Command and Control Methods at Sub-unit Level: Mission Command and Self-synchronization

The purpose of this paper is to explore command and control at sub-unit level. The overarching method adopted by the Swedish Army is mission command, derived into directive command and restrictive control. Although a new main battle tank with an operational battle management system has been introduced, few changes can be traced with respect to methods of command and control. Starting out with describing the prescribed way of command and control at sub-unit tank units, the effects when utilizing alternative methods were explored. In order to do this, the theories of the Law of Requisite Variety, the Viable System Model and theories on Dynamic Decision Making were used to analyze data produced by a tank platoon. In order to explore the effects of self-synchronization, five combat missions were conducted using two different methods. A seminar discussion provided further insights in understanding the results. From the conclusion of these investigations, a hypothesis is derived, alleging the possible use of directive command at sub-unit level and in what context self-synchronization could be utilized. The relevance of the hypothesis is then discussed in a wider context referring to military operations on urbanized terrain.

The results indicate that initiative and the ability to explore given opportunities are experienced as being greater if directive command is applied instead of the traditionally restrictive control. Concerning the utilization of the battle management system, my conclusion is that the potential of the system is not yet fully explored. The basis of this statement is the declared opinion of a lack of adequate training, and there is also an outspoken discrepancy in willingness to use the system.

Keywords: mission command, self-synchronization, tank platoon, network.
Actually, sometimes the battle plan survives contact with the enemy - but it only ever happens for one side...

(unknown author)
TABLE OF CONTENTS

1 INTRODUCTION ........................................................................................................... 6
1.1 FROM THE GOLAN HEIGHTS TO DIGITAL WARFARE ........................................... 6
1.2 ALL IS NEW AND NOTHING HAS CHANGED? ...................................................... 7
1.3 THE PURPOSE AND THE ISSUE TO BE EXPLORED ........................................... 10
1.4 OVERALL METHOD AND STRUCTURE ................................................................ 11
1.5 DELIMITATIONS .................................................................................................... 12
1.6 STRUCTURE AND READING GUIDELINES ......................................................... 13

2 THEORY ...................................................................................................................... 14
2.1 INTRODUCTION OF THE THEORETICAL FRAMEWORK ....................................... 14
2.2 THE COMBAT ENVIRONMENT ........................................................................... 14
2.3 SYNCHRONIZATION ......................................................................................... 17
2.4 CYBERNETICS – A THEORY OF SYSTEM CONTROL ........................................... 18
2.5 THEORIES ON DYNAMIC DECISION MAKING ............................................... 22
2.6 SUMMARY ........................................................................................................... 28

3 THE TANK COMPANY AS A SYSTEM ................................................................... 30
3.1 GENERAL ........................................................................................................... 30
3.2 THE DOCTRINAL FRAMEWORK ........................................................................... 30
3.2.1 Maneuver warfare ........................................................................................ 30
3.2.2 Mission Command - The Swedish adaptation of a philosophy ................... 31
3.3 ORGANIZATION AND OPERATIONAL TASKS .................................................... 31
3.4 COMMAND AND CONTROL ............................................................................. 33
3.4.1 Methods of command and control ............................................................... 33
3.4.2 Advancing to contact and when in enemy contact ....................................... 34
3.5 COMMENTS .......................................................................................................... 35

4 METHOD ..................................................................................................................... 36
4.1 SCIENTIFIC APPROACH ..................................................................................... 36
4.2 FROM THEORY TO DESIGNING EXPERIMENTS ................................................. 38
4.3 TWO MODELS OF THE SYSTEM ....................................................................... 39
4.4 THE DATA PRODUCTION FACILITIES .............................................................. 40
4.5 LAYOUT OF THE MISSIONS ............................................................................... 42
4.5.1 Mission 1: Restrictive control - assault ....................................................... 42
4.5.2 Mission 2: Self-synchronization - assault .................................................... 43
4.5.3 Mission 3: Restrictive control - recon patrol .............................................. 44
4.5.4 Mission 4: Self-synchronization - recon patrol ........................................... 44
4.5.5 Mission 5: Self-synchronization - rescue of civilians .................................. 45
4.6 DEVELOPING PERFORMANCE MEASUREMENTS .......................................... 46
4.7 DESCRIPTION OF PARTICIPANTS ..................................................................... 48
4.8 VALIDITY AND RELIABILITY ............................................................................ 49
4.9 DOCUMENTATION ............................................................................................. 51
4.10 SUMMARY ......................................................................................................... 52

5 EMPIRICAL DATA .................................................................................................. 53
5.1 GENERAL .......................................................................................................... 53
5.2 MISSION 1: RESTRICTIVE CONTROL - ASSAULT ........................................... 53
5.2.1 Course of events ................................................................. 53
5.2.2 Observations ..................................................................... 53
5.3 MISSION 2: SELF-SYNCHRONIZATION - ASSAULT .......... 54
  5.3.1 Course of events ................................................................. 54
  5.3.2 Observations ..................................................................... 55
5.4 MISSION 3: RESTRICTIVE CONTROL - RECON PATROL ...... 57
  5.4.1 Course of events ................................................................. 57
  5.4.2 Observations ..................................................................... 57
5.5 MISSION 4: SELF-SYNCHRONIZATION - RECON PATROL ... 58
  5.5.1 Course of events ................................................................. 58
  5.5.2 Observations ..................................................................... 58
5.6 MISSION 5: SELF-SYNCHRONIZATION - RESCUE OF CIVILIANS ... 59
  5.6.1 Course of events ................................................................. 59
  5.6.2 Observations ..................................................................... 60
5.7 SUMMARY .............................................................................. 60

6 ANALYSIS.................................................................................. 61
  6.1 GENERAL ............................................................................ 61
  6.2 THE CONDITIONS OF DYNAMIC DECISION MAKING ...... 62
    6.2.1 The goal condition ......................................................... 62
    6.2.2 The action condition ...................................................... 63
    6.2.3 The model condition ..................................................... 66
    6.2.4 The observability condition .......................................... 68
  6.3 THE PERFORMANCE MEASUREMENTS ......................... 71
  6.4 THE DIMENSIONS OF DYNAMIC DECISION MAKING ...... 73
    6.4.1 Complexity .................................................................. 73
    6.4.2 Feedback delay and feedback quality ............................ 73
    6.4.3 Rate of change ............................................................ 75
    6.4.4 The extent to which decision making power can be delegated .. 75
  6.5 JOINING THE ANALYSIS INTO A HYPOTHESIS .............. 76
    6.5.1 A summary of the analysis ......................................... 76
    6.5.2 On the adherence to the prescribed method of C2 ....... 77
    6.5.3 Conclusions on new methods of C2 .............................. 77
    6.5.4 Returning to the questions and developing a hypothesis ... 78

7 APPLYING THE HYPOTHESIS, A DISCUSSION ................. 81
  7.1 GENERAL ............................................................................ 81
  7.2 THE FUTURE IS HERE - CYBERNETICS AND MOUT .......... 81
  7.3 SOME THOUGHTS ON C2 WHEN CONDUCTING MOUT ...... 82
  7.4 C2 PRACTICED AT SUB-UNIT LEVEL IN OPERATIONS IN IRAQ .. 83
  7.5 CONCLUSIONS .................................................................. 85

8 FINAL DISCUSSION AND CLOSING REMARKS .................. 87
  8.1 STRENGTHS AND SHORTCOMINGS OF THIS PAPER .......... 87
  8.2 FUTURE AREAS FOR EXPLORATION ............................... 88
  8.3 CLOSING REMARKS ............................................................ 89
  8.4 EXPRESSION OF GRATITUDE ............................................ 90

SOURCES ...................................................................................... 91
## List of figures and tables

<table>
<thead>
<tr>
<th>Number</th>
<th>Contents</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fig. 1.1.1.</td>
<td>Photo of TCCS display.</td>
<td>8</td>
</tr>
<tr>
<td>Fig. 1.1.2.</td>
<td>Photo of TCCS display.</td>
<td>8</td>
</tr>
<tr>
<td>Fig. 1.3.1.</td>
<td>The plan of the realization of the paper.</td>
<td>11</td>
</tr>
<tr>
<td>Fig. 2.4.1.</td>
<td>Applying the Law of Requisite Variety to the conditions of a tank unit.</td>
<td>18</td>
</tr>
<tr>
<td>Fig. 2.4.2.</td>
<td>Two dimensions of the neurophysiological control (referring to the VSM).</td>
<td>19</td>
</tr>
<tr>
<td>Fig. 2.4.3.</td>
<td>Translation of the Viable System Model to the conditions of a tank unit.</td>
<td>21</td>
</tr>
<tr>
<td>Fig. 2.5.1.</td>
<td>Tentative chains of decisions (referring to dynamic decision making).</td>
<td>23</td>
</tr>
<tr>
<td>Fig. 2.5.2.</td>
<td>The four conditions of decision.</td>
<td>24</td>
</tr>
<tr>
<td>Table 3.3.</td>
<td>The meaning of the tasks seize and defend.</td>
<td>28</td>
</tr>
<tr>
<td>Fig. 3.3.1.</td>
<td>A tank company conducting offensive operations.</td>
<td>32</td>
</tr>
<tr>
<td>Fig. 3.3.2.</td>
<td>Defensive operations; battle positions for company, platoon and single tank.</td>
<td>32</td>
</tr>
<tr>
<td>Fig. 3.3.3.</td>
<td>The organization of a tank company and subunits.</td>
<td>33</td>
</tr>
<tr>
<td>Fig. 4.1.1.</td>
<td>The hermeneutic process.</td>
<td>36</td>
</tr>
<tr>
<td>Fig. 4.2.1.</td>
<td>Consequences of the conclusions from the theory</td>
<td>38</td>
</tr>
<tr>
<td>Fig. 4.3.1.</td>
<td>The hierarchal structure of the model (A) organization.</td>
<td>39</td>
</tr>
<tr>
<td>Fig. 4.3.2.</td>
<td>The flattened structure of the model (B) organization.</td>
<td>40</td>
</tr>
<tr>
<td>Fig. 4.4.1.</td>
<td>The simulated environment of the BTA.</td>
<td>41</td>
</tr>
<tr>
<td>Fig. 4.4.2.</td>
<td>The tank commanders/platoon leaders station in a simulator module.</td>
<td>41</td>
</tr>
<tr>
<td>Fig. 4.4.3.</td>
<td>The tank commanders/platoon leaders station in a simulator module.</td>
<td>41</td>
</tr>
<tr>
<td>Fig. 4.4.4.</td>
<td>The control station of the BTA.</td>
<td>41</td>
</tr>
<tr>
<td>Fig. 4.5.1.</td>
<td>The overlay for mission 1 and mission 2.</td>
<td>43</td>
</tr>
<tr>
<td>Fig. 4.5.2.</td>
<td>The overlay for mission 3.</td>
<td>44</td>
</tr>
<tr>
<td>Fig. 4.5.3.</td>
<td>The overlay for mission 4.</td>
<td>45</td>
</tr>
<tr>
<td>Fig. 4.5.4.</td>
<td>The overlay for mission 5.</td>
<td>46</td>
</tr>
<tr>
<td>Table 4.4.1.</td>
<td>Score table for measuring the efficiency of the platoon.</td>
<td>47</td>
</tr>
<tr>
<td>Table 4.4.2.</td>
<td>An overview of the participants self estimation of their experience.</td>
<td>48</td>
</tr>
<tr>
<td>Table 4.4.3.</td>
<td>The positions of the participants in the five scenarios.</td>
<td>49</td>
</tr>
<tr>
<td>Table 5.1.</td>
<td>Course of Events Table 1.</td>
<td>53</td>
</tr>
<tr>
<td>Table 5.2.</td>
<td>Course of Events Table 2.</td>
<td>54</td>
</tr>
<tr>
<td>Table 5.3.</td>
<td>Course of Events Table 3.</td>
<td>57</td>
</tr>
<tr>
<td>Table 5.4.</td>
<td>Course of Events Table 4.</td>
<td>58</td>
</tr>
<tr>
<td>Table 5.5.</td>
<td>Course of Events Table 5.</td>
<td>59</td>
</tr>
<tr>
<td>Fig. 6.2.1.</td>
<td>Diagram.</td>
<td>62</td>
</tr>
<tr>
<td>Fig. 6.2.2.</td>
<td>Diagram.</td>
<td>63</td>
</tr>
<tr>
<td>Fig. 6.2.3.</td>
<td>Diagram.</td>
<td>64</td>
</tr>
<tr>
<td>Fig. 6.2.4.</td>
<td>Diagram.</td>
<td>64</td>
</tr>
<tr>
<td>Fig. 6.2.5.</td>
<td>Diagram.</td>
<td>65</td>
</tr>
<tr>
<td>Fig. 6.2.6.</td>
<td>Diagram.</td>
<td>65</td>
</tr>
<tr>
<td>Fig. 6.2.7.</td>
<td>Diagram.</td>
<td>67</td>
</tr>
<tr>
<td>Fig. 6.2.8.</td>
<td>Diagram.</td>
<td>67</td>
</tr>
<tr>
<td>Fig. 6.2.9.</td>
<td>Diagram.</td>
<td>68</td>
</tr>
<tr>
<td>Fig. 6.2.10.</td>
<td>Diagram.</td>
<td>69</td>
</tr>
<tr>
<td>Fig. 6.2.11.</td>
<td>Diagram.</td>
<td>69</td>
</tr>
<tr>
<td>Fig. 6.2.12.</td>
<td>Diagram.</td>
<td>70</td>
</tr>
<tr>
<td>Table 6.3.1.</td>
<td>Table showing the compiled results of the missions.</td>
<td>71</td>
</tr>
<tr>
<td>Fig. 6.4.1.</td>
<td>Diagram.</td>
<td>75</td>
</tr>
</tbody>
</table>
1 INTRODUCTION

1.1 From the Golan Heights to digital warfare

Some of the fiercest battles in the Yom Kippur War in 1973 took place on the Golan Heights. The orders transmitted by radio to one of the defending Israeli tank units were not detailed:

Yanosh [Brigade Commander] came through with orders to proceed to the border and block a Syrian advance.
“What area?”
“Move fast to Forward Position Nine, and stop them there.”

The next day, the Syrians infiltrated the lines with an airmobile unit:

“They broke through. About a company of infantry. They…” [remaining Israeli tank reporting]
Yanosh ordered him to break off rearming and move north fast with all his vehicles – up to the entrance to Buk’ata. He told Uri about the tank and its report.
Move! Destroy. Over and out.”

These two examples show a method of command and control (C2) defined as mission command. In the directives, the commander only states what is to be accomplished and gives subordinates a high level of freedom in the choice of how to do it.

