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Collaborative Command and Control Practice:
Adaptation, Self-Regulation and Supporting Behavior

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ABSTRACT

This article describes a study, which aimed to document the work practice of a team of commanders responding to an emergency, and to identify areas and activities, that may be enhanced by the use of command and control tools. The study was based on a 'human-in-the-loop' simulation with emergency management commanders as participants. Communication analyses – episodic analysis, socio-metric status and communication roles – were used to assess coordination among the commanders. The results indicate that the commanders used informal arrangements within the established command and control structures to perform various informal functions and take on diverse communication roles across organizational and domain boundaries. Cross-domain and cross-organizational knowledge was the most important enabler of this type of coordination. General tools providing methods and aids to indicate and support informal functions and communication roles were identified as absent. [Article copies are available for purchase from InfoSci-on-Demand.com]

Keywords: *Command and Control; Communication; Communication Roles; Coordination; Episodes; Simulation; Socio-metric Status*

INTRODUCTION

Many organizations working with emergency management invest in information and communication technology, hoping to increase performance and control capabilities in both everyday work and critical situations. Information and communication technologies that are particularly relevant in this context are tools designed to enhance resource management, real-time situation assessment and communications in 'com-

mand and control' (C^2). Such tools integrate diverse technologies, like multimodal communications, geographical information systems, real-time sensors and advanced (non-conventional) databases.

An issue is if and in what way C^2 tools increase the performance and the control capabilities in reality. Authors working in diverse fields, such as computer supported cooperative work (Schmidt & Bannon, 1992), distributed cognition (Hutchins, 1995) and cognitive systems engineering (Hollnagel & Woods, 2005), all emphasize the importance of scrutinizing the usefulness and the actual effect of new tools when applied in practice in addition to assessment of potential effects of these tools from a theoretical understanding.

A key feature of modern C^2 tools is that they are often intended to support teams of commanders working collaboratively. These tools often allow novel ways of work, leading to radical organizational and technological changes (Woods & Dekker, 2000; Cummings, 2004). It is therefore equally important to take into account not only how a C^2 organization should behave, but also what the actual C^2 organization does when designing C^2 tools. In other words; it is necessary to empirically evaluate how an actual C^2 organization performs and how the C^2 organization's performance changes when using a new C^2 tool (Adelman, 1991; Hollnagel & Woods, 2005).

Problem Area

This research focuses on the issues of design and development of C^2 tools to support collaborative work and processes in C^2 teams, where team members may be distributed across different organizations. This article presents empirical results from a C^2 study, called ALFA-05, which is based on a 'human-in-the-loop' simulation with professionals – emergency management commanders – as participants. The study aimed (1) to document the work practice of a team of commanders responding to an emergency, and (2) to identify areas and activities that may be enhanced by C^2 tools.

BACKGROUND

Team Perspective

This research concerns a group of commanders jointly responding to an emergency. We describe this group by applying the team perspective and related concepts.

A team is a group of people (team members) engaged in a set of goal oriented activities, which are carried out in a collaborative manner (Orasanu & Salas, 1993). Team members often have explicit roles and tasks; they also have access to different information and often use specialized tools (Klein & Thordsen, 1989; Artman, 2000). The team members' actions take place within the same time-framework and are interrelated and interdependent (Orasanu & Salas, 1993; Brannick & Prince, 1997).

The type of teams in focus here are engaged in 'dynamic control tasks', such as emergency response or military operations. Teams working under such circumstances are called 'C^2 teams'.

This also means that C^2 teams exist on a temporary basis, i.e., the actual structure and size of a C^2 team is dependent on the nature and the impact of the event the C^2 team is aiming to control. C^2 teams are also commonly distributed and the communication with some of the team members is mediated through a technical system (Urban et al.,

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