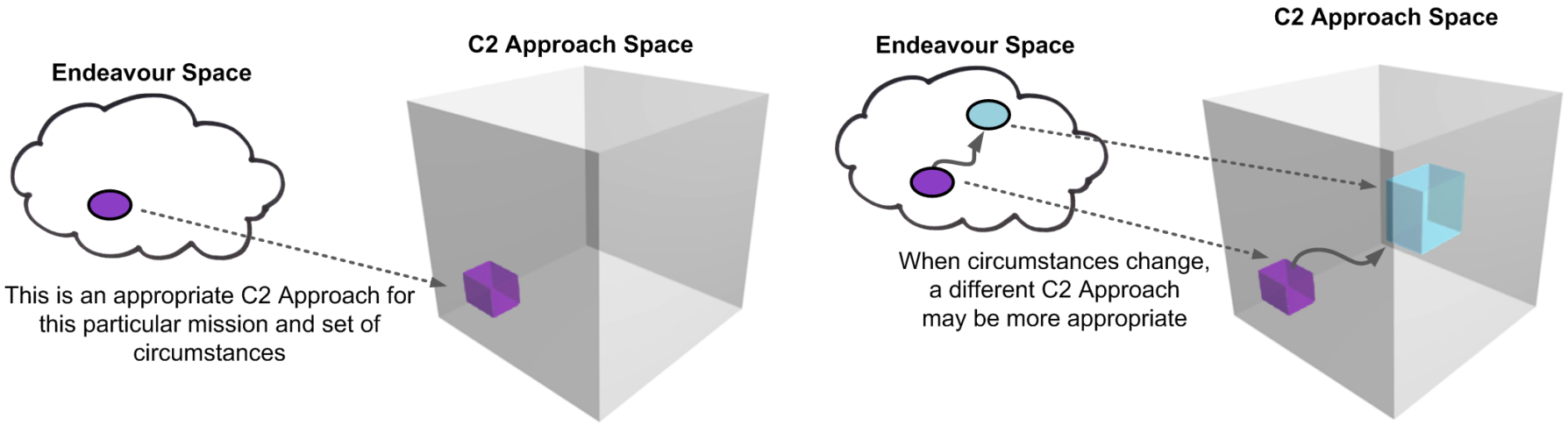
IDA

Need for C2 Agility

- There is no one-size-fits-all C2 Approach that works well for all missions and circumstances and thus, militaries need to be able to execute different C2 Approaches.
- Complex Endeavors are dynamic and, at times, changed circumstances will necessitate a need to change the C2 Approach (maneuver in the C2 Approach Space)
- Cyberattacks and the impact of cyber defenses can make some C2 Approaches infeasible.

C2 Agility Requirements

- C2 Agility requires
  - Locating one's current position in the C2 Approach Space
  - Determining if the current C2 Approach is appropriate
  - Understanding which C2 Approach options are appropriate
  - Recognizing the significance of changes in circumstances
  - Transitioning from one C2 Approach to another, as required