During the path of history, the dynamic relationship between the evolution of new technology and implementation of the improvements for military purposes can be traced. The fast evolution of information technology and data communication has resulted in both the need and possibilities for alternative C2 structures. This has led to the evolution of new concepts. One such is Network Centric Warfare (NCW). The basic idea of this is that networking all assets in a technical sense, and thus facilitating the exchange of a wide variety of data, could render a multitude of synergetic effects. The Swedish government has prescribed that the capability of NCW is to be implemented in weapons and material systems used by the armed forces; both ones existing and being developed. The profound hope is to increase the combat power by incorporating all systems in a network.

The dominant command philosophy in the NCW concept is said to be mission command. The concept even takes it a step further and introduces the idea of self-synchronization. Traditional military methods utilize top-down coordination when massing at the decisive points. The essence of self-synchronization is that coordination is to be performed in a bottom-up procedure.

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1 Kahalani (1992), p. 87.
2 Ibid., p. 115.
3 Regeringens proposition 2004/05:5, p. 50.
4 Friman et al. (2004), p. 56.
Skeptical and, perhaps, sound criticism has arisen, enlightening problems like the focus on expensive technology related to the high ambitions and the absence of a tangible overall vision for the NCW concept. Instead the suggestion has been made to start on a small scale, building the organization from bottom-up with technical systems that could be used by our operational units today.5

Taking these opinions into account the work will be focused on studying methods of command and control at sub-unit level. When studying C2, one comes to the conclusion that the term is broad and encompasses everything from factors related to motivation and responsibility to defining a common set of goals for the unit. When attempting to narrow down the concept, Martin van Creveld’s definition of command is helpful:

\[\text{Command may be defined as a function that has to be exercised, more or less continuously, if the army is to exist and to operate. The definition is a happy one, since it serves to bring out the extraordinary importance of command; few other functions carried out by, or inside, the armed forces are as important in both respects, existence and operation.}\]

Berndt Brehmer identifies the content of C2 as comprehending what is to be decided, what is to be achieved, not what is to be done or how this is to be conducted.7 This could be interpreted as an emphasis on the formulation of the goal as the important element of C2, not the distribution of tasks or detailing of the execution. Taking those explanations into account, in this work, C2 will be defined as the continuous effort to establish, express and communicate a common set of goals in order to unite the combat power of the unit to achieve the objective.

A way of studying C2 is to divide it into three areas: (A) The way C2 is supposed to be practised. Prescribed formally by doctrines and informally in training, this is the way we think C2 is best conducted. (B) The way C2 is practised in reality. This is the way we do business. Like theory and reality do not always walk hand in hand, C2 in reality does not automatically have to correlate with what is said in manuals. (C) The third area concerns how C2 could be practised. This is an area for exploration of C2 to enhance and improve the methods.8 Given a set of assumptions based on an analysis of systems theories or examples from reality, it is a creative act to develop a hypothesis of how to practice C2 successfully.

1.2 All is new and nothing has changed?

Starting from this perspective, this work will use the Swedish 122 MBT (strv 122) system as an object for research. Introduced in 1997 strv 122 has the ordinary capability for voice radio transmissions, as well as an operational battlefield management system (BMS), which enables all tanks in the company to have a common situational picture. The term common situational picture is

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8 Ibid., p. 7-10.
associated with several definitions. Hence, an examination of the capabilities of The Tank Command and Control System (TCCS) will serve the reader as an explanatory definition of how the term *common situational picture* will be used in this work. The TCCS connects the tanks in the unit into a network. In this network, all tank commanders have a visual graphic display with a digital map of the operations area. On the graphical display, icons representing friendly tanks are visualized. This is facilitated by each tank having a navigation capability based on inertia navigation, and the position is broadcasted to all units in the network. The TCCS offers the tank commander the possibility of choosing whether he wants to center the map on his tank or scroll over the area. If the company commander, when for instance giving orders, wants every tank commander in the unit to center on the exact same area of operations, this is normally done by issuing a vocal order on the radio net.

![Fig. 1.1.1 and 1.1.2. The TCCS showing the digital map and the button menu that is the interface for creating overlays. (photo: Ted Strömbäck, 2005-10-18).](image)

The TCCS allows graphical orders and overlays to be stored and broadcast or selectively transmitted to all of the other tanks in the unit. Hence the TCCS facilitates the ability to send graphical control measures, for example unit borders, unit icons, axes of advance etc. as overlays, to supplement vocal orders on the radio net. The TCCS can also be used for directing fire on identified targets: Targets can be lazed subsequently target data can be input into the TCCS and then transmitted to other units. The data for the icons showed on the display are thus input by the tank units, either automatically, the friendly positions, or manually, the enemy reports and graphical overlays. Within the tank, the digital map also facilitates the commander to direct the driver by issuing waypoints to follow. The driver is given information of heading and distance to the next waypoint. He can also see chassis heading relative to north, and in which direction the main gun is aimed.

Hence, the TCCS offers the tank commanders a common situational picture that is updated at least every 30 seconds, incorporating positions of all friendly tank

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9 The update frequency is normally 30 seconds.

10 laze: an American term used by tank crews to express the procedure of measuring the range to an acquired target with the tank’s laser rangefinder. The range measured is then automatically input in the fire control unit in order to calculate the gun lead and elevation.
units, and includes the possibility of transmitting graphical overlays and enemy information between the tanks. This enables all tank commanders, platoon leaders and company commanders to see the same data that comprises the common situational picture.

The technical means for exercising C2 with the previous tanks\textsuperscript{11} were limited to radio communication, and in case that was not suitable, hand signals and flags were used. Each tank was issued with three flags: a blue, a yellow and a green. The blue and yellow colors were used to signal when charging in line formation or column formation, and the green was for seeking communication with the closest infantry commander on the ground. The tanks were also equipped with an external telephone for communication with infantry units. But the introduction of the strv 122 system in the armored units did not only affect the capacity of transmitting data between the tanks. Compared to the replaced tank systems, the maximal road speed roughly doubled along with a considerable increment in firepower and armor protection.

Considering this, it is interesting to note that from a doctrinal point of view, not much has altered with respect to the introduction of the new tank system\textsuperscript{12}. The old field manual from 1984 states the tasks for tank units in offensive and defensive operations: When conducting a deliberate attack, a tank company normally attacks to seize an objective with a width of 500-700 m. Primary objectives are generally not set deeper than 1,000 m when attacking an enemy in prepared defense positions. When attacking in degraded visibility the width and depth of the objective is decreased. A tank company defends a battle position with a width of 3-5 km. The larger width only applies in open terrain.\textsuperscript{13}

Comparing this with the field manuals from 2003, the only difference is an increment in offensive objectives to 1,500 m.\textsuperscript{14} Even when taking into account that the organization of the tank company has been augmented by two additional units, totaling fourteen tanks, the difference is marginal.

The impression is that few tactical techniques and command methods have really changed, in spite of the fact that technical potential has increased enormously, is also reflected in the doctrinal approach on C2. When catching a glimpse of what the 1984 field manual has to say about command philosophy for tank units: The aim is to use mission command at all command levels and in all types of units. The method implies that the superior commander states the mission, allocates resources and permits the subordinates to act freely to the largest possible extent in order to complete the mission and fulfill the superior commander’s intent. The need for coordination between units and supporting elements may constrain the commander to restrict subordinates’ freedom of action. Only necessary constraints should be enforced.\textsuperscript{15}

\textsuperscript{11} The strv 121 (Leopard II A4) and strv 122 superseded the strv 101/102/104 Centurion and strv 103 S in the armored units from 1995. The strv 121 is now being phased out as well.
\textsuperscript{12} Strv 122.
\textsuperscript{13} Chefen för Armén (1984), § 5:17-18.
\textsuperscript{14} Försvarsmakten (2003), p. 17-21.
\textsuperscript{15} Chefen för Armén (1984), § 6:5-6.
The latest field manual manifests the above, or if not, one can trace an attempt to strive for a lesser degree of mission command. The latest manual prescribes that mission command is the overarching command philosophy. But when it comes down to implementing mission command, the manuals stipulate that there are two methods: restrictive control and directive command. The first method requires the company commander’s continuous control of the situation, enabling him to manage the action of his company, in Swedish defined as stridsleda; a constant flow of orders, to direct the subordinates’ actions.\(^{16}\)

Directive command on the other hand, is very similar to the basic elements of mission command, emphasizing a high degree of freedom in the choice of technique. But do we really apply this method?

One reflection of this is, that although a new tank system has been introduced, the ambition of the tasks has remained much the same. Another striking thought is, that when introducing a new system incorporating a common situational picture capability, the emphasis is to strive for a higher degree of control, thus, as a result limiting the subordinates’ freedom of action.

One conclusion of this discussion is that the armored units are equipped with a highly potential tank system incorporating a BMS. The introduction of the new system does not seem to have imposed any changes in the field manuals with respect to tasks and methods of C2. The procedures are more or less the same as twenty years ago, with the exception that they might be done at a faster pace. Curiously, one could ask whether the full potential of technical improvements has been taken into account when developing the methods for C2. Another conclusion could be that the NCW concept presents some interesting new methods. When exploring C2 at sub-unit level units, these factors will set the stage for the work.

1.3 The purpose and the issue to be explored

Having the impression that the prescribed methods and tactical procedures do not seem to have been noticeably changed during the last twenty years, one could raise the question as to whether the full potential of the new equipment has been explored. Could this phenomenon be explained by the theory that the introduction of new technology and its interaction with an organization is a function of the different actors and the socio-historical contexts implicated in its development and use?\(^ {17}\)

Without disrespecting the older methods, could it be possible that we did not fully understand the opportunities offered by the strv 122 system when we developed the tactical manuals?

While mission command is considered to be the overarching method of C2 within the Swedish army, do we really live by the rules when it comes down to C2 at sub-unit level tank units? Could the fact that the BMS in strv 122 enables all the tanks in the unit to have a network with a common situational picture, facilitate the introduction of a more mission oriented C2 method? Would it be possible to apply some of the thoughts on C2 from the NCW concept?


\(^{17}\) Orlikowski (1992), p. 66.
This paper will explore the methods of C2, to investigate effects of different C2 techniques to unite the combat power of a unit\(^{18}\) in order to efficiently achieve the objective. The purpose is to investigate and try to understand how C2 could be conducted at sub-unit level tank units. To focus, and be able to examine the results of the research, two subsidiary questions will be discussed:

1: Compared with prevailing C2 methods, what are the effects when applying mission command at platoon level?

2: Could it be feasible to implement self-synchronization as a method for C2 at sub-unit level units?

### 1.4 Overall method and structure

Having defined the area to explore in this work as C2 at sub-unit level units, the tank platoon will be used as an object in laboratory experiments built on five combat scenarios. The scenarios will be conducted as platoon missions and they will be developed in conjunction with the exercise director of the tank unit organizing the training of tank units at one of the armored regiments.

Firstly, the way C2 is practiced today will be analyzed. The purpose of this is to establish a frame of reference. This reference is based on my experience from training company grade officers, the practical implementation of doctrinal frameworks and laboratory experiments to be conducted in a simulator environment. Secondly, the possibility of introducing some ideas from NCW will be explored. This is done in order to investigate the potential of self-synchronization. The basis of this is the laboratory experiments in simulators and interviews with the participants.

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\(^{18}\) The organization and capabilities of the tank unit will be further explained in section 3.3.
Finally, a seminar discussion will be conducted in order to further explore these areas and validate the analysis of the laboratory experiments. The participants in the seminar will consist of:

The theories of decision making and cybernetics and the result from a questionnaire will be used to support the analysis and understanding of the results from the experiments. The outcome of the experiments and the analysis will finally be presented and discussed in a seminar attended by a mixed group of experts; personnel serving at the tank training company that took part in the tests, company commanders as well as instructors from the BTA\textsuperscript{19} tank crew training installation. From these results a hypothesis about possible techniques for C2 at sub-unit level units will be presented. A discussion of applications of the hypothesis to real world scenarios concludes the work. This discussion will be supported by material from representatives of a US unit presently operating in Iraq and the Swedish study group on military operations in urbanized terrain.

1.5 \textbf{Delimitations}

During the last century, the Swedish Armed Forces’ main task was territorial homeland defense. During this period, in 1942, the branch of the Armored Corps was established and now, after several organizational reductions, battalion size mechanized units constitute the backbone of the Army.

The Swedish Armed Forces are presently focusing on defending Swedish interests within the framework of the European Union and United Nations, and thus enhancing the capacity to conduct operations abroad.\textsuperscript{20} By tradition, Swedish contributions to international operations have consisted of ground units, scaling in size from platoon to battalion. Currently one of the largest tasks for the Swedish Army to undertake is the organization and training of an EU Battle Group where the main body consists of a battalion, comprising two mechanized companies and an airborne squadron. One option for reinforcement is an additional tank platoon. Having said this, the conclusion is that it could be suitable to focus this work at sub-unit level mechanized units.

Since I have a background in armored units and the opportunities to conduct laboratory experiments with a tank platoon arose, the work will be focused on this type of unit. Another strong motive for using the tank platoon is the existence of an operational BMS for the strv 122.

Considering the time available at the tank crew training installation, only five combat missions with three tank crews were possible to conduct. Hence, the conclusions based upon the limited empirical material are attempting to point out tendencies.

\textsuperscript{19} Besättnings Tränings Anläggning (BTA): The tank crew training installation. This is further described in section 4.4.

\textsuperscript{20} Regeringens proposition 2004/05:5, p. 69-70.
1.6 Structure and reading guidelines

The first chapter introduces the challenge that the paper will deal with. It states the issue to be explored and defines some central concepts. The second chapter defines theories on conditions for control and systems of control, largely based on cybernetics and theories on dynamic decision making. These form the foundation and the framework for the work. Chapter three express the essence of the Swedish command philosophy and describes the system and organization of sub-unit level tank units. The fourth chapter illustrates the method chosen for the work. This includes an explanation, the approach that has been chosen to deal with the empirical data and the motives for the choice. The fifth chapter consists of an overview and a summary of the empirical tests in a simulator environment. Chapter six is an analysis of the data collected in an attempt to understand the results from the experiments. On the results of this analysis of the mission data, a hypothesis of possible applications of mission command, directive command and self-synchronization at sub-unit level is presented. In chapter seven, the hypothesis is used as a basis for a discussion to relate the results in a wider context, including the possible application in military operations on urbanized terrain. The last chapter reviews the discussion and suggests some ways to continue the research.
2 THEORY

2.1 Introduction of the theoretical framework
The theoretical base is divided into four elements. All systems, concepts and theories are supposed to be utilized in a combat environment, and hence the first section will deal with the characteristics of battle space.

The terms of synchronization and self-synchronization as concepts for orchestrating the forces’ efforts in a combat environment are discussed in the second section. The third section, the theory on cybernetics comprises a general overview and a translation of the model to fit the conditions of a tank platoon. The purpose is to promote understanding of how organizations can be controlled and the demands put on an organization in order to cope with environmental demands.

