SAF-SwAF

Edge Organization: Testing a New C2 Model of Battlefield Information Sharing and Coordination

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Overview

- In this study we compared two different *procedures* of doing C2, in a traditional two-level command organization, executing a combat operation. One of the procedures was designed based on Edge principles and the other was designed as a Traditional military hierarchy. We compared the two organizations regarding shared situation awareness, decision speed, decision quality, and appropriateness for real-life operations.

- Our technical platform was the Singapore MissionMate C2 system and the ATLAS wargame simulation system.

- Participants from Singapore AF and Swedish AF formed 1 Brigade and 3 Battalion staff units (reduced) and performed 2 different experiment runs in each of the two conditions, over 4 consecutive days, at SCME.

Disposition

- Define the Problem and introduce the Concept we tested
- Describe the Experiment Methods
- Present the Results
- Discuss the Findings

The Problem

- Current C2 theory advocates the *Edge organization* as a response to the challenges of current military missions, as well as to the opportunities of the new information technology.

"As part of its network-centric warfare initiative, the Command and Control Research Program (CCRP) is engaged in developing and testing principles of organization that significantly reverses traditional command and control practices, transferring power and decision rights to the edge of the organization."

"missions designed with superior shared awareness, trust and self-synchronization will perform with greater speed, precision, effectiveness, and agility than missions conducted under traditional hierarchical command structures. This is achieved by placing decision rights at the "edge of the organization," close to the points of consequence."

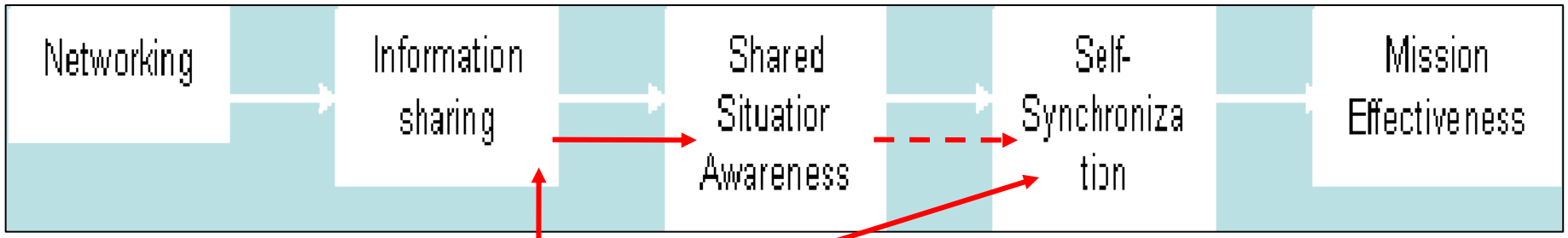
- This hypothesis already has some support from lab research but in order to support the development of more effective military C2 we need to develop and test actual Edge procedures in realistic battlefield scenarios.

The Proposed Solution

An Edge concept: Non-Hierarchical Information Management (NHIM) – What is that?

Concept Introduction

- NHIM is a part of NEC^3 that is a development of NBD that is a development of NCW…
- NHIM and current C2 theory:



Non-hierarchical info management

Can we develop new routines for non-hierarchical info-sharing (management) in a way that will increase shared situation awareness and also enable increased self sync?

P.S Nothing will happen without changes in doctrine and training!

What is NHIM?

- NHIM is a concept (in SwAF) and for this experiment we have operationalized NHIM as a procedure in terms of:
- A C2 hierarchy (1 Bde, 3 Bns)
- The C2 Systems used
- The Information flow within the C2 chain
- How Coordination within the C2 chain should be done (during execution but not during planning!)

Operationalize NHIM

Systems:

- All units will have access to the same information and the same situation map (sitmap)
- All units can collaborate through common workspaces in MM the same way as if they were physically co-located.

Operationalize NHIM

Information flow:

- Situation reports (sitrep) and Fragmentary orders (fragos) are posted in the system and will be available to all units simultaneously (through Pull).
- Sitmap info for all units will be available to all other units in ”real time”

Operationalize NHIM

Coordination:

- Bn – Bn is encouraged if a Bn Cdr have a problem!
- Bn Cdrs' should adopt a holistic (brigade) view and take initiative to assist each other within the frame of Bde Cdr's Intent!
- Bde should allow, simplify and encourage Bn-Bn coordination (e.g. by a clear intent).
- Bde should "listen in" and can "veto" against Bn-Bn coordination.
- A different "mindset" is Necessary!

The comparison: HIM

What is Hierarchical Information Management?

