

Chapter 1 – INTRODUCTION

BACKGROUND

NATO, its member Nations, other countries, and organisations of all types have, to varying degrees, embarked on a journey of transformation with the goal of fully leveraging the concepts and capabilities of the Information Age. Whether it is called Network-Enabled Capability (as it is in NATO), Network Centric Operations, Network Enabled Defence, or Edge Organisations, this transformation is predicated upon a set of network-centric tenets.

The tenets that form the intellectual foundation for these ongoing transformations are:

- A robustly networked force (enterprise) enables the widespread sharing of information.
- Widespread information sharing and collaboration in the information domain improves the quality of awareness, shared awareness, and collaboration (C2 and operations processes).
- This, in turn, enables self-synchronisation.
- This results in a dramatic improvement in operational effectiveness and agility.

The approach that is taken to Command and Control (C2) directly affects how decisions are allocated, the nature of C2 processes, and the distribution of information. As such, C2 is at the heart of transformation.

GOALS AND OBJECTIVES

Because C2 is the heart of an Information Age Transformation, understanding the implications of existing and new approaches to C2 is on the critical path of transformation roadmaps and progress depends on achieving this understanding. This is because the ability to represent C2 in general, and new network-centric command concepts specifically, is a prerequisite for our ability to understand, explore, and assess emerging concepts of operation and transformational capabilities.

SAS-050 was formed to explore new approaches to Command and Control and the group adopted the following specific goals and objectives:

- Develop a conceptual model (CM) identifying the key variables and the relationships among them.
- Identify tools that can explore the nature of the relationships among these variables.
- Apply the model and tools to a test case.
- Conduct a peer review of the model.
- Disseminate the model and the group's findings.

MEMBERSHIP

Because interest in new approaches to C2 is global and because coalition operations are most successful when the functions associated with C2 are performed well, membership in SAS-050 was open to non-NATO nations. Thus representatives from NATO members Canada, Denmark, Germany, Italy, Portugal, Norway,

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the Netherlands, the United Kingdom, and the United States were joined by representatives from Australia and Sweden. The members of SAS-050 are presented in Figure 1-1.

Name	Nation	Organization
Dr. David Alberts	US	OSD NII, Chair SAS-050
Mr. Graham Cookman	UK	AMS
Mr. Natalino Dazzi	IT	Orizzonte Sistemi Navali S.p.A.
Dr. Lorraine Dodd	UK	QinetiQ
Ms. Petra Eggenhofer	GE	ITIS University of the Federal Armed Forces, Germany
Mr. Geir Enemo	NO	FFI
Mr. Fernando Freire	PO	Academia Militar
Dr. Anne-Marie Grisogono	Australia	DSTO
Dr. Richard Hayes	US	EBR
Dr. Gary Horne	US	Marine Corps Warfighting Lab
Dr. Reiner Huber	GE	IT IS Universitat der Bundeswehr
Mr. Reinhard Hutter	GE	IABG
Mr. Gert Jensen	DK	DDRE
Ms. Sarah Johnson	US	MITRE
Mr. Nickolas Lambert	NL	NATO C3 Agency/C3I Analysis and Support Branch
Mr. Viggo Lemche	DK	DDRE
Ms. Danielle Martin	US	EBR
Mr. Graham Mathieson	UK	DSTL
Dr. Daniel Maxwell	US	Innovative Decisions, Inc.
Dr. James Moffat	UK	DSTL
Mr. Allen Murashige	US	Hq USAF/XIW
Mr. Klaus Niemeyer	GE	IABG
Mr. Arne Norlander	SE	Swedish Defense Research Agency
Maj. Paulo Nunes	PO	Academia Militar
Dr. Paul Phister	US	AFRL
Mr. Valdur Pille	CA	DRDC-Valcartier
Mr. Dieter Rathmann	GE	EADS Dornier
Mr. Xander Roels	NL	TNO-FEL
CPT Jens Roemer	GE	IT IS Universitat der Bundeswehr
Mr. Gunther Schwarz	GE	EADS Dornier
Mr. Mark Sinclair	US	EBR
M.Sc. Mink Spaans	NL	TNO Defence, Safety & Security
Ms. Kristi Sugarman	US	EBR
LTC (Ret) Klaus Titze	GE	IT IS Universitat der Bundeswehr
Mr. Rick van der Kleij	NL	TNO Human Factors

Figure 1-1: SAS-050 Members.

PRODUCT AND INTENDED USES

The main product of SAS-050 was a conceptual model of Command and Control. This model consists of a Reference Model, a Value View, and a generic process view.

The Reference Model contains over 300 variables and a selected subset of the possible relationships among them that were felt to be important to understand Command and Control and the implications of different approaches to Command and Control. The Value View posits links in the value chain that lead from characteristics of the force and its approach to C2 to measures of mission and policy effectiveness, and finally to agility.

The SAS-050 Conceptual Model is intended to serve as a point of departure for researchers, analysts, and experimenters engaging in C2-related research, conducting analyses of C2 concepts and capabilities, and designing and conducting experiments. The Reference Model serves as a checklist to ensure that adequate attention is afforded to important variables and relationships. The definitions and accompanied measures provided are meant to be tested in practice and built upon.

CAVEATS

It is in the nature of a conceptual model and its instantiations to never be “finished.” That is, the model represents, at any given point in time, the state of our knowledge and because this state is incomplete and constantly improving, the model will be in a constant state of change. Having stated this, the SAS-050 Conceptual Model represents a significant step forward for the C2 community. For the first time, we have a model that accomplished C2 professionals from NATO and non-NATO countries accept as a basis for exploration and investigation. While referred to later as the Conceptual Model, the product of SAS-050 is best understood as a Reference Model that provides a detailed specification of variables and the relationships between those variables.

In building this model, SAS-050 made improvements in the state of the art in many different areas. However, the most significant improvements were focussed in the area of team characteristics and behaviour. This was because, although the literature about Network Centric Warfare and Operations has, since its inception, stressed the need to understand key concepts like shared awareness and self-synchronisation (a manifestation of team behaviour), sufficient time and energy has not yet been focussed on these concepts to have determined the details of the value chain and the identity of the variables that “moderate” or influence the relationships among the links in the value chain.

Thus, the work of SAS-050 in team characteristics and behaviours is both incomplete and relatively immature. Many of the concepts that apply to individuals (e.g., awareness) have a team or group counterpart (e.g., shared awareness). These team counterparts, while they are similar, are not identical to their individual partners and much work will be needed to better measure and understand them.

MAP TO CONCEPTUAL REFERENCE MODEL

A major portion of this report is devoted to an in-depth discussion of the SAS-050 Reference Model and the Value View. This discussion is organized as follows:

- C2 Approach (Chapter 3)
- Information Domain (Chapter 4)

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- Individual Characteristics and Behaviours (Chapter 5)
- Team Characteristics and Behaviours (Chapter 6)
- Decisionmaking, Actions, Effects, and Consequences (Chapter 7)
- Value View (Chapter 8)

The Value View chapter of this report is followed by a discussion of the group's approach to validating the model, including the results of two case studies.