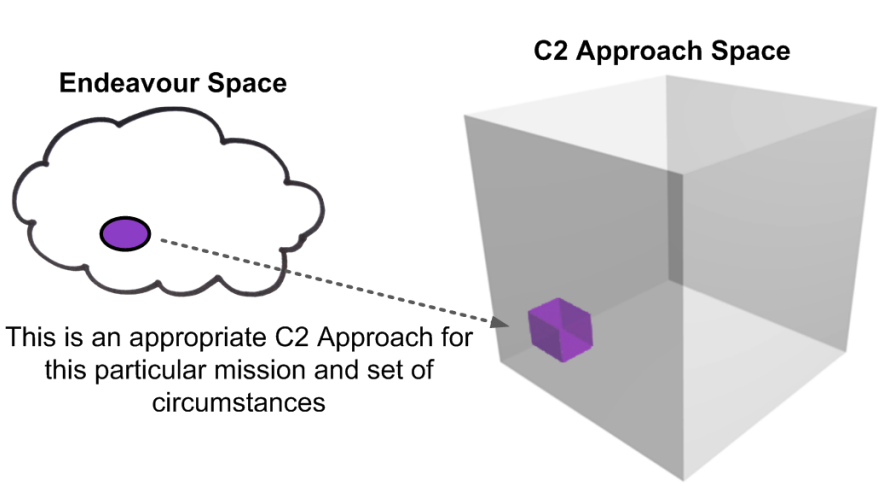


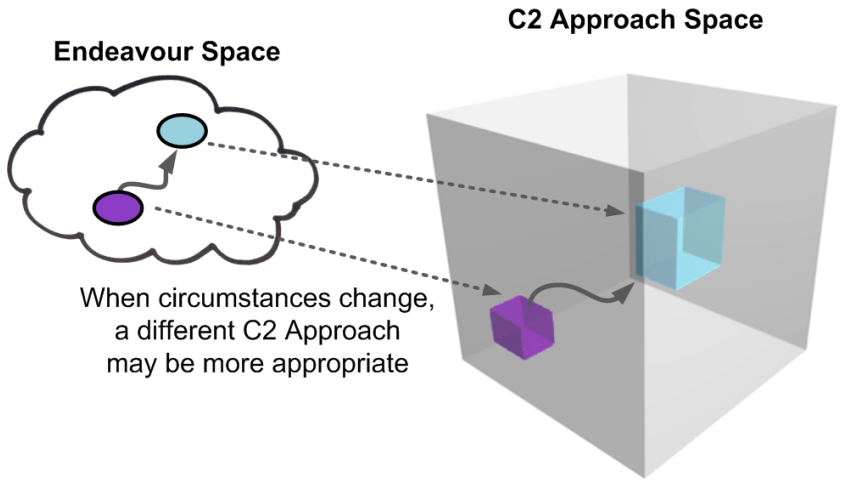
C2 Agility Requirements

- C2 Agility requires
  - Locating one's current position in the C2 Approach Space
  - Det
  - Und
  - Rec
  - Transitioning from one C2 Approach to another, as required

Do we know how to do these things?

Can we do them on the battlefield?





Feasibility of C2 Approach Monitoring and Assessment (1)

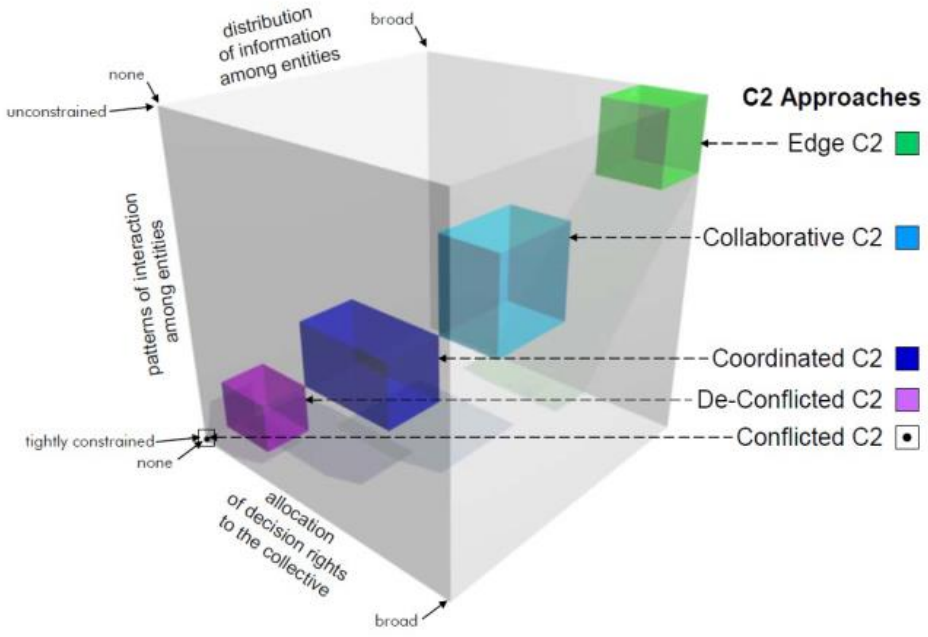
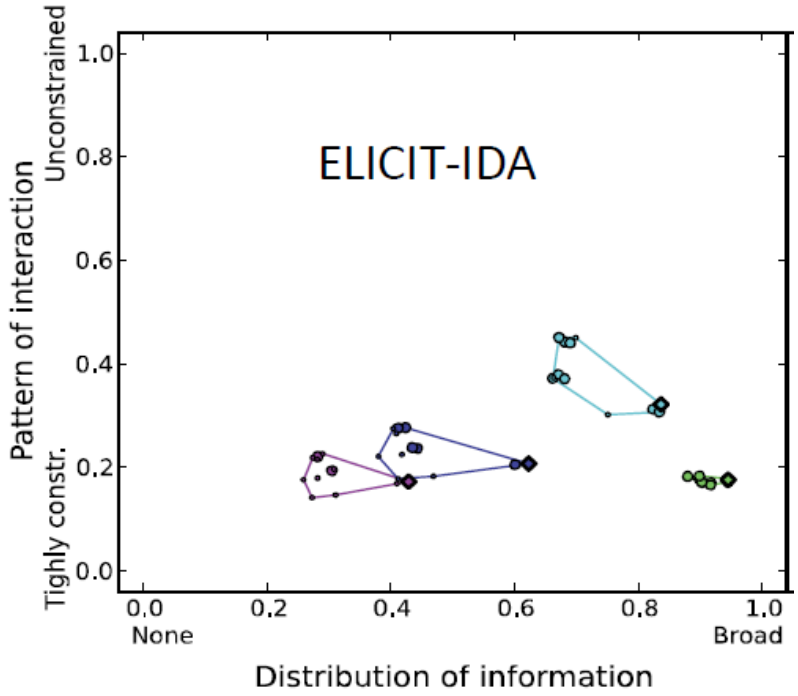