- The ”traditional” process
- No common sitmap
- No collaborative workspace through the C2 system
- Hierarchical flow of sitreps and fragos
- Hierarchical coordination between Bns (through the Bde)

Expected benefits of NHIM

- A closer to real-time and more complete awareness of the battlefield situation.
- A more holistic perspective of the battlefield situation also on lower command levels.
- Faster detection and resolve of conflicting info and detection of ”weak signals.”
- More shared understanding of the battlefield situation among Cdrs.
- Faster and more responsive actions/reactions on the battlefield.
- More time for the higher cdr to plan ahead as opposed to understand the current situation (and coordinate current ops).

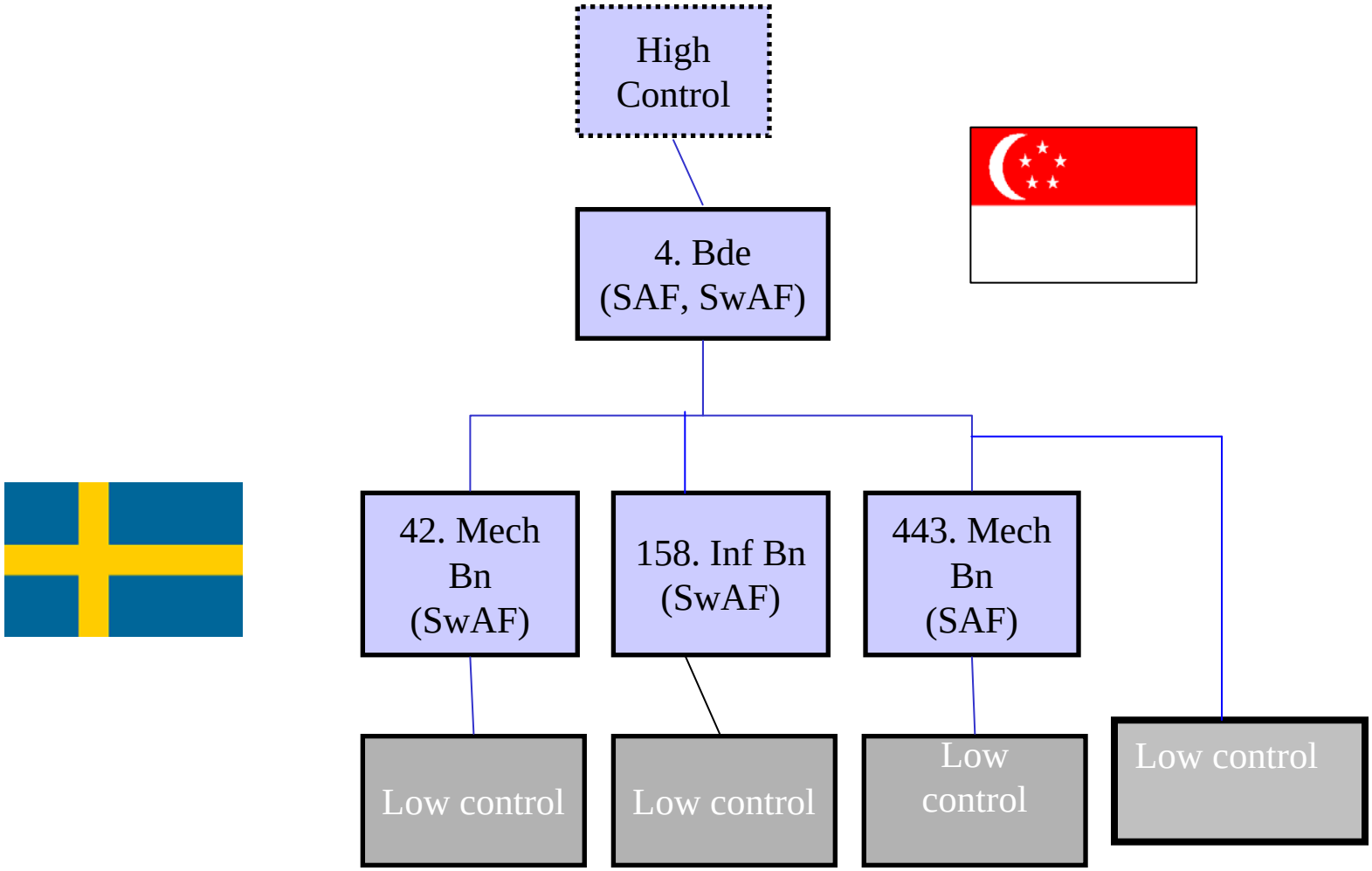
Risks with NHIM

- Ambiguity about map symbols and short text

  -meaning

  -implications
- Sitmap info can be overlooked
- Info indate can be delayed
- Bns self coordination can lock Bde resources in less preferred directions from a Bde perspective
- Self-coord can be more demanding to Bns than to receive direct orders from the Bde.

Participants



Task and Scenario

- The task was to execute a mission that had been pre-planned by the brigade before the experiment.
- They were also instructed to follow the NHIM and HIM procedures closely.
- The scenario modeled a modern combat operation, with the added complexity of having to deal also with Civil-Military Relations (CMR).