The fourth section describes the theory of dynamic decision making and presents a model for control of a system that will be implemented in the laboratory experiments. The final section (2.6) is a summary attempting to link the theories described.

2.2 The combat environment
In his collected works, On War, Carl von Clausewitz makes an attempt to formulate a theory on what characterizes combat. He starts off by defining the phenomena:

"War therefore is an act of violence intended to compel our opponent to fulfill our will."\(^{21}\)

A conclusion of this is that combat is a situation characterized by dynamics. It is the act of friendly forces’ violence upon the enemy, countered by reactive responses of the enemy and vice versa. When one of the parties no longer responds the duel is over and one of them could be considered the victor of the battle.

To be able to move on, we will disregard psychological factors adherent to combat, like horror and agony of death. These will always be connected to situations where the outcome of the action may be fatal for the participants. We will ignore them for practical reasons. Even if the participators in a peacetime exercise may accumulate some stress and fatigue, this is for obvious reasons, far from simulating the real combat situation in all aspects. Hence, the full continuum of reality is hard to re-create and consequently it just is not feasible to measure. Instead we will focus on other characteristics that are connected to the battle and the human effort to control the outcome.

"Everything is very simple in War, but the simplest thing is difficult. These difficulties accumulate and produce a friction which no man can imagine exactly who has not seen War."\(^{22}\)

\(^{22}\) Ibid., p. 164.
This is a fundamental thesis where Clausewitz uses friction, a metaphor from thermodynamics, to visualize the difficulties that will occur in conducting battle, due to the fact that it is a struggle between independent forces that have opposing goals and intentions. But he states that friction is not concentrated to one or a few points, it is actually a phenomenon that is present in all interfaces between actors, whether an object or a human, that have to interact. But it not only ends by this description, outer frictions also add to the nonlinearity of the situation. This may be exemplified by bad weather and similar factors. Although bad weather and degraded visibility on some occasions may be beneficial, they may constitute a considerable disadvantage in other situations.

One foundation for making sound judgments is information. Clausewitz’s view on information in combat is:

> Great part of the information obtained in War is contradictory, a still greater part is false, and by far the greatest part is of doubtful character.\(^{23}\)

This is due to several factors. Going back to the basic definition of combat, the opponent will do his utmost to deny information and spread false information. The complexity of factors involved in combat also makes it difficult to observe the situation. Friction plays its part by delaying, piecemealing and sometimes completely disallowing information to reach through to the receiver. The lack of precise and timely information is a characteristic of the battle space.

The magnitude of multifaceted factors that is involved in the outcome of a battle is described by Clausewitz as:

> Further, every War is rich in particular facts, while at the same time each is an unexplored sea, full of rocks which the General may have a suspicion of, but which he has never seen with his eye, and round which, moreover, he must steer in the night.\(^{24}\)

By this we can conclude that Clausewitz perceives battle as a dynamic environment and that he observes that a characteristic of combat is the degraded ability to objectively observe the full spectrum of the environment in order to get information to support decisions. The definition of combat as a dynamic environment is further supported by the theories of Henry Mintzberg. Environment, according to him, is not limited to the terrain and weather, but also incorporates all outside factors that have an impact on the organization. He groups the environmental factors in four parameters:\(^{25}\)

1) Stability. The environment can range from the extremes stable to dynamic. While stable represents a solid linear, predictable evolution, dynamic represents the random, not in the sense variable but in the meaning of unpredictable. Clausewitz’s theories on combat as a duel and the inability to control the acts of the enemy may be applied here.

2) Complexity. The environment can vary from simple to complex. This not only incorporates deviations in technical equipment but also in the

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\(^{23}\) Clausewitz (1968), p. 162.
\(^{24}\) Ibid., p. 166.
human knowledge required to operate it. The concept of complexity also addresses the phenomena that relatively complex knowledge can be rationalized into simple knowledge by breaking it down into comprehendible parts, each consisting of relatively simple knowledge. For example, destroying a moving target at a range of 1,000 meters may be considered a complex knowledge. But this could be broken up into sequential simple processes, such as choosing ammunition, loading the gun, lazing, aiming, leading and firing, observing and adjusting fire.

3) Market diversity. This can range from integrated to diversified. Transferred to the environment of battle, one can state that the grade of diversity derives from the variety of tasks, geographical locations and different purposes that are demanded of the unit to complete.

4) Hostility. Mintzberg points out that an army fighting a war is in the most extreme of hostile organizational environments.

The effects of a dynamic and hostile environment related to the time constraint that the decision maker will have to operate under is described as:

> Of course, hostile environments are typically dynamic ones. But extreme hostility has a special effect on structure that we wish to distinguish. Hostility affects structure especially through the intermediate variables of the speed of necessary response.\(^{26}\)

Studying these parameters, the conclusion is that the combat environment could be considered dynamic. It also gives guidance of the time constraints that the organization must operate within. Consequently an organization operating successfully in this environment must have the ability to cope with situations that are not anticipated in the planning stage of the operation. Furthermore, it must also be able to not only react to unforeseen enemy actions but also be able to act and exploit situations that are favorable for the friendly forces. To further amplify the demands, the organization must be able to rely on a situational awareness that will never be perfectly updated. In all those aspects a relative time constraint is present. Mintzberg explains this as:

> What matters about environment in the design of structure is its specific effect on the organization. In other words, it is not the environment per se that counts but the organization’s ability to cope with it – to predict it, comprehend it, deal with its diversity and respond quickly to it.\(^{27}\)

Considering that this spectrum of capabilities, ranging from the avoidance of defeat by an enemy action to exploitation of enemy weaknesses that evolves, covers a wide variety of requirements. For the continued analysis one can assume that the organization must be able to react rapidly under uncertainty in order to remain a coherent unit. The wide variety of scenarios imply that the individuals that constitute the unit will have a limited possibility of gaining exact information to support the decisions needed to be taken.

\(^{26}\) Mintzberg (1993), p. 137.

\(^{27}\) Ibid., p. 137.
2.3 Synchronization

Synchronization could be defined as the arrangement of military actions in time, space, and purpose to produce maximum relative combat power at a decisive place and time. The effort to generate those arrangements is a fundamental thought when conducting operations and thus it is one of the key processes that C2 is occupied with. The evolution of the combat environment has however challenged the possibilities to successfully synchronize all the different force elements. The evolution is characterized by: an increasing complexity, a growing heterogeneity, and a faster pace of events. Increasing complexity stems from dispersion of forces and an increasing capability and technical sophistication of the weapons employed. These factors work in conjunction with a desire for more precision in operations and an urge to minimize casualties among own and allied forces. The growing heterogeneity springs from the variation of actors involved. Whereas combat historically was more or less an exclusive process between two entities, the nature of the battlefield now has developed to include coalition forces, governmental and non-governmental organizations, media and civilians. The threat has also changed from being clearly defined to a more vague description that could include military and para-military organizations. The evolution in sensors and transmission of data has led to an increased pace of events. This places higher demands on C2 functions in order to operate successfully.

There are a variety of methods to facilitate the continuous effort to establish, express and communicate a common set of goals in order to unite the combat power of the unit to achieve the objective. Some of these are shared prior knowledge, highly centralized command and control, centralized command and decentralized control, collaboration and self-synchronization.

Shared prior knowledge is a traditional means of management by establishing doctrines and creating a culture of teamwork. In combination with this, extensive planning, training and mission rehearsals strive to achieve synchronization. When centralizing the C2 process, the forces are given directives by a central planning and scheduling cell. This procedure is preferably done in a relatively stable and predictive environment. Centralizing command and decentralizing control incorporates the planning and scheduling at the higher level and leaves subsequent decisions associated with the execution to be decentralized. In collaboration, the C2 is an exchange of situational information up and down the chain of command in order to adjust plans, schedules and decisions with respect to the changes in situation. Finally, self-synchronization is a form of highly decentralized C2. It calls for sub-unit level decision makers to be guided by training, their understanding of the commander’s intent and their situational awareness of the relevant battle space.

30 Ibid., p. 213.
31 Ibid., p. 217.
2.4 Cybernetics – a theory of system control

One theory that can be used when examining systems for control is cybernetics. It is based on control theory and hence it has its origins in engineering. Having defined the combat environment as a dynamic milieu, it is of interest to seek a C2 system that can survive the challenges. This means being stable enough to manage to keep control in order to direct activities to achieve the goal. Ross Ashby’s *Law of Requisite Variety* is an explanation of what demands are placed on a system to maintain stability.35

![Diagram of a tank unit on the battlefield](image)

*Fig. 2.4.1. Applying the Law of Requisite Variety to the conditions of a tank unit on the battlefield.*

The figure above describes the system where a unit and its commander are trying to seize the objective. During this effort it is affected by changes in the environment. To cope with the alteration in conditions, the commander of the unit is to guide the unit to maintain cohesion and still be able to make progress towards the goal. The commander does this by checking the environment for changes and reacting to them by giving instructions to the unit. In order to control the system, the commander must have enough resources to respond to changes in the environment. As long as he has that, he complies with the *Law of Requisite Variety*. In this example the commander as a person is used to personify the control function. This implies that he is the one who is most aware of what is needed to be done in order to achieve the objective.

Another perspective would be to use the mission and the superior commander’s intent as a control function without intermediaries. If those are generally known and understood within the system, they provide a direction when vectoring the efforts of the system. By this it is possible to say that they could provide a control function and thus there is more redundancy in the system.36

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35 Ashby (1956), p. 113-117.
Based upon the Law of Requisite Variety, Stafford Beer developed the Viable System Model (VSM). This description of the VSM is based upon his theories as explained in his book *Brain of the Firm*.

The VSM consists of five systems: system 1 (action), system 2 (coordination), system 3 (control), system 4 (intelligence) and system 5 (policy). One way of understanding the VSM is to use the human body as a metaphor.

This translation of the model identifies system 1 as the muscles, the heart, the lungs and the skin. System 1 is the real output of the system and is also an interface with the outside worlds, in that they provide signals of impressions and stimulus from the environment. Activity in system one is coordinated by the sympathetic and parasympathetic nervous system. They encompass the whole of system 1 and thus give the organism a capability to coordinate automatic functions and to control the activity of system 1. These capabilities are referred to as system 2. System 2 is regulated by system 3, referring to the prolongation of the spinal cord. When these systems are in function, the organism will survive, being able to keep up the heart and lung functions. It will also be able to sense and react to threats against the organism. For instance, it will send an unconditioned reflex to withdraw the hand from a hot plate. But apart from that it will not take any planned actions. Those three systems comprise the autonomous management of the system.

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System 4 is the sensor of the organism, consisting of four of the five senses. As such they constitute an interface for the system to the environment, perceiving the environment that the organism is working in.

System 5 is the policy-making system that is responsible for making forecasts based upon strategy and inputs about the system status and environmental status supplied from the other systems. This system makes judgments of what alternative reactions are best suited for survival.\(^{38}\)

A viable system is regarded as being built up of these five systems and it has some typical characteristics. First, control is a function homogeneous to the system under control:

> The first principle of control is that the controller is part of the system under control. The controller is not something stuck on to a system by a higher authority which then accords it managerial prerogatives.\(^{39}\)

The conclusion that the control function in itself is built into the system gives the system a quality of being autonomous.

> The word 'autonomy' is pure Greek; it might be freely translated as meaning 'a law unto itself'. So when we speak of autonomy, either in the body or in the firm, we mean that the branch or function indicated is responsible for its own regulation. It is necessary that large areas of any such complex organization should in fact be autonomous. If every aspect of the business, every smallest decision had to be thought about at the senior management level, then the firm would grind to a halt rather quickly. It is the same in the body and the same reasons apply.\(^{40}\)

The system has inbuilt characteristics to react to signals from the environment and take proper actions in order to maintain stability.

> The important outcome of regulation is, as we learned from our study of homeostasis, to hold critical response variables within physiological limits.\(^{41}\)

This characteristic where homeostasis is the reluctance to change, could be related to Ashby’s Law of Requisite Variety. Thus, while an organism takes actions to respond to changes in the environment, it must also keep those changes within the physiological limits in order to maintain inner stability. To be able to do so, the array of response alternatives must be of such dimensions that they meet the requirement from the variety of the environment. If it meets those two conditions, i.e. is able to maintain both outer and inner stability, it could be referred to as a viable system, a system that will survive.

Having explained the VSM by applying it to the human body, the next step is to make an attempt to model tank units according to these theories. In order to do so, one must bear in mind that the VSM is based on the theory that the system is

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\(^{39}\) Ibid., p. 25.
\(^{40}\) Ibid., p. 103.
\(^{41}\) Ibid., p. 187.
a recursive one. By stating this, the system is built out of subsystems that are structured in the same way as the higher system.

Thus, a tank company comprises, with its commander as the control function, a system that in turn is made up of tank platoons with a similar organization. The platoon consists of three tanks that are similar subsystems. However, when segmenting the single tank into individual crew members, one could say that every single individual is a VSM. However, he/she will be constrained by individually varying goals, resources and differing capacities. So then again, looking at the tank as a system, it will not work as intended if it is divided into single crew members. Thus, the model of the system will allow the company down to a single tank to be visualized with respect to the five systems of the VSM. Thus, the figure below shows where in the tank company the five different systems are identified.42

![Figure 2.4.3. Translation of the Viable System Model to the conditions of a tank unit.](image)

The flow between the systems is depicted by arrows in the figure. The recursive characteristics of the system also imply that the system can be separated to platoon level. As such, the platoon leader would substitute the company commander’s role in fig. 2.4.3. The individual tank commander would then in turn assume the role of control and coordination.

The theories of cybernetics as models for control are not undisputed. Criticism has been raised stating that the model is not complete; that it does not recreate the entire process of C2. In order for a cybernetic system to become activated, it demands an input signal, something that the system should strive towards. The goal the system is to achieve is not something the system itself creates. Enemy

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42 Beer (1981), p. 130. Fig. 22.
activity that the system reacts to, or a mission from a superior commander making system 5 initiate action, could exemplify this input signal. To defend the qualities of using the model in this work, it would not be inappropriate to state that it is most likely that sub-unit level units do have some sort of mission to accomplish. Even the doctrine states that if the commander (at all levels) does not have a mission and sees an opportunity, he is to take the initiative and explore the situation. But in order to do so, it is more likely that he initiates the right action if the superior commander’s intention is clearly and correctly communicated.

2.5 Theories on dynamic decision making

Since the scope of this paper is on control in battle, it is appropriate to include a model for decision making (see fig. 2.5.1 and fig. 2.5.2). The model chosen in this work is that of dynamic decision making as outlined by Brehmer.

Dynamic decision making, i.e., decision making under conditions which require a series of decisions, where the decisions are not independent, where the state of the world changes, both autonomously and as a consequence of the decision maker’s actions, and where decisions have to be made in real time.

