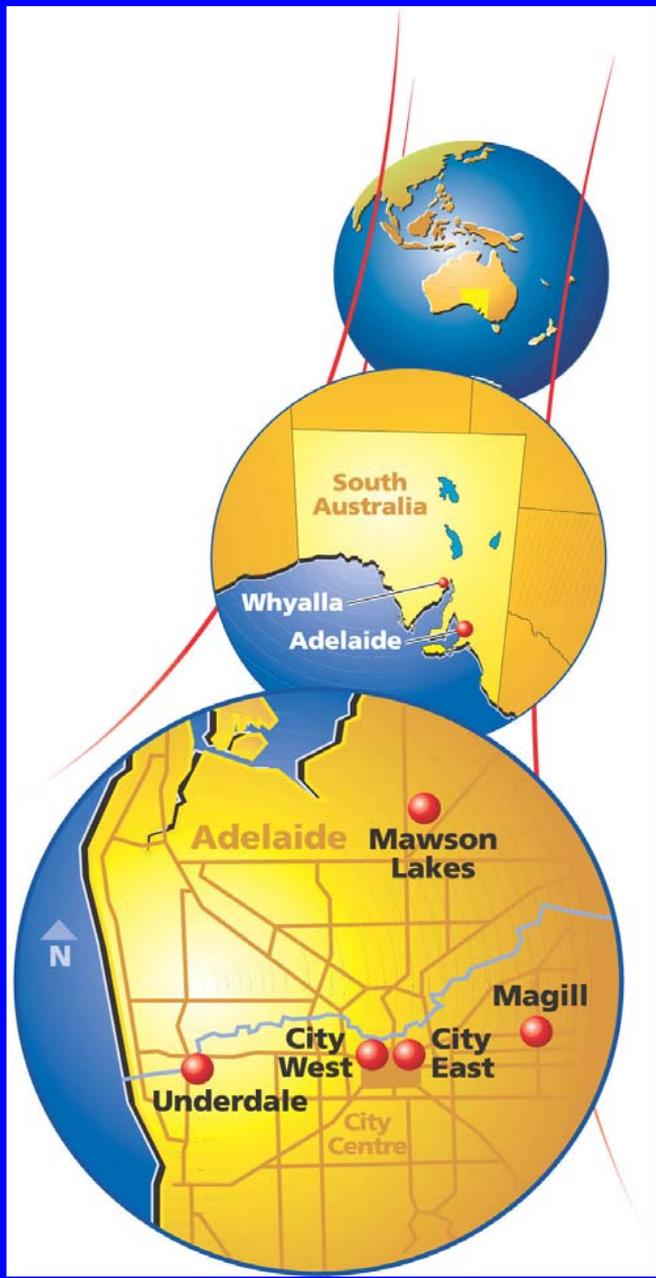SEEC

Harnessing complex socio-technical Systems

Towards a Science of Command & Control (C2)

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Outline

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Introduction

- Context - Command and control (C2) is recognised as a key enabler of military capability

- Need - What is lacking, however, is a rigorously defined framework for the systematic study of C2 as a means for advancing knowledge in this area

- Problem - What is the science of command and control?

Introduction

- Purpose - Understanding of research laboratories' coverage of the discipline, to determine areas of complementarity with allied laboratories, and to identify priority areas of C2 research

Command and Control?