Figure ES 1. C2 Approaches as regions in the C2 Approach Space



Feasibility of C2 Approach Monitoring and Assessment (2)

Helmand Province Evidence Table

Concept/Enabler	Aug 2010 (Phase 1)	Sept 2010 (Phase 2)	Oct 2010 (Phase 3)	Nov 2010 (Phase 4)	Dec 2010 (Phase 5)	Jan 2011 (Phase 6)
C2 Maneuver Agility						
Endeavour Space Complexity	(Very) High	(Very) High	(Very) High	(Very) High	(Very) High	(Very) High
Appropriate (Required) C2 Approach	Edge	Edge	Edge	Edge	Edge	Edge
Actual C2 Approach	Conflicted	Conflicted	De-conflicted	Edge	Edge	Edge
Self-Monitoring	None	None	None	Recognized the need to change approaches	Recognized the need to change approaches	Recognized the need to change approaches
C2 Approach Space						
– Allocation of Decision Rights	Narrow (isolated)	Narrow (isolated)	Less Narrow (expanding network awareness)	Broad (expanding network awareness)	Broad (expanding network awareness)	Broad (expanding network awareness)
– Distribution of Information	Vertical Narrow Push	Vertical Narrow Push	Vertical/Lateral "push-pull"	Lateral "push-pull"	Lateral Push-pull	Lateral push-pull
– Patterns of Interaction	Tightly constrained	Tightly constrained	Constrained	Unconstrained	Un-constrained	Un-constrained
C2 Approach Agility						
Flexibility	Low	Low	Med	Med High	High	High
Adaptiveness	Low	Low	Med	Med high	High	High
Responsiveness	Low	Low	Med	Med High	High	High
Versatility	Low	Low	Med	Med High	High	High
Innovativeness	Low	Low	Med	Med High	High	High
Resilience	Med High	Med High	Med High	Med High	High	High

IDA

Way Ahead

- Increase awareness of the importance of understanding and monitoring one's C2 Approach
- Introduce C2 Approach monitoring and assessment into exercises and Experiments
- Develop instrumentation and visualization tools to facilitate monitoring and assessment
- Research C2 Approach related metrics
- Lessons learned re: appropriate C2 Approach as a function of mission and circumstances