When approaching the model two essential elements are revealed. One is that decision making itself is not the primary focus of activity. Decision making is always related to an activity that is directed towards some goal. The other is the dynamic character of the tasks that the decision maker faces. This is linked to the dynamics in a combat environment. Thus the definition of dynamic decision making encompasses four elements:

(a) A chain of decisions is needed to achieve the goal. This is related to a process where decision making enables control of a constantly changing situation. But in order to understand the process, every single decision must be studied in the context of the other decisions.

(b) The decisions in the chain are related to each other. A decision taken is restrained by previous decisions and will consequently restrain the possible options for following decisions.

(c) The situation, and the circumstances for the problem change, not only in the dynamics of the environment, but in the actions taken by the decision maker.

(d) The decisions are needed to be made in real time, i.e. this is not the situation of a planning stage, where decisions could be reversed.

The figure below describes how chains of decisions are interdependent. Already from the starting point, a choice of A1 disqualifies further choices of B3-B4 and C5-C8. The same situation occurs when a choice of either B1 or B2 renders

44 Försvarsmakten (2003), p. 5.
45 Brehmer (1992), p. 211.
46 Ibid., p. 212.
either C1-C2 or C3-C4 obsolete. This shows the need to relate each decision to time and context of other decisions.  

![Diagram of decision chains]

**Fig. 2.5.1. Tentative chains of decisions, showing the relations between previous decisions and possible future decisions.**

To understand why decisions are made in a certain order and why this is important, the goal condition is introduced:

*Here, the observation that decisions are made to achieve some goal is helpful. As noted above, a general formulation of this observation is to think of the goal of decision making as that of achieving control: that is, that decisions are made to achieve some desired state of affairs, or to keep a system in some desired state.*

To lay down a general framework for the dynamic decision making theories, again we turn to the branch of engineering and use control theory. The usage of this has its limitations. Control theory is unable to handle the psychological aspects of human perception. While accepting that the theory is incomplete in that respect, it is still useful for the purpose of this work, since it defines four general conditions for control of any system, irrespective of whether it is controlled by a human being or a machine.

*There are four general preconditions:
- there must be a goal (goal condition),
- it must be possible to ascertain the state of the system (the observability condition),
- it must be possible to affect the state of the system (the action condition),
- there must be a model of the system (the model condition).*

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48 Ibid., p. 216.
49 Ibid., p. 217.
50 Ibid., p. 217.
The four conditions can be divided into system related conditions, that is observability and action, whereas the model and goal conditions are stipulated by the decision maker. The action and the observability conditions relate to the system’s characteristics, whereas the goal and the model conditions are associated with the decision maker.51

![Diagram](image.png)

Fig. 2.5.2. The four conditions define the aggregated controllability and capacity which defines what is possible to decide.52

When the action condition is satisfied, the decision maker is enabled to or has the permission to change the status of the system in order to vector the efforts to accomplish the goal. The dimension of this condition can be related to command authorities, the span of control that the decision maker has, and the doctrinal approach to command and control. The resource available must also be taken into account.

The observability condition comprises the possibilities for the decision maker to attain knowledge of the system in order to be able to determine the status of the system at a given moment. With this I mean the ability to observe the situation, encompassing all factors that exert an influence; for example the friendly and enemy situation; feedback in the form of known facts about these entities, and feedforward in the form of intelligence and assumptions on both enemy and friendly actions and units. The data that make up the observability are comprised from data produced at the tank unit: observations and assessments of the situation, as well as data relayed to the tank via hand signals, the TCCS and voice communication on the radio net.

To summarize these system related conditions, one could say that the structure of the organization and the doctrinal prescription set the preconditions for the

51 Brehmer (1992), 218.
52 Kylesten (interview, Linköping, 2005-04-18 and correspondence, 2005-10-10).
decision maker when defining what continuum of authority is delegated to him. The observability is dependant on the tank commander’s ability to incorporate data from his own tank and external data relayed to him into a situational picture describing the present status. His ability to coordinate this information affects the situational awareness that he perceives.

The model condition represents the mental model of the system that the decision maker has defined. This incorporates knowledge and experience of friendly and enemy forces’ composition, disposition, tactics and previous knowledge of situations that resemble the present situation. This mental model enables the decision maker to assess the consequences of action or passivity; what will probably occur if a certain action is decided upon or refrained from. The presence of a mental model is difficult to confirm. The training of tank commanders and platoon leaders incorporates education in a military decision making process. The rudimentary element of the process is a consideration of time available, terrain, friendly forces, enemy forces most likely and most dangerous course of action. The purpose of establishing a mental model is to be able to foresee the consequences of an action and thus proactively facilitate to act or counteract to enemy actions. Some elements that support this process are knowledge on enemy and friendly organization and tactics. The presence of a mental model ought to be reasonably dependant upon the decision maker’s mental condition; a decision maker on the verge of panicking has probably a very fragmentary mental model.

When defining that the goal and the model pertain to the decision maker, this could be represented by the fact that the model condition is a mental feature that is constituted by the decision maker’s knowledge and experience, while the goal is a little more dualistic in its nature. While it is something that is prescribed by a decision maker at a higher level, i.e. the higher commander, it could also be divided into subsidiary goals by the decision maker in order to sequentially or in parallel accomplish the main goal defined by higher command.

A systematization of dynamic tasks into six dimensions could be useful when trying to understand the results of a laboratory experiment. It is of value because this could serve as a guide to understand the behavior of the participants in the experiment. One categorization of dynamic tasks into six dimensions is to look at them from the perspectives of; (1) complexity, (2) feedback quality, (3) feedback delays, (4) rate of change, (5) the relation between the characteristics of the processes to be controlled and those of the process used for control, (6) the extent to which the decision making power in the system can be delegated.53

Lacking metric values, complexity is a relative concept. In this lies that it has to be related to something to be intelligible. For our purpose, the decision maker’s capacity is something that can be related to the complexity. This could also be referred to the Law of Requisite Variety, in the sense that the need for variety is dependant on the amount of influences from the environment that have to be dealt with in order to keep the system stable. This is related to the fact that

human capacity is limited with respect to the number of processes it can handle at a given time. But there is not a linear relation between the number of processes and the complexity of control since not all processes are related to control.\textsuperscript{54}

In the studies of complexity, some observations have been made that subjects in experiments with computer simulations have had difficulty in finding adequate goals. This could be related to the fact that they were given very general and diffuse goals that they then had to derive and formulate into more concrete goals before they were able to act efficiently. This suggests a connection between the goal formulating process and the mental models that the subjects may have. However, this circumstance has not yet been proven.\textsuperscript{55}

Applying this to a tank unit, one could see the resemblances in the commander’s ability to continually manage the actions of his company during operations in order to deal with the present enemy threat, in order to keep his system stable. In the absence of an enemy, it would be relatively simple to manage the actions of the unit. One can assume that the complexity will increase when in enemy contact; the increment however, will not necessarily be linear. The type of enemy, the enemy positions, to the front, flanks or rear, the rate of fire, the terrain and visibility etc, all interact in a nonlinear way to increase the complexity.

To this dimension could be added that a vague mission or objective forces the commander to seek, assess and define the purpose on his own before being able to make rational decisions and act.

Feedback is discussed in two dimensions. One is \textit{quality}, consequently the characteristics of the feedback influence the observability condition.\textsuperscript{56} The second is \textit{feedback delays}. This also affects the observability in that delays will affect the up-to-datedness of the observation of the system.\textsuperscript{57}

In the tank unit this addresses several issues. The TCCS gives reasonably accurate data on friendly units, updated at least twice every minute.\textsuperscript{58} The geographical precision of spot-reports can be accurate but due to time delays in the manual input process, the quality can be degraded. Intelligence and assessments can also be marred by ambiguity due to the quality of the assessment, the basis of the assessment and the time delay between the assessment and the distribution of the assessment.

\textsuperscript{54} Brehmer (1992), p. 228-229.
\textsuperscript{55} Ibid., p. 232-233.
\textsuperscript{56} Ibid., p. 229.
\textsuperscript{57} Ibid., p. 229.
\textsuperscript{58} Standard update on friendly tank units are 30 seconds. The divergence between the real position of a tank advancing at 40 km/h and it’s position as displayed in the TCCS is approximately 300 m.
The fourth dimension is *rate of change*. This is related to the frequency of changes in the process to be controlled. Hence a dynamic task can vary from rapid to slow depending on how the situation develops.\(^{59}\)

If this is related to the commander of a tank, this can be associated with the sort of management of the unit’s action he has to conduct, the enemy threat present and the quantity of subordinates that demand directives.

The relation between the characteristics of the processes to be controlled and those of the process used for control refers to the relation between the action to be controlled and the control process. This relationship is open for further exploration and we will stay with an assumption that for our purposes there is a linear relationship between them. This means that the decision maker reacts logically to system changes, implying that he is somewhat aware of feedback, such as enemy reports that are a little delayed, and that he is also aware there will be some delay between when an order is issued and when it is executed.\(^{60}\) Outgoing from the effects of combat environment, one can assume that this will not be a linear relationship between control and the consequences of the input in the system. But training and technical means will enhance the capability to better identify the consequences of how the input and control measures will affect the system.

The last concept is *the extent to which the decision making power in the system can be delegated*, or distributed, among the persons in the system. This affects the performance of the decision maker especially when the updating frequency of the observability is low. An increase in efficiency may then be noted if the decision making is located closer to the actual event, where the observability is more accurate.\(^{61}\) This is valid under the condition that sufficient resources can be massed to allow action and hence, if resources are inaccessible, a higher level decision is necessary. A relevant conclusion is that since speed is beneficial in decision making, profits could be made if adequate resources are allocated, promoting the decision to be made close to the event.

Again, relating this to the tank unit, there is a difference in the distribution of decision power between using restrictive control (centralized command) and directive command (decentralized command). The condition is also related to the commander’s presence; he is more likely to get a grip of the situation if he is positioned near the occurrence. This point of view is reflected in the field manuals; the company commander exercises C2 from a position that is most favorable for coordination.\(^{62}\) This could also indicate that if the company commander is not present at the event, the platoon leader might be the one that has a better situational awareness to support a sound platoon decision. Again this opinion could be disputed if the TCCS and radio reports enable the company commander to get an adequate situational awareness.


\(^{60}\) Ibid., p. 230.

\(^{61}\) Ibid., p. 230.

2.6 **Summary**

The theoretical foundation of this paper is based upon theories on the characteristics of the combat environment, the Law of Requisite Variety, cybernetics and theories on dynamic decision making. The links between these theories are exemplified by the arrows (A, B, C) in the figure below.

![Diagram](image)

*Fig. 2.6.1. The purple arrows (A), (B) and (C) depict how the Law of Requisite Variety, the Viable System Model and the theory on dynamic decision making are related.*

The environment in which the system is to operate, i.e. the combat, is characterized as a hostile, dynamic environment based upon the theories of von Clausewitz and Mintzberg. Having accepted the thought of combat as a dynamic phenomenon, the application of the Law of Requisite Variety is used as a theoretical approach to understanding the demands that will be put on an organization in order to survive and be able to act in a combat environment. From this point of view, the Viable System Model gives an explanation of how a system can be designed in order to meet the requirements.

Referring to the figure, three relations will be exploited. Arrow (A) indicates the connection between the objective or the endstate the system tries to reach and the goal condition. Arrow (B) points out the control system that is tasked to keep the system stable. In the Viable systems Model, this is done by system 5, policy making i.e. issuing orders to synchronize the efforts of the unit. The policy is a result of decisions taken, and hence the policy making could be referred to the conditions of dynamic decision making, as shown by arrow (C).

Using cybernetics and control theory as a theoretical approach in order to understand systems and systems control, is generally accepted. Furthermore, control theory applied as a metaphor in order to understand the dynamics of
decision making in the environment of combat, is a means used to understand how decisions are taken.

Assuming the acceptance of combat as a dynamic environment, the model of dynamic decision making could be appropriate to apply when interpreting the results of the laboratory experiments. The model has previously been used successfully by Birgitta Kylesten at the Swedish Defence Research Agency (FOI) when conducting field trials and research in military decision making, focusing on battalion commanders.\textsuperscript{63} From these two perspectives I have found the model relevant for this work.

\textsuperscript{63} Kylesten (2004).
3 THE TANK COMPANY AS A SYSTEM

3.1 General
This chapter is written with the purpose of giving the reader a summary of the doctrinal framework and a description of the organization, tasks and the command and control process of a tank company. The text is based on Swedish field manuals regarding command and control and operations with tank units. The manuals are issued from 1997-2005. Personal comments are supplemented in section 3.5.

3.2 The doctrinal framework
3.2.1 Maneuver warfare
Maneuver theory constitutes the fundamental concept for operations for all Swedish units. The concept emanates from a theory, focusing on the importance of diminishing the opponent’s will and power to continue the fight, rather than pure physical destruction of his forces. Maneuver theory is both a mental and practical approach to how a problem should be solved based on the notion that a conflict is a struggle between two or more wills. Since the combat is dynamic, the actions cannot be based on a prefabricated plan, there must be a freedom of actions to act and exploit unforeseen opportunities that arise. Maneuver theory also implies that there are other means at hand for problem solving, than pure military means. This way of looking at the matter is what constitutes maneuver theory, and is to be implemented regardless of the character of operation to be conducted. The military application of maneuver theory is called maneuver warfare.

Maneuver warfare is based on three interdependent components. They are mission command, initiative and the interaction between the indirect and direct approach. Maneuver warfare is the practical and military application of the maneuver theory. The endeavor should be to plan and conduct the operation with speed and agility by an effective use of objectives, success factors and a high degree of flexibility, with respect to means and methods. Rightly applied and used, this will lead to opportunities of gaining a higher speed and agility than the adversary. Our ambition is to accomplish the objectives with a minimum of resource consumption. The speed and agility must always be considered in relation to the adversary, making sure that speed does not result in a lack of coordination, when the situation demands this. That is why our speed and agility should encompass command processes, logistics and tactical maneuver in order to ensure that all these elements are faster than our adversary’s. This does not necessarily imply that in all situations we should

maneuver fast with our units. Speed does not always equal the same as a vehicle pace of advance.67

3.2.2 Mission Command - The Swedish adaptation of a philosophy

The foundation of a mission based command philosophy is an optimistic view of people confronted with the uncertainty of war and chaos. Man is generally fully capable of independent actions under the most extreme conditions. He is also able to act and take initiative that goes far beyond given orders and directives based on very imperfect information. This condition is valid in peace and crisis as well as in war. The basis for command and control in ground operations must be mission command. The ambition must be to grant commanders and units as great a freedom as possible to solve issued missions.