- "We are so familiar with the words 'command and control' that one may believe no problem exists. After all, these two words sound like a perfect marriage, giving the impression of equal weighting, value, and importance. While few would challenge this observation, there is little consensus on what "command and control" really means." [Roman, 1996]
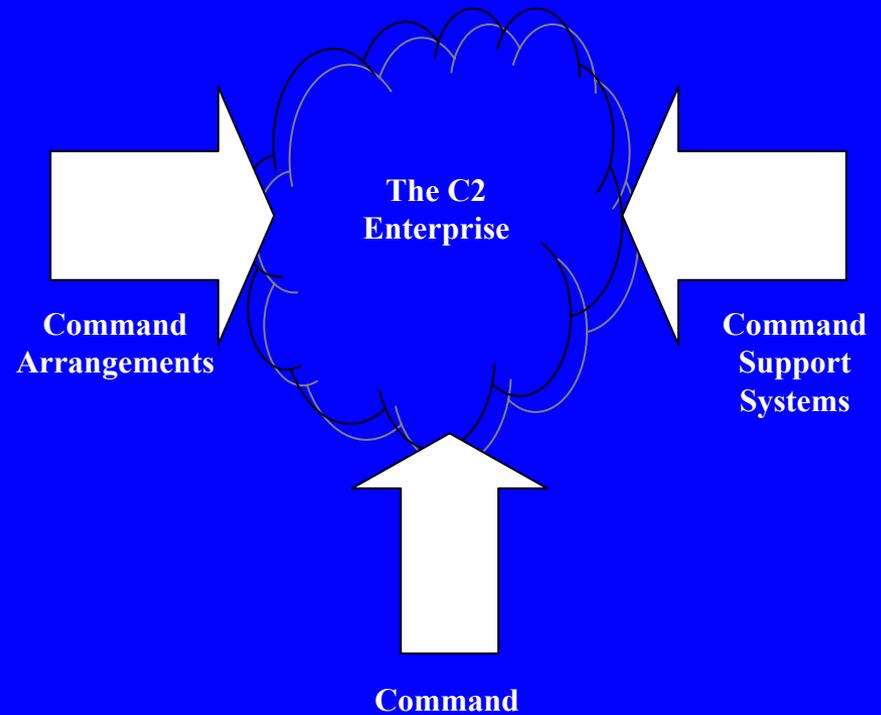
The C2 Triad

- Command Arrangements:
  - '…the degree of operational authority between headquarters, formations, and units' and are concerned with '…assigning missions and tasks for particular circumstances' [Australian DoD, 1998]

- Command:
  - The job of commanders is to '…lead, guide, and motivate their soldiers and organisations to accomplish missions and to win decisively. Command is the commander's business' [Alberts & Hayes, 1995]

- Command Support Systems:
  - '…functions are performed through an arrangement of personnel, equipment, communications, facilities, and procedures…' [US DoD, JP1-02, 2001]

What about Control?

- Command and control has become a compound word

- We don't attempt to understand "rock and roll" by separately analysing each of these words

- C2 is used in a variety of ways, each generally identifiable as one or more of the three meanings in the C2 triad

C2 as a System

- The properties of the C2 system only emerge at the level of the integrated system
- C2 is the art and science of the management of conflict

The C2 Enterprise

Command Arrangements

Command Support Systems

Command

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Drivers for a Science of C2

- The broad nature of C2 and C2 systems requires a theoretical basis that draws from 'hard' science and engineering AND 'soft' concepts of system architecting

Science

- Science can be regarded as a combination of:

  - An organised body of knowledge about a particular area of interest or endeavour;

  - The methods used for acquiring that body of knowledge, and;