Design of the Study

Day 1	Day 2	Day 3	Day 4
NHIM	NHIM	HIM	HIM
Run1	Run2	Run 1	Run2

Two runs in each condition

Formal training preceeded both NHIM and HIM runs

Dependent variables

- DV1: Shared situation Awareness
- DV2: Response time to important events
- DV3: Quality of orders and actions
- DV4: Pattern of communication
- DV5: Time allocation of Bde Cdr
- DV6: Subjective evaluation of NHIM and HIM

Result Shared SA

- Expectation: Higher Shared SA in NHIM than in HIM
- The shared knowledge of map-symbols was equally high
- The shared agreement among the different command teams regarding the current situation was higher in HIM than in NHIM
- The shared agreement regarding the predicted development of the situation over time was higher in NHIM.
- The expectation that the level of shared situation awareness should be higher in the NHIM condition was only partly supported by the results, but also partly disproved.
- However, subjective evaluation indicate that a higher level of SA is accomplished *earlier* in the NHIM condition, and that the Bns get a more holistic understanding of the battlefield.

Result : Response time

- Expectation: That the rights for the Bns to share information directly (timely), and coordinate directly with other Bns (i.e. NHIM) would result in shorter response time, that is, faster development and issue of Fragos to subordinated units in response to important events on the battlefield.

- The average time to develop Fragos in the NHIM condition was 49.5 minutes (SD 18.2) and in the HIM condition it was 82.5 minutes (SD = 18.5). The difference was statistically significant.

- This result was also confirmed by the ratings done by the participants after the conduction of both conditions. Thus, the expectation was confirmed.

Result : Subjective Quality of orders

- Expectation: The Bn-Bn coordination should result in equally high quality of the Bn Fragos as the Bde coordination, from the perspective of the Bde Cdr, thus we expected same quality in NHIM as in HIM.
- The Bde Cdr regarded the quality of actions and orders taken by the Bns to be about the same level in NHIM as in HIM.
- The participants and observers rated their fragos to be of the same quality in both NHIM and HIM.
- Thus, the expectation was confirmed.

Result : Pattern of communication

- Expectation: That it should be more horizontal and less vertical communication in NHIM

- The expectation was confirmed and indicate that the participants did apply the NHIM and HIM procedures regarding how coordination was supposed to be done.

Result : Time allocation of Bde Cdr

- Expectation: Bde Cdr should have more time devoted to planning ahead as opposed to engaging in current activities in NHIM
- Observer protocols indicate a 10 % difference between the two conditions (42% of the time devoted to planning ahead in NHIM vs. 32%in HIM, but not statistically significant.
- After each condition the Bde Cdr also estimated how much attention he had devoted to planning ahead during the two runs in each condition. His estimation was 60% during NHIM and 30% during HIM. Thus, our expectations was supported.

Result : Subjective evaluation

- Expectation: We expected NHIM to be perceived as more effective.
- 77% of the participants agreed that they would prefer the NHIM procedure in a real-life field operation and the remaining 23% found NHIM and HIM to be equally good. No participant preferred HIM.
- On a related item participants agreed more with NHIM as being an effective procedure in a real-life field operation compared to HIM .
- Thus our expectation was supported.

Why was NHIM preferred?

- The *advantages with NHIM* could be referred to three main areas (a) Self-synchronization is flexible and effective both during planning and execution (6 comments), (b) Information-sharing procedures (unrestricted) allows for faster and more total situation awareness (10 comments), and (c) Self-synchronization and information-sharing allows for better anticipation and planning ahead (5 comments).

- One sample comment: “NHIM is Flexible. Mostly speed up the C2 procedure. Does not need full control of a Bde commander and if the communication between subordinates and commander is disturbed, everything does not stop. Great chance to take advantage of upcoming situations on the battlefield.”

Discussion - Conclusions

- In this experiment NHIM worked well, but a successful implementation of the NHIM procedure into real field units require advancements or improvements in the technical C2 systems. There need to be enough computer capacity, connectivity, band-with, and a collaborative C2 application as well as communication channels' admitting voice and chat communication and email, and this is also a so far unsolved security constraint.
- However, if these issues were to be solved, we also identified a need to further clarify the NHIM procedure.

Refinement of the NHIM procedure

- The main problem is that all the information-sharing and common access to other units situation overlays and reports that is a part of NHIM demand a very clear information-management standing operating procedure.
- We need to clarify how many overlays should be used, how to name and store them, how to distribute rights to update them and how to store data in a common data base. We probably also need to implement effective search engines in order for different functional officers to search or even prescribe to information that is of interest to specific C2 functions.

Future research

In our next joint study we plan to take the NHIM procedure one step further towards implementation and develop and test an SOP for NHIM for SwAF and for SAF.

Questions?