Mission command presupposes a dialogue between commander and subordinates. Hence, the commander must be distinct both when mediating the intent and the purpose of the mission, as well as when pointing out what resources and support are accessible for the mission. The balance between mission and resources is of crucial importance. The time available dictates the scope of the dialogue. The understanding and comprehension of the goal of the mission enables soldiers and commanders to improvise and exploit opportunities that arise, leading to success. To visualize the goal is an important part in the coordination of the operation. Coordination is conducted either by collaboration or command. Detailed coordination could be necessary in a certain phase of the operation, such as the decisive phase of an operation or in a situation that demands a coordinated execution in time and space. The guiding principle must nevertheless be that commanders are trained in a way that enables them to act according to the prevailing situation and the goal formulated by superiors in higher echelons.

Missions are issued in the form of orders. On certain occasions these are, if necessary, supplemented with timeframes, command relationships and relevant Rules Of Engagement, along with necessary needs for collaboration. If this mission based command philosophy is to have impact, commanders at all levels must, through experiences and exercises, contribute to the practical implementation of this command philosophy.68

3.3 Organization and operational tasks

The tank company normally operates with other units in the battalion but can be issued independent tasks. The aspiration is to fight as a united company. The offense is characterized by an effort to take advantage of the tank company’s inherent firepower and mobility. The aspiration is to rapidly and sequentially seize terrain that is necessary for mission accomplishment. Task organization should be kept simple and command relations clear.

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68 Ibid., p. 57-58.
Table 3.3.1.

<table>
<thead>
<tr>
<th>Task</th>
<th>Definition</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seize</td>
<td>Occupation by force to gain access to terrain for a certain purpose.</td>
<td><strong>Seize terrain</strong> means that a platoon must move to occupy an objective or defined terrain. The need for coordination of fire and movements varies with respect to the enemy, terrain and weather conditions.</td>
</tr>
<tr>
<td>Defend</td>
<td>Denying the enemy to seize or use terrain or establishment.</td>
<td><strong>Defend</strong> is conducted in a mobile and active manner, using fire from battle positions, indirect fire, air defense and support from engineers. An interlocking system of fire in front depth is preferred.</td>
</tr>
</tbody>
</table>

The meaning of the tasks seize and defend.

In the offense, an objective for the tank company does not normally exceed 1,500 m in width. The tank platoon is normally tasked to seize an objective not exceeding 300 m in width. The width of objectives can be reduced when attacking at night or in decreased visibility.

![A tank company conducting offensive operations](image)

**Fig. 3.3.1. A tank company conducting offensive operations.**

![Defensive operations; battle positions for company, platoon and single tank](image)

**Fig. 3.3.2. Defensive operations; battle positions for company, platoon and single tank.**

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70 Ibid., p. 88.
Defense operations are to be conducted in a mobile and active manner. Prepared battle positions for tank platoons are used to facilitate redeployments in order to mass the fires and to encounter enemy air assaults and enveloping operations. The tank company normally defends a battle position not exceeding 5 km in width and with a depth that enables a mobile action. The tank platoon normally occupies a battle position not exceeding 1,000 m in width.  

Consisting of an HQ/logistics platoon and four tank platoons of three tanks each, the tank company is organized according to the figure below.

![Fig. 3.3.3. The organization of a tank company and subunits.](image)

The HQ/logistics platoon constitutes the company’s resource for command and control, NBC, engineers, medical and logistical services. L1 is the company commander, L2 is the executive officer, L3 is the quartermaster. E depicts the fire support team. Other units are the armored recovery vehicle, the armored bridge layer, the four medical transportation squads and the staff section. Finally the technical squad, whose primary responsibility is the classification and prioritizing of damaged vehicles.

### 3.4 Command and control

#### 3.4.1 Methods of command and control

Mission command is an overarching method or philosophy of command that forms the base for our command and control. It requires:

- Independent commanders

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73 Ibid., p. 19-20.
Commanders that accept that subordinates act differently than what they would have done

- Encouragement of the will to take initiative and risks
- Mutual trust between commanders
- High levels of skill and training

Within the framework of mission command, two methods of command and control can be applied: directive command and restrictive control.

Directive command executed by the commander by issuing commander’s intent, formulating tasks and distributing the right to use resources, allows the one that has received the mission, as far as possible, to decide how the mission is to be accomplished. Subordinates must be well aware of the operational order to enable them to act according to the purpose.

In order to be successful with the operation, it is not possible to entirely exercise directive command on occasions that demand an action or response characterized by drill. This statement is principally valid for mechanized units at a tactically lower level than battalion. At this level restrictive control is usually exercised. Restrictive control encompasses limits in freedom of action and is principally used when operating within time constraints, aiming at coordinated fire and movements in order to achieve local supremacy.

Restrictive control does not challenge directive command, instead the demand of coordination determines the choice of command method.

3.4.2 Advancing to contact and when in enemy contact

Field manuals stress the importance of the company commander’s ability to continually manage the actions of his company during operations. That is his most important task, primarily using the method of restrictive control. This activity results in a constant flow of fragmentary orders often resulting in directing the subordinates in detail. The company commander exercises command and control from a position that is most favorable for coordination. He is also responsible for coordinating all combat support.75

To facilitate this, subordinate commanders conduct positive reporting. This means that subordinates suggest actions to take in order to get them approved from the superior commander. Reports on the friendly situation are conducted by referring to graphics in the operational order; waypoints, battle positions or by using the TCCS. Enemy situation is reported using map references omitting information on the friendly graphics. The TCCS could also be used to report enemy situation.76

The platoon leader exercises command in personal contact with the platoon by (a) establishing a personal view of the situation, (b) controlling the ongoing processes, (b) applying active leadership, and (c) coordination of different

resources at crucial moments of the operation. If a platoon leader has not been issued a task, or if he identifies propitious opportunities to act, and if the connection with the company commander is lost, he is prescribed to act according to the company commander’s operational order of execution. The company commander is to be advised about the taken actions as soon as possible.77

The method obviously steers the processes of decision making and management of the actions of the company to the company commander, and the result of the achievement of the company is coupled to his capacity to perform these duties. The stress on his ability applies especially when conducting operations in terrain that prohibits visual contact with other than the closest of the sub-units in the company and their actions. One could then assume that a more distributed decision making process would ease the burden of the company commander as well as being more aligned with the intents of the mission command philosophy.

### 3.5 Comments

I have noticed a distinct opinion that the company commander should strive to exercise command and control by extreme control.78 This applies particularly when advancing to contact and when in contact.

The joint radio network for the company is to facilitate this procedure. All subordinates in the company monitor at the same radio frequency. This renders it possible for the company commander to bypass the platoon leaders in order to manage single tanks in the company. The use of a common company frequency also, for practical reasons, limits the platoon leaders’ chances of directing the platoon over the radio. This discipline in using the net is commonly stated as “the company commander owns the company net”. The Situation-execution-task model of order is for three practical reasons almost entirely only used by the company commander and neglected by platoon leaders. The first is to avoid the overload of the company net. The second is a result of the striving to mass not only fire but the sheer volume of tanks to a narrow space, exposing the enemy for the massed company. Thus the situation is more or less the same for the whole of the company. The third is the doctrinal principle that prescribes the platoon leaders’ role primarily to being a control instrument for the company commander, making sure that his orders are executed.

Before the introduction of the TCCS an ordinary way for the platoon leader to command the tank platoon was, and still often is, using hand signals. Sometimes the method of gathering the tank commanders on the roof of the platoon leader’s tank turret and issuing verbal orders is used. The TCCS, however, offers new solutions for the platoon leaders by the possibility of sending data transmissions to their subordinates.

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78 Based on my experience while serving with the 6th, 7th, 18th Armored Regiment and the Army Combat School, 1990-2003.
4 METHOD

4.1 Scientific approach

We have now come to the point where an overview of the chosen scientific method is elementary for the continued work. When doing this, the considerations have initially taken a starting point from the fact that the research is primarily founded upon data collected from various tests, inquiries and interviews, complemented with deductions from literature. This will be supplemented by a seminar discussion with company grade officers in tank service.

At this point, it would be difficult to propose that I would be able to approach the material objectively without being influenced by my previous experiences from military service and the fact that I had the opportunity to watch and interact in the tests from a certain point of view. Together, this has resulted in the conclusions that a hermeneutic method would be proper to use.

The fundamental idea of hermeneutics is that the meaning of a component can only be understood if it is applied in the context of the system it is an integral part of. Parallel with this is the assumption that the entirety can only be understood by examining parts of it. This can be interpreted into a circular arrangement where a dual relationship interacts when the whole material is used as a context when comprehending details; furthermore, details facilitate the understanding of the whole. This dialogue emanates from the theories of mission command, directive command and self-synchronization. Hence pre-comprehension is chosen as the angle of incidence. This could be motivated by the hypothesis that not much has changed in the execution of C2 despite the introduction of new technical means.

2) Constituent
   Examining factors presumed to have influence on the course of event

1) Pre-comprehension
   Starting off with a broad theory

3) Comprehension
   Interaction of the factors to create a full picture

4) Entirety
   Using the new knowledge to refine the theory

Fig. 4.1.1. In the hermeneutic process, the methodological order used for this work is pre-comprehension, constituent, comprehension and entirety, leading up to a hypothesis.81

79 Benched next to the exercise coordinator during the tests, there was a mutual exchange of observations made and orders issued.
81 Ibid., p. 165.
The examination of the material will be conducted from an abductive perspective. Abduction is a combination of inductive and deductive methods. The inductive perspective searches for a general phenomenon in a quantity of cases and thus tries to establish something that is significant for all cases as a general rule. The deductive perspective starts off with a proven conclusion and uses this to explain a significant case. Hence, the abduction is applied to explore a case with a general hypothesis, and if this seems to be trustworthy, explains the case. This explanation should then be subjected to renewed observations in order to prove its relevance.\(^{82}\)

An abductive method will be used to study several missions conducted by tank crews. The data produced in the laboratory experiments will be studied using a comprehensive hypothetical pattern, a theory of decision making, based upon the presence of the four conditions (goal, action, observability, model). This theory will be used when analyzing the efficiency of the C2 method applied with respect to the ability to unite the combat power of the unit to achieve the objective.

Having established those conditions, and applied a variation in decentralization, the aim is to explore the effects of C2 inspired by the fundamentals of self-synchronization; highly decentralized C2 calling for sub-unit level decision makers to be guided by training, their understanding of the commanders’ intent and their situational awareness of the relevant battle space.

With this stated, the purpose of the work will be to examine the empirical data in order to understand the presumed relationship between (a) the interpretation of the task and commander’s intent as given in a mission, (b) the ability to interact and influence the course of events by variance in the action condition, related to the C2 philosophy used and (c) the result/outcome of the mission. The result will be an analysis in which my observations will be triangulated with the theories\(^{83}\) and the opinions of the participants in the laboratory experiments.\(^{84}\)

The data from the laboratory experiments will be subject to a qualitative investigation. Here one can choose between a qualitative and a quantitative perspective. A qualitative approach will aim at seeking an explanation from the perspective of the studied participants, and the produced data, even if the data are of a quantitative nature. A quantitative perspective would seek to explain a phenomenon with the aid of calculation, a more mathematical approach to the data. An example of this is when demonstrating a hypothetical relationship by using statistics.

This decision to use a qualitative analysis is based upon the fact that the attempt is not to state a general hypothesis founded upon statistical basis. Instead the work is an attempt to explore the effects of various methods of C2. Hence, a

\(^{82}\) Alvesson et al. (1994), p. 41-42.

\(^{83}\) Cybernetics and a theory of dynamic decision making as described in chapter 2.

qualitative approach, offering a possibility for a deeper understanding of the empirical data, is preferred to a quantitative approach.\footnote{Hallenberg et al. (2004-09-15), p. 9-11.}

## 4.2 From theory to designing experiments

This section will present some conclusions from the theories that will have a tangible influence on the design of the empirical tests. By using the theories of cybernetics and dynamic decision making and the links between the theories as described in section 2.6, the attempt will be to explore different methods of C2.

My conclusions are:

(a) The combat environment implies a need for a C2 method that is adaptive to a dynamic situation in order to meet the Law of Requisite Variety.

(b) Control theory could be used as a base for exploring C2. Four conditions are thus needed for the C2. Hence, there may be exposable interdependencies between the conditions for command.

(c) The observability condition is dependant on the observation systems of the system and is also affected by the combat environment. Since the environment exists, regardless of the chosen method for C2, the laboratory experiments will not purposively manipulate the observability.

(d) The goal condition for different C2 systems should also be a stable value in order to facilitate a reasonable objectivity when assessing the performance of C2 related to the level of goal compliance. But with respect to this, a difference in communicating the goal or commander’s intent could be exploited.

(e) The action condition, the ability to act in order to change the status of the system, would be interesting to vary. This condition could be used to explore differences in restrictive control and directive command.

(f) The model condition will be somewhat altered due to the introduction of a flattened organization. The participants will have little previous experience of this and hence, the ability to foresee the consequences of decisions might not be the same as in the usual hierarchal organization.

![Diagram](image_url)

*Fig. 4.2.1. Depicting the consequences of the conclusions resulting in guidelines for the laboratory experiments.*
Hence, two different methods of C2 will be explored. They will be related to the context of two different organizational structures. Restrictive control in a hierarchal organization is the present method and organizational structure that is used in the armored units at sub-unit level. The aim of conducting this type of laboratory experiment is to establish a reference. By applying directive command in a flattened organization, the purpose is to explore the effects when the communication of the goal to the subordinates is the main element to unite the efforts to accomplish the mission objective. Thus, by focusing on the mission and its objectives when briefing the operational order and by organizing the tank commanders on the same hierarchical level, the intent is to not limit their ability in the action condition. By doing this, the objective will be to explore the effects when the participants are unrestricted by echelons. The absence of a superior commander’s direct coordination ought to result in a need for the participants to conduct coordination by agreements. By creating these circumstances, the possibility of exploring the effects of self-synchronization appears.

Using the goal condition and measuring mission accomplishment gives us a possibility of creating a performance measurement as one way of determining the efficiency of the C2 system. This could be further explored when analyzing whether the goal condition is satisfied, ascertaining if there is a goal and if it is communicated and understood in accordance with its “idea”.

4.3 Two models of the system

We will now translate the organization of the tank platoon described in section 3.3 into two viable organization models to test: (a) a model that will pertain to a strict hierarchal command structure embraced by the present organization, and (B) a model that will comprise a model of a flattened command structure. Model (A) is a hierarchy in all respects. The top level being the company commander, via the platoon leader, the lowest level will be the tank commanders.

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![Diagram of the hierarchal structure of the model (A) organization.](image-url)
The second model will be that of a flattened organization in the respect that there will be only two levels of command, the company commander and the tank commanders. When utilizing the model (B) organization, the hypothesis is that self-synchronization will be necessary and it is allowed.