  - The processes and methods of applying the body of knowledge.
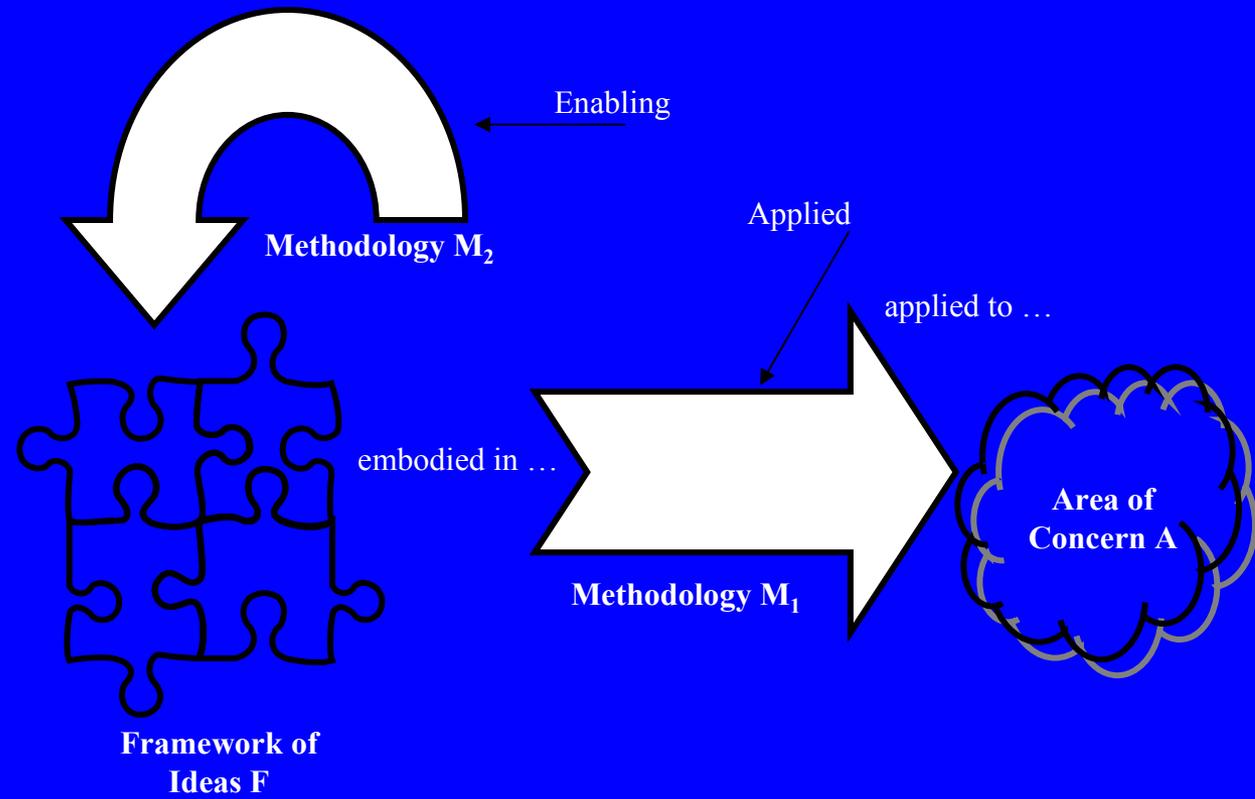
A Science of C2

- The <u>Science of C2</u> comprises:
  - The organised body of knowledge of the management of military operations that encompasses, at the highest level, command arrangements, command, and command support systems;
  - The method(s) of acquiring that organised body of knowledge through a set of qualitative and/or quantitative disciplines that underpin the management of military operations across the broad areas of command arrangements, command, and command support systems; and
  - The methods and processes to apply this body of knowledge to the creation and evolution of the socio-technical systems that underpin military operational management activities.

Research in C2

- How can the Science of C2 be used to drive research in C2?

C2 Research Framework

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Enabling

Methodology M$_2$

Applied

applied to …

embodied in …

Area of Concern A

Methodology M$_1$

Framework of Ideas F

Based on Checkland

Applications

- Analysis of research activities in C2:
  - Research Profile Matrix (RPM)
  - A tool to analyse the relative strengths/weaknesses of a C2 research organisation
  - Potential as a tool to address areas of complementarity and collaboration

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Area of Concern	Command Arrangements	Command	CSS
Framework of Ideas. (The Body of Knowledge: level of maturity, expertise, manuals)	Maturity of Knowledge: High	Maturity of Knowledge: Low	Maturity of Knowledge: Low
Applied Methodologies (M_1). (Design: using 'F')	Research focus: Low	Research focus: Medium	Research focus: Medium
Enabling Methodologies (M_2). (Research: building 'F', learning)	Research focus: Medium	Research focus: Low	Research focus: High

Key Concepts (1)

- C2 is a socio-technical activity that encompasses three areas:
  - Command Arrangements;
  - Command;
  - Command Support Systems.
- Together these form the basis for the creation of a system for the management of military operations
- The triad is the foundation of a more complex C2 ontology

Key Concepts (2)

- A Science of C2 can be defined as a basis for the advancement of knowledge of this discipline

- The Science of C2 is characterised by:
  - A body of knowledge
  - The process of acquiring that body of knowledge
  - The process of applying that body of knowledge

Key Concepts (3)

- A framework of elements of C2 research can be defined, based on the definition of the science of C2, and serves as a mechanism for guiding C2 research

- The framework consists of:
  - An area of concern (A);
  - A framework of ideas (F);
  - A acquisition methodology (M_1);
  - An enabling methodology (M_2).

- A practical application of this framework is the Research Profile Matrix (RPM)