Two issues regarding both figures need an explanation. The test will only encompass one platoon for practical reasons: there are only three networked tank crew-training modules available in Sweden. The other issue is regarding the hierarchal organization that actually continues from the tank commander down to his crew consisting of three subordinates. But since the focus is on C2 interactions between company commander – platoon leader – tank commanders, this aspect is disregarded. The tank and its crew are considered as one unit, represented by the tank commander’s actions. This phenomenon could be accepted since the tank crew will, and have to, act as one unit to function as a system.

The purpose of using these two organizational models is to create an environment that is suitable for conducting tests. The tests are done in order to understand the relationship between gaining control by using the goal condition paired with the action condition. Making use of a flattened organization is attempting to explore the possible characteristics of self-synchronization.

### 4.4 The data production facilities

To generate empirical data, the tank platoon is used as an object. The platoon generally consists of three main battle tanks\(^{86}\). The set up for the empirical data collection can be described in general, as letting three tanks conduct missions with different complexity. They will operate within two different organizational structures and with two different action conditions. To be able to collect as much data as possible, the experiments have to be done in a simulator environment.

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\(^{86}\) Stridsvagn 121 (Leopard II) now being phased out and replaced by Strv 122 (Leopard IIS). The later is equipped with TCCS.
Consisting of three tank crew modules and a control and evaluation station, the BTA is a simulator installation designed to train tank crews at squad, platoon and company level with the strv 122 system. All stations are networked and thus all incidents occur simultaneously in real time at all stations.

The exercise director provided the contextual background for the mission issued to the participants. One advantage of this arrangement was that participants accepted the scenarios as credible, i.e. the missions were not considered as laboratory experiments.
In conjunction with the data collection facilitated by the BTA, a questionnaire was carried out with all tank commanders and platoon leaders after each mission. The purpose was to capture the participants’ personal reflections on the mission to facilitate a deeper analysis on background factors that might have influenced the results.

4.5 Layout of the missions

The missions constituted the experimental environment. They facilitated a friendly unit organized as model A or model B, an enemy situation and a mission to accomplish. This section will present the information and missions that were used during the five missions. All operational orders were given vocally in Swedish. In mission 1 and 3 only the platoon leader was briefed and in mission 2, 4 and 5, the three tank commanders were present at the briefing.

The exercise director provided the situational background for the missions. In summary, the platoon missions were to be conducted as a part of a peace enforcement operation, aiming at separating two factions and establishing a demilitarized zone (DMZ). The Swedish government has committed a mechanized battalion for this mission and it is currently deployed as a task force reserve within the multinational UN division. The Rules of Engagement (ROE) enable the use of deadly force and violations of the DMZ are to be considered as hostile acts towards the UN troops. This is to be interpreted that a force entering the DMZ should be neutralized.

4.5.1 Mission 1: Restrictive control - assault

The mission was conducted as a platoon mission. Organizational model (A) with a platoon leader was utilized. The platoon leader used restrictive control as a method of C2.

Situation: The enemy has attacked in an easterly direction over the railroad and conducted raids in the urban area of Stigtomta. The size of the enemy is assessed to be a mechanized infantry platoon reinforced with tanks. Friendly situation: QJ (Mechanized infantry company is deployed to the east of our company. We are presently not supported by artillery.

Mission: Our company, SJ, will attack with one platoon to seize the urban area of Stigtomta. The purpose of the mission is to seize terrain in order to facilitate using the road leading from Stigtomta in an easterly direction as a main supply route.

Execution: Initially one tank platoon will attack along the road to seize the urban area of Stigtomta-the railroad. Then the platoon will defend a battle position in the vicinity of the railroad.

Tasks: AS (Tank platoon) is to seize checkpoint 1, then continue to advance and seize checkpoint 2.

Service support: We will be supported by QJ medical assets.

Command and signals: Company commander will lead from command post.
4.5.2 Mission 2: Self-synchronization - assault

The mission was conducted as a platoon mission. Organizational model B without a platoon leader was utilized. Self-synchronization in the form of collaboration was used by the tank commanders.

**Situation:** The enemy has attacked in an east direction over the railroad and conducted raids in the urban area of Stigtomta. The size of the enemy is assessed to be a mechanized infantry platoon reinforced with tanks. Friendly situation: QJ, Mechanized infantry company, is deployed to the east of our company. We are presently not supported by artillery.

The purpose of the mission is to seize terrain in order to facilitate using the road leading from Stigtomta in an easterly direction as a main supply route with unarmored vehicles. Decisive for the battalion operation is that the road is open for traffic within 1-2 hours. Decisive for the company operation is that the road from Stigtomta to the junction 1 km northeast is open for traffic.

The enemy must be denied the possibility of laying direct fire on the road from combat vehicles.

**Terrain:** We must seize a crossing in Stigtomta and control it with direct fire in order to deny enemy traffic and allow further advance with friendly units.

We must be able to guide supply traffic in an easterly direction over the crossing. We must be able to protect supply traffic along the road from the crossing to the junction. The friendly supply units will contact us on our radio frequency.  
87

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87 This was the operation order briefed vocally in Swedish by the company commander to the platoon leader. (translation by the author).
4.5.3 Mission 3: Restrictive control - recon patrol

The mission was conducted as a platoon mission. Organizational model A with a platoon leader was utilized. The platoon leader as a method of C2 used restrictive control.

**Situation:** The enemy force has retreated in a northerly direction. Confirmed observation of two tanks; type unknown.

**Mission:** Our company SJ, will conduct reconnaissance in force, in order to clear the enemy situation in our area of operations between the railroad and the lake.

**Tasks:** AS conducts reconnaissance between the railroad and the lake up to the border of the company operations’ area.

**Service support:** Collection point for casualties will be at checkpoint 2.

**Command and signals:** Company commander will lead from command post located in Stigtomta.

Fig. 4.5.2. The overlay depicts the friendly and enemy disposition and composition for mission 3. Two enemy tanks are deployed in defensive positions.

4.5.4 Mission 4: Self-synchronization - recon patrol

Mission 4 was similar to mission 3. Since the same tank commanders as those who conducted mission 3 were assigned, a new set of terrain was suggested and approved. The enemy was organized to resemble mission 3 but in order to assure that enemy contact was established, the enemy force was enhanced from two to five tanks and one BTR 80, deployed over a larger area. The mission was conducted as a platoon mission. Organizational model B without a platoon leader was utilized. The tank commanders used self-synchronization in the form of collaboration.
**Enemy situation:** The enemy is assessed to be of size one-two tanks deployed in defensive positions between Stigtomta and the defilation between the lakes.

Decisive for the battalion operation is knowledge of the enemy situation in the area of defilation between the lakes. It is decisive since the road system is planned to be used for the transportation of an infantry battalion with trucks.

**Intent:** The task is solved when the enemy situation within the large circle is known and we can continuously monitor and report on the situation within the small circle.

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4.5.5 **Mission 5: Self-synchronization - rescue of civilians**

Mission five was considered to be the most difficult mission of the five conducted, since it involved civilians and non-governmental organizations in the target area. Applying time constraints and communications problems further increased the level of complexity. The mission was conducted as a platoon mission. Organizational model B without a platoon leader was utilized. The tank commanders used self-synchronization in the form of collaboration.

**Situation:** The enemy has infiltrated our area of responsibility with smaller units. These forces have begun deportation of the population in the village of Kristineholm. One unit, consisting of two tanks and one BMP guarding approximately 50 civilian hostages advances in a north easterly direction from Kristineholm and is assessed to reach the marked terrain within 30 minutes. An enemy tank platoon, supposed to assume the role of a quick reaction force is deployed in the area and is assessed to be able to reinforce the other unit within 15-20 minutes after orders or indications of our activity.

**Intent:** When the mission is accomplished, the enemy has been forced to discontinue the deportation of civilians. The non-governmental organization has been able to aid and assist the civilians with transportation and medical care.
Coordinating instructions:
Rules of engagement: you may open fire on enemy military vehicles and soldiers.

The aid organization Nagornos Future will arrive with a 50 passenger bus transport and one or two softskins to checkpoint 10. Lacking radio equipment, they will await your further guidance there, before intervening with medical aid and transportation.

The friendly assembly area
The enemy quick reaction force
The enemy starting point
(Two tanks one BMP with the civilian hostage)
Tentative attack by fire position
(This was also the position utilized)
The rendezvous point with the NGO

Fig. 4.5.4. The overlay depicts the friendly and enemy dispositions for mission 5.

4.6 Developing performance measurements

The challenge in assessing differences in efficiency when conducting a mission with a tank platoon is multifaceted. What is really the essence of the mission? What is to be conducted? What are the relations between mission accomplishment and loss tolerance? My conclusions as a previous tank instructor and having both participated and observed others evaluate tank crews and battalion staffs, are that the methods are both varying and often based on fairly subjective observations by the instructor. One source is just to listen to the radio communications to get the feeling that orders are issued in a logical sequence. The interaction between units and the ability to make use of the terrain for protected and concealed firefights and advances is also often to be taken into account.

Unambiguous results are often used and sought after. They are proof of the result of the achievement. Consequently, the outcome of simulator duels, the time measured in the process observation-identification-laying fire on an enemy target, are hard value figures in the evaluation of combat performance at sub-unit level units.
The focal point of this paper is on C2 at low level units. The emphasis has been placed at the platoon level and the interaction between tank commanders and if present, the platoon leader. Hence, the communication within the respective tank crews has been disregarded. Since it was the exercise executive who was responsible for both the situation, the general framework for the missions, and the specific conditions for the situations, it was natural to involve him in the discussion. The commander of the training installation also participated in these talks that took place the day before the first mission was conducted. The discussions concerned the following topics; gradation of mission accomplishment and how to identify mission accomplishment as well as the gradation of enemy destroyed and friendly casualties. We started by assuming that a platoon scores ten points for accomplishing mission. Furthermore, we assumed that conduct of operations for a Swedish unit participating in a UN operation is characterized by force protection and therefore the aim is for lowest possible risks. Next, we came to the conclusion that if the cost for mission accomplishment was two friendly casualties, the sum would be zero, and hence one casualty would be worth minus five points. Then we compared the relation in points between enemy and friendly. The conclusion was that assuming the force protection aspect as being valid, an enemy tank could not be regarded as high as a friendly tank. Hence, we set the value to about half, ending up with the score of three for the destruction of an enemy tank. Since an enemy AFV was considered less valuable than an enemy tank we agreed upon grading the destruction of an AFV to score one point. The product of this discussion of values for efficiency related to the performance measurement could be seen in the table below.

\[
\text{Table 4.4.1.}
\]

\[
\begin{array}{|l|c|}
\hline
\text{Mission accomplishment:} & \text{10 points} \\
\text{Destroying an enemy combat vehicle} & \text{1 point} \\
\text{Destroying an enemy main battle tank} & \text{3 points} \\
\text{The loss of a friendly tank} & \text{- 5 points} \\
\hline
\end{array}
\]

\textit{Score table for measuring the efficiency of the platoon.}

The values were stated before the tests began, but kept secret from the crews during all missions so as not to promote a focus on scoring efficiency points.

The exercise executive, acting as company commander was responsible during the tests for deciding when a mission was to be considered accomplished. The discrepancies between the values of destroyed enemies and friendly losses were due to the assumption that a friendly loss is probably less likely to be tolerated at a ratio one to one in international missions not involving defending Sweden.

The selected values introduced a situation where an accomplished mission resulting in the loss of two friendly tanks was worth 10-5-5=0, and a mission accomplished without enemy contact was worth more (10 p) than a frontal assault resulting in destroying three enemy tanks (total 9 p). Other resources spent to accomplish the mission, like ammunition, diesel fuel etc. were disregarded. The time space was generally omitted with respect to the mission complexity and also for practical exercise reasons.
4.7 Description of participants

The subjects of the empirical data collection were active officers of 7th Tank Training Company serving at the 7th Armored Regiment. During May 7th through May 10th 2005, a group of nine instructors and a company commander conducted skill training at the BTA.

Since all three crew-modules were to be manned, the instructors rotated the positions of platoon leader, tank commander, gunner and driver. The groups of three were kept intact during the tests. The manning of the loader station was omitted due to the low grade of interaction. Instead the loading mechanism was set to automatic mode, simulating realistic time cycles for loading.

The participants were all company grade field officers but with varying experience of command and equipment. Hence, before the tests they were all subjected to a questionnaire with the purpose of estimating the status of their qualities. The scale was set at five degrees from 1=little experience, to 5=much experience. A summary of the results is presented in tabular form (table 4.4.2).

<table>
<thead>
<tr>
<th>Officer</th>
<th>Years in tank service</th>
<th>Experience serving as a tank company commander</th>
<th>General experience with the tank system</th>
<th>Experience serving as a tank platoon leader</th>
<th>Experience serving as a tank commander</th>
<th>Experience with strv 122</th>
<th>Experience with TCCS</th>
</tr>
</thead>
<tbody>
<tr>
<td>N1</td>
<td>16 years</td>
<td>3</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>N2</td>
<td>8 years</td>
<td>2</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>none</td>
<td>1</td>
</tr>
<tr>
<td>N3</td>
<td>6 years</td>
<td>2</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>N4</td>
<td>12 years</td>
<td>3</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>N5</td>
<td>3 years</td>
<td>2</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>N6</td>
<td>4 years</td>
<td>1</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>N7</td>
<td>2 years</td>
<td>none</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>N8</td>
<td>2 years</td>
<td>none</td>
<td>5</td>
<td>none</td>
<td>3</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>N9</td>
<td>2 years</td>
<td>none</td>
<td>4</td>
<td>none</td>
<td>none</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

An overview of the participants’ self estimation of their experience. The scale is set to five degrees from 1=little experience, to 5=much experience.

A dialogue with the exercise executive who also served as the tank commander was conducted concerning the distribution of the different commands. The purpose was twofold: (A) the most important purpose was to make sure the training week was for the benefit of the personnel of the tank company and (b) to make sure that the tests were conducted with a valid selection of personnel for command. We both agreed that the consensus decision we reached satisfied those purposes. The results with our mutual comments are presented in table 4.4.3.
Table 4.4.3.

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Personnel</th>
<th>Comments to the distribution of commands</th>
</tr>
</thead>
</table>
| Mission 1 (Restrictive control) | Platoon leader: N7
Tank commanders: N8, N9 | Less experienced platoon leader and tank commanders but a fairly common set up for the conditions in the scenario. Could be used as a reference scenario. |
| Mission 2 (Self synchronization) | Tank commanders: N1, N3, N2 | Experienced tank commanders in a scenario with similar conditions as in scenario 1, but the absence of a platoon leader was considered a new challenge. |
| Mission 3 (Restrictive control) | Platoon leader: N8;
Tank commanders: N9, N7 | Less experienced commanders but a fairly common set up for the conditions in the scenario. Could be used as a reference scenario. |
| Mission 4 (Self synchronization) | Tank commanders: N6, N5, N4 | Experienced tank commanders in a scenario with more complex conditions than in scenario 3, facing a stronger enemy. The absence of a platoon leader was also considered a new challenge. |
| Mission 5 (Self synchronization) | Tank commanders: N6, N5, N4 | Experienced tank commanders, but a scenario with many more conditions to take in account than in all previous missions. There was no reference to this scenario but instead the purpose was to explore if the complexity was too much of a challenge to face with a unit without a named platoon leader. |

The participants’ commands in the five scenarios (personnel referring to table 4.4.2).

According to the above, one can see that the selection of officers for tank commanders and platoon leaders could be interpreted in two ways. In a comparison between missions one can see that the experience level of the tank commanders is high in mission 2, especially with respect to their training as tank company commanders. This might have an influence in the way that the tank commanders behave. Because of their experience of company command, they are used to of the concept of commander’s intent. Thus, they might have a greater understanding of mission command. In mission 1 and 3, a fairly inexperienced platoon leader was in command. The platoon leader himself had however had two years of tank experience, trained at the basic officer course and tank platoon leader course. At least one of them thought he had a high experience level working with the tank system. From the aspect of familiarity with the TCCS, the difference between the missions is less significant.

4.8 Validity and reliability

Measuring the difference in effect between a tight control function and a looser one based on mission intent is difficult in many respects. In this section and the following sections, some key elements of the problem are discussed.

Several factors are identified as possible elements influencing validity and reliability of the tests. Related to the doctrine and the nature of the test some factors listed are:

(a) An atmosphere to encourage the will for initiative
(b) Mutual trust between the participants
(c) A need for independent, self-confident, active individuals
(d) Participants’ previous experience and training
(e) Possible overspread of knowledge between tests
(f) Adherence to mission
(g) Perceived realism in scenarios
(h) Lack of interest in test participation and questionnaire

88 Försvarsmakten (2005), p. 54.
Concerning factor (a), all means possible were taken to encourage initiative. Besides normal mission related limits, like in some missions a company border, no limitations that could decrease the will to take initiative were intentionally introduced. Factor (b) was measured subjectively by the participants after each mission and will be discussed in detail separately. The influence of factor (c) is hard to estimate. Less experienced officers may tend to show less confidence and act more cautiously when confronting the uncertainty in the scenarios. However, the atmosphere of the exercise was relaxed and it was emphasized that the purpose was not to focus on individual performance or look for scapegoats. This may have reduced the influence of this factor.

Previous skill level and training with the tank system was be discussed in detail in section 4.6 above. Worth noting in this respect is the participants’ ability and the previous experience of using commander’s intent instead of issuing orders by stating direct tasks. The mission intent is not widely used below battalion level in Sweden. My experience of battalion level is that, though it is described in detail in field manuals, instructions and doctrines, it is practically conceptualized in a very vague way. With respect to this, it may be said that a new concept is introduced at Swedish sub-unit level units. The outcome of the tests and discussions with the exercise executive, personnel from the training installation, and the officers at the tank training company gives the impression that it was an unfamiliar but not difficult concept.

The possible transfer between tests was given a thought and resulted in the attempt of not using identical, but similar terrain. The enemy situation was also slightly different; minor shifts in location but not organization or tactics. Discussions with the participants gave the result that when using the identical terrain and enemy situation (mission 1 and 2) it did not influence the performance since a rotation between crew stations were conducted between the missions. Factor (f) is in some respects related to (a), (c) and (d). It is my and the company commander’s subjective opinion that the participants tried to accomplish given missions and not to conduct activities that would be counter productive or negatively influence the results. The perceived realism in the scenarios (g) that set the framework for the missions was mentioned by the participants in a positive response. Based on the company commander’s general situation, the scenarios were an attempt to reflect missions that could be conducted within the framework of an international operation. The participants did not dispute the absence of pure conventional war scenarios. Finally, the lack of interest or concentration (h): firstly, this is disputed by the meticulous way that the tank commanders filled in the questionnaire, secondly, the wish to extend the exercise to involving Tuesday evening. This contradicts a lack of interest from the participants.

By using a variation of several influences, it is thought that the factors interfering with reliability would be eliminated to some extent. The influence on

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89 This opinion was further confirmed at the seminar (Skövde, 2005-10-14).
90 The concept of using commander’s intent at platoon level is not revolutionary. It is used in the US Army sub-unit level. (Authors experience at the Infantry Captains Career Course (ICCC #2-2001), Ft Benning, 2001.)
the participants as experiencing a test situation is treated with respect. Hence, the performance measurements were unknown to the participants and the tank training company’s training executive assumed the role of formulating the framework of the scenario and acting as the field company commander during the tests.

The question concerning validity has been given special considerations and this has been dealt with from two perspectives. Firstly, an attempt to achieve internal validity by presenting the results of the missions and the analysis in a seminar discussion where participants in the laboratory experiments took part. Secondly, at the same seminar, external experts represented by personnel from the BTA and the exercise director participated, all of whom have had previous company commands. The external validity has been further enhanced by discussions with representatives from the Army Combat School, 7th Armored Regiment and US Army, concerning both the hypothesis and military operations on urbanized terrain.91

All in all, one could summarize this and say that the validity and reliability of the data produced during the tests are more or less incontrovertible. But it would be impossible to make that statement. However, the negative effects in the tests caused by human factors are probably not severe enough to interfere with the results presented. On the other hand the technical equipment has, in some cases, proven to be not fully reliable. Due to an upgrade in software of the simulator conducted simultaneously with the exercise, some tank crews have occasionally experienced degradation in performance of the system. Faults were remedied as they occurred, sometimes with short pauses in the missions as a result. Also some recorded data in the simulator has been lost as a result of rebooting. In those cases, notes taken during the course of events substitute the recordings of voice-traffic.

The performance measurements are one important parameter in order to determine the effectiveness. Other more cognitive factors such as amount and quality of radio communications, participants’ subjective opinion and comments from the after action reviews and participating observers are also taken into account. All in all, the expectation is that they will contribute to the analysis becoming broader and qualitative enough to be credible.

4.9 **Documentation**

All recorded material used in this paper is kept by the author. The material related to the missions consists of nine descriptions of the participants, 15 questionnaires answered by all commanders after each mission, a DVD with video recordings of briefings before missions and platoon after action reviews, notes taken of the course of action and company net radio communications, eighteen screen shots of situations during missions and recordings of the

4.10 Summary

At this stage the scientific foundation has been established. The hermeneutic approach to the empirical data will be utilized. Conclusions from the theoretical basis will influence the design of the laboratory experiments. Hence, two organizations, the flattened and the hierarchal, will be used in order to explore different C2 methods. Five combat missions for platoons have been designed. Mission 1 and 2 are comparable as are mission 3 and 4. The two pairs will be conducted with both organizations, the hierarchal applying restrictive control (mission 1 and 3) and the flattened (mission 2 and 4) utilizing directive command and self-synchronization. Due to time constraints in the BTA, mission 5 is a solitaire. This will be exploited by using a more diversified scenario and making use of directive command and self-synchronization. Thus, this mission will try to test the limits of this C2 method. The background and experience of the officers has been discussed and it is appropriate to point out some difficulties. First, officers conducting mission 1 and 3 will have less experience, being fresh from the basic officer course. They may however have more recent training, than older officers due to lack of command slots. The dualisticity in this problem when estimating the participants’ experience may be worth bearing in mind. Secondly, all the officers are from 7th Armored Regiment, a unit that has just recently been equipped with the strv 122, and hence the experience with the TCCS vary. These parameters may interfere with the reliability. The validity has been dealt with both internally and externally by seminar discussions and by discussions with several external experts.
5  EMPIRICAL DATA

5.1  General
In this chapter the results of the laboratory experiments, after action reviews (AAR) and observations, personal and those made by participants and the observer-controllers, are presented. The purpose is to give a more detailed description of the course of events of the five missions and external observations. The missions were conducted for three days and before the first mission, a warming up mission was performed in order to familiarize the participants with the simulator environment. This first session is not included in the analysis and thus the data is not presented.

5.2  Mission 1: Restrictive control - assault

5.2.1  Course of events

<table>
<thead>
<tr>
<th>Time (minutes)</th>
<th>Event</th>
<th>Callsign^93 (To←From)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>D+0</td>
<td>Ready to move out</td>
<td>AS← SJ</td>
<td></td>
</tr>
<tr>
<td>D+2</td>
<td>ROE permission to fire at SJ</td>
<td>SJ← AS</td>
<td>This was not questioned</td>
</tr>
<tr>
<td>D+8-30</td>
<td>Systems failure. Reboot of system</td>
<td></td>
<td>Short break</td>
</tr>
<tr>
<td>D+47</td>
<td>Contact w/ enemy observation post (OP)</td>
<td>GA← AS</td>
<td></td>
</tr>
<tr>
<td>D+50</td>
<td>Bypassing enemy OP</td>
<td>AS← EA</td>
<td></td>
</tr>
<tr>
<td>D+52</td>
<td>Enemy infantry close in on GA</td>
<td>AS← GA</td>
<td></td>
</tr>
<tr>
<td>D+55</td>
<td>Enemy AFVs destroyed</td>
<td>AS← GA</td>
<td></td>
</tr>
<tr>
<td>D+55</td>
<td>Orders: Defend battle position at waypoint 1</td>
<td>AS← SJ</td>
<td></td>
</tr>
<tr>
<td>D+58</td>
<td>Contact w/ two enemy tanks in Stigtomta</td>
<td>AS← EA</td>
<td></td>
</tr>
<tr>
<td>D+59</td>
<td>Two enemy tanks destroyed</td>
<td>AS← EA</td>
<td></td>
</tr>
<tr>
<td>D+68</td>
<td>Contact w/ enemy tank</td>
<td>AS← GA</td>
<td></td>
</tr>
<tr>
<td>D+70</td>
<td>AS friendly fatal casualty</td>
<td></td>
<td>Platoon leader knocked out</td>
</tr>
</tbody>
</table>


5.2.2  Observations
At the AAR, the platoon leader was well aware of the task and purpose of the platoon. The tank commanders were aware of the task but vague when asked to describe the purpose. It was possible to divide the development of the mission into two phases: The advance to contact with the enemy forward observation post and then the advance to contact with the enemy tanks in Stigtomta.

The initial part of the first sequence could be characterized as a relatively stable situation. The platoon leader utilized restrictive control and the platoon applied

^92 All Course of Event Tables refer to the missions described in section 4.5.
^93 Call signs in the hierarchal organization; Company commander: SJ, platoon leader: AS, tank commanders: EA and GA.
bounding overwatch technique\textsuperscript{94}. As contact with the enemy OP (BMP 2 and enemy squad) was established optically GA also encountered a small belt of mines. The following firefight was not controlled by the platoon leader: (a) the mines were not reported instantly, instead it took 35 minutes before their presence was generally known in the platoon, (b) the enemy situation was unclear; EA mistakenly acknowledged the BMP as destroyed and continued the advance approximately 300 m, whereas GA believed he was in contact with three BMPs, (c) the platoon leader lost orientation and did not participate at all. This could be because he did not utilize the TCCS to acquire his and the other tanks’ positions in relation to the objective.

The three tanks then started to chase the enemy infantry in different directions. As GA destroys the BMP, the platoon leader decides to gather the platoon at waypoint 1 and continue the advance. This renders a renewed advance into the minefield, and some confusion.

As the platoon leader regained control, that is, got a hold of his and the other tanks’ position and issued orders for a continuation of the attack from waypoint 1, new orders came in from SJ, stating AS to destroy the remaining enemy infantry and defend battle position at waypoint 1. The platoon leader decides that the presently occupied terrain is unsuitable and hence decides and advises SJ that AS will continue the attack towards Stigtomta.

As the advance starts, EA gets in contact and destroys two enemy tanks. AS and GA are passive; GA awaits directions from the platoon leader. Then GA gets in contact and the platoon leader is destroyed by another enemy tank.

In the AAR the observer-controllers also encouraged the use of the TCCS to distribute information on minefields to all tanks.

\section*{5.3 Mission 2: Self-synchronization - assault}

\subsection*{5.3.1 Course of events}

\begin{table}[h]
\centering
\begin{tabular}{|c|c|c|c|}
\hline
\textbf{Time (minutes)} & \textbf{Event} & \textbf{Callsign\textsuperscript{95}} & \textbf{Comments} \\
\hline
D+0 & VQ will arrive at Stigtomta within 90-120 minutes & All stns\leftarrow VQ & VQ: logistics battalion \\
\hline
D+4 & GA prepared to attack & FA\leftarrow GA & \\
\hline
D+6 & EA prepared to attack & All stns:\leftarrow EA & \\
\hline
D+8 & EA advances to observe the enemy OP & All stns:\leftarrow EA & \\
\hline
D+8 & FA prepared to attack. Will advance & All stns:\leftarrow FA & \\
\hline
\end{tabular}
\caption{Table 5.2}
\end{table}

\textsuperscript{94} Bounding overwatch: A movement technique used when contact with enemy forces is expected. The unit moves by bounds. One element is always halted in position to overwatch another element while it moves. The overwatching element is positioned to support the moving unit by fire or by fire and movement. See FM 101-1-5, p. 1:21.

\textsuperscript{95} Call signs in the flattened organization; Company commander: SJ, tank commanders: EA, GA, logistical battalion: VQ. All stns; abbreviation of all stations, meaning a broadcast call to all radio stations listening to the radio frequency.
towards the enemy OP as reported on overlay in TCCS

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Station</th>
</tr>
</thead>
<tbody>
<tr>
<td>D+9</td>
<td>No enemy observed in front of us</td>
<td>All stn:s ← EA</td>
</tr>
<tr>
<td>D+9</td>
<td>Will advance towards the farm at waypoint 1 to observe</td>
<td>All stn:s ← FA</td>
</tr>
<tr>
<td>D+9</td>
<td>Suggest you support by fire from your position as EA, FA advances</td>
<td>FA ← GA</td>
</tr>
<tr>
<td>D+10</td>
<td>Acknowledged, FA will support by fire from tree line</td>
<td>GA ← FA</td>
</tr>
<tr>
<td>D+13</td>
<td>Enemy contact, AFV, EA engages</td>
<td>All stn:s ← EA</td>
</tr>
<tr>
<td>D+14</td>
<td>Will continue advance along the wood line</td>
<td>GA ← EA</td>
</tr>
<tr>
<td>D+14</td>
<td>Sending spot report on TCCS</td>
<td>All stn:s ← GA</td>
</tr>
<tr>
<td>D+15</td>
<td>FA engages and destroys two AFVs</td>
<td>FA</td>
</tr>
<tr>
<td>D+15</td>
<td>Platoon now advances in echelon left</td>
<td>GA</td>
</tr>
<tr>
<td>D+16</td>
<td>FA overruns and destroys enemy infantry</td>
<td>GA</td>
</tr>
<tr>
<td>D+17</td>
<td>EA assumes fire position to support by fire</td>
<td>All stn:s ← EA</td>
</tr>
<tr>
<td>D+17</td>
<td>FA destroys enemy tank</td>
<td>All stn:s ← FA</td>
</tr>
<tr>
<td>D+18</td>
<td>FA systems failure on fire control system</td>
<td>GA</td>
</tr>
<tr>
<td>D+20</td>
<td>Enemy contact, tank, engaging</td>
<td>All stn:s ← GA</td>
</tr>
<tr>
<td>D+20</td>
<td>GA destroys enemy tank</td>
<td>All stn:s ← GA</td>
</tr>
<tr>
<td>D+21</td>
<td>FA destroys enemy tank</td>
<td>All stn:s ← FA</td>
</tr>
<tr>
<td>D+21</td>
<td>GA changes to alternate fire position</td>
<td>All stn:s ← GA</td>
</tr>
<tr>
<td>D+22</td>
<td>EA destroys enemy tank</td>
<td>All stn:s ← EA</td>
</tr>
<tr>
<td>D+23</td>
<td>FA destroys enemy tank</td>
<td>All stn:s ← FA</td>
</tr>
<tr>
<td>D+23</td>
<td>GA changes to alternate fire position</td>
<td>All stn:s ← GA</td>
</tr>
<tr>
<td>D+23</td>
<td>EA destroys enemy tank</td>
<td>All stn:s ← EA</td>
</tr>
<tr>
<td>D+24</td>
<td>GA receiving fire, changes to alternate fire position</td>
<td>All stn:s ← GA</td>
</tr>
<tr>
<td>D+24</td>
<td>EA hit by enemy tank but not fatally destroyed. Will support by fire from present position.</td>
<td>All stn:s ← EA</td>
</tr>
<tr>
<td>D+25</td>
<td>GA envelops enemy from south</td>
<td>GA</td>
</tr>
<tr>
<td>D+26</td>
<td>FA attacks to envelop enemy from north</td>
<td>GA</td>
</tr>
<tr>
<td>D+27</td>
<td>FA destroys enemy tank</td>
<td>All stn:s ← FA</td>
</tr>
<tr>
<td>D+29</td>
<td>VQ will be at the crossing site in 10 minutes</td>
<td>All stn:s ← VQ</td>
</tr>
<tr>
<td>D+30</td>
<td>EA is partially restored</td>
<td>GA</td>
</tr>
<tr>
<td>D+34</td>
<td>FA assumes initiative and escorts VQ</td>
<td>GA</td>
</tr>
<tr>
<td>D+38</td>
<td>GA defends to support the escort of VQ</td>
<td>GA</td>
</tr>
</tbody>
</table>

Comments: Mission accomplished. Enemy destroyed: two AFVs and seven tanks. One friendly tank partially damaged.

5.3.2 Observations

After the operational order was given, the three tank commanders gathered for ten minutes to discuss the mission and to make a concept of operations. Some comments were:

*We must avoid this degenerating into “High-Chaparral”, guiding is a little tricky, we must make sure that the road is unblocked, one alternative is attacking from the north, another is a frontal assault, anyway, we must get there to get an overview of the situation then we can make up a plan and distribute it to the TCCS, remember, no one will give us orders to assume fire positions, we will have to regulate this individually, should we have one commander, no, but we will advance as a platoon unit.*
At the AAR the platoon was asked if the goal of the mission was generally known among all crew members, and it was. Further, questioned on how synchronization was facilitated, one tank commander stated:

_We did not promote a platoon leader, instead it was automatically the one that could overlook the terrain best or the one that had the best situational awareness in each situation that made the decisions and put them forward as suggestions or as “Be advised, I will do this and that”._

The question of level and freedom of initiative was also discussed. One tank commander stated:

_There was a great difference compared to ordinary conditions. Many more things were accomplished now than what you ordinarily experience as a subordinate to a platoon leader, where you await orders and directives before taking actions. Damn! This time there was more than one who noticed the possibility of advance and used the advantages gained by the other tanks... If he can assume fire position there, I can advance to his left and use the gap to take a new position._

Some problems were also identified: the difficulty of coordinating the unit if one wanted to mass the fire on one target, as well as the importance of the tank commander’s awareness of the other tanks, when using larger areas than the ordinary width of 300 m. Also the mindsets of the tank commanders were discussed as the platoon had advanced in a different order than normal:

_One thing I experienced as a problem, being a methodical person, was that EA and GA switched positions in the beginning by mistake, and I, as commander of GA, ended up in the left wing. That felt troublesome, since I am used to being in the right wing and as the enemy resistance was hard on my wing I dragged after the rest of the platoon and had to rely on the TCCS to get a situational picture._

Another issue related to coordination was security and the risk of friendly fire. Here the gunners were asked for their perspective:

_One had to be quite alert, and on frequent occasions a friendly tank crossed the line of sight, well, not frequently, but it occurred sometimes, but there was no problem separating enemy targets and friendly units._

The tank commanders explained how the TCCS was utilized:

_You used the TCCS more frequently to identify the friendly positions and when possible you established optical contact._

One element in the mission was the guiding of the logistic battalion. The distribution of the tasks was discussed and the tank commander explained that the coordination was there for practical reasons, the one tank that was closest, guided and escorted while the others assumed fire positions to secure the crossing.

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96 During the seminar (Skövde, 2005-10-14) this procedure of reaffirming the information of friendly units was discussed. The general opinion was that this is a very common (and easy) practice to overcome the 30 second delay in the update of friendly units in the TCCS.
5.4 Mission 3: Restrictive control - recon patrol

5.4.1 Course of events

<table>
<thead>
<tr>
<th>Time (minutes)</th>
<th>Event</th>
<th>Callsign (To←From)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>D+0</td>
<td>SJ mission briefing</td>
<td>AS← SJ</td>
<td></td>
</tr>
<tr>
<td>D+28</td>
<td>Prepared to advance</td>
<td>SJ← AS</td>
<td></td>
</tr>
<tr>
<td>D+29</td>
<td>Move out</td>
<td>AS← SJ</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AS advances in column formation with the platoon leader 400 m in front of the platoon. The platoon leader heads the advance by about 400 m.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D+31</td>
<td>GA systems failure, engine system</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D+31</td>
<td>EA assume fire position to wait for GA</td>
<td>EA← AS</td>
<td></td>
</tr>
<tr>
<td>D+33</td>
<td>AS contact w/ one enemy tank that is destroyed.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D+45</td>
<td>Mission is accomplished and the platoon returns to the assembly area.</td>
<td></td>
<td>Only one of the two enemy tanks in the area was spotted.</td>
</tr>
</tbody>
</table>

Comments: Mission accomplished. One enemy tank was destroyed without friendly casualties.

5.4.2 Observations

The coordination of the initial stage of the operation was staggered due to mechanical failures on one of the tanks (GA). The problem of the dispersion of the platoon was countered by the platoon leader so that EA was ordered to defend a battle position as GA tried to catch up with the rest of the platoon.

The scheme of maneuver chosen by the platoon leader was column formation and this formation was maintained during the whole mission. The correctness of this could be discussed, due to the fact that the purpose of the mission was reconnaissance, i.e. to scout the terrain for enemy positions. The platoon leader however motivated his choice with the fact that a column is easier to control. This might be correct but due to the fact that the enemy situation was unclear, it might have been more favorable to use a bounding overwatch or a traveling overwatch technique.

The enemy tank that was encountered was dealt with according to standard operating procedures. However, contact was only made with one of the two enemy tanks in the area. The failure to engage the other one could possibly be related to the tight formation used by the platoon.

The AAR was conducted late in the evening due to systems failure in the BTA and owing to the late hour it was kept short. The main issues discussed were the platoon leader’s attempt to gain complete control of the situation. This resulted

97 Traveling overwatch: A movement technique used when contact with enemy forces is possible. The lead element and trailing element are separated by a short distance which varies with the terrain. The trailing element moves at variable speed and may pause for short periods to overwatch the lead element. It keys its movement to terrain and the lead element. The training element overwatches at such distances, that should the enemy engage the lead element, it will not prevent the trailing element from firing or moving to support the lead element (see Department of the Army, Headquarters (1997), p.1:157).
in that the same orders were given several times. Also the terrain analysis in relation to mission and formation to advance were questioned. Among the positive factors identified were the unwillingness to take unnecessary risks and the mission accomplishment without friendly casualties.

5.5 Mission 4: Self-synchronization - recon patrol

5.5.1 Course of events

<table>
<thead>
<tr>
<th>Time (minutes)</th>
<th>Event</th>
<th>Callsign (To←From)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>D+0</td>
<td>Mission briefing</td>
<td>All stn:s← SJ</td>
<td></td>
</tr>
<tr>
<td>D+30</td>
<td>EA begin advancing</td>
<td>All stn:s← EA</td>
<td></td>
</tr>
<tr>
<td>D+32</td>
<td>GA begin advancing</td>
<td>All stn:s← GA</td>
<td></td>
</tr>
<tr>
<td>D+32</td>
<td>FA begin advancing</td>
<td>All stn:s← FA</td>
<td></td>
</tr>
<tr>
<td>D+37</td>
<td>FA in assault position and prepared</td>
<td>All stn:s← FA</td>
<td></td>
</tr>
<tr>
<td>D+37</td>
<td>EA in assault position and prepared</td>
<td>All stn:s← EA</td>
<td></td>
</tr>
<tr>
<td>D+37</td>
<td>GA in position 500 m from EA, FA, EA has good possibilities to observe and support by fire. Will support until assault is conducted.</td>
<td>All stn:s← GA</td>
<td></td>
</tr>
<tr>
<td>D+41-67</td>
<td>Systems failure. Reboot of system</td>
<td>Short break</td>
<td></td>
</tr>
<tr>
<td>D+76</td>
<td>GA prepared to assault, will seize the right part of the objective.</td>
<td>FA← GA</td>
<td></td>
</tr>
<tr>
<td>D+77</td>
<td>All tanks begin assault</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D+79</td>
<td>FA contact w/ enemy tank</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D+79</td>
<td>FA destroyed enemy tank</td>
<td>All stn:s← FA</td>
<td></td>
</tr>
<tr>
<td>D+80</td>
<td>FA breaches enemy position at A1</td>
<td>All stn:s← FA</td>
<td></td>
</tr>
<tr>
<td>D+81</td>
<td>EA contact w/ enemy AFV</td>
<td>All stn:s← EA It is a tank, not an AFV</td>
<td></td>
</tr>
<tr>
<td>D+81</td>
<td>EA destroyed enemy tank</td>
<td>All stn:s← EA</td>
<td></td>
</tr>
<tr>
<td>D+82</td>
<td>We will continue the assault to objective A2 in line formation</td>
<td>FA←GA</td>
<td></td>
</tr>
<tr>
<td>D+89</td>
<td>EA contact w/ enemy, fires smoke screen and tries to envelop on right flank</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D+93</td>
<td>FA has advanced halfway to objective A2</td>
<td>All stn:s← FA</td>
<td></td>
</tr>
<tr>
<td>D+95</td>
<td>GA contact and is fatally destroyed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D+101</td>
<td>FA contact w/ enemy tank</td>
<td>All stn:s← FA</td>
<td></td>
</tr>
<tr>
<td>D+101</td>
<td>FA destroyed enemy tank</td>
<td>All stn:s← FA</td>
<td></td>
</tr>
</tbody>
</table>


5.5.2 Observations

The coordination between the tank commanders was made after the operational order was given. This collaboration resulted in the establishment of graphical control measures for the platoon in the form of two coordinating lines (A1 and A2). The initial advance could be characterized as uncoordinated; the platoon used an approximately 2,500 m width where two tanks to the north used a bounding overwatch technique, whereas the third tank advanced without support of the other two tanks. As the three tanks closed into the first coordinating line, they were in a width of about 500 m, which could be said is close to the normal dispersion. At this moment, EA advises FA and GA that he will support by fire as they attack. This is done as the assault commences, but almost immediately
EA realizes that his ability to lay accurate fire on the objective is reduced and he joins the other two tanks. The initial enemy contact is resolved and two enemy tanks are destroyed. At this stage GA, the southernmost advancing tank, gets in contact and without support from EA and FA, he is destroyed. The remaining two tanks continue to accomplish the mission.

The AAR dealt with the problems and risks of friendly fires when screening a large area on a broad front. In this it was raised the questionable about continuing the advance 700-1,500 m before taking care of the casualties (GA). Also the questions about the relation of the importance of mission accomplishment with respect to further risks for casualties were discussed. In this case the tank commanders assessed it as most important to fulfill the mission and pushed on, regardless of the casualties already inflicted and the lack of adequate intelligence on the enemy situation.

The tank commanders experienced a freedom to take initiative as described in mission 2 (section 4.3.2) and also held the opinion that coordination of friendly movement when in dense terrain was difficult. The TCCS was a good help to track friendly movement but the problem was to identify targets fast as the engagement range was so short.

### 5.6 Mission 5: Self-synchronization - rescue of civilians

#### 5.6.1 Course of events

<table>
<thead>
<tr>
<th>Time (minutes)</th>
<th>Event</th>
<th>Callsign (To←From)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>D+0</td>
<td>Mission briefing</td>
<td>All stns← SJ</td>
<td></td>
</tr>
<tr>
<td>D+12</td>
<td>Collaboration between the tank commanders</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D+29</td>
<td>GA prepared to advance</td>
<td>All stns← GA</td>
<td></td>
</tr>
<tr>
<td>D+30</td>
<td>EA prepared to advance</td>
<td>All stns← EA</td>
<td></td>
</tr>
<tr>
<td>D+30</td>
<td>FA prepared to advance</td>
<td>All stns← FA</td>
<td></td>
</tr>
<tr>
<td>D+36</td>
<td>I will support by fire as you advance</td>
<td>GA← FA</td>
<td></td>
</tr>
<tr>
<td>D+37</td>
<td>FA gives a description and assessment of the terrain chosen for the attack by fire</td>
<td>All stns← FA</td>
<td></td>
</tr>
<tr>
<td>D+40-45</td>
<td>Final coordinations of how to conduct the attack by fire on the enemy column: distribution of field of fires and tentative assignment of targets</td>
<td>Conducted as a collaboration on radio (voice and TCCS)</td>
<td></td>
</tr>
<tr>
<td>D+45</td>
<td>Sitrep and sending of overlay for attack and also continued attack to meet the enemy QRF in order to protect the NGO</td>
<td>SJ← FA</td>
<td></td>
</tr>
<tr>
<td>D+46</td>
<td>Contact with enemy column, distribution of targets</td>
<td>Conducted as a collaboration on radio (only voice)</td>
<td></td>
</tr>
<tr>
<td>D+47</td>
<td>All enemy targets destroyed, all tanks advancing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D+50</td>
<td>Systems failure. Mission discontinued due to major fault in the BTA.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comments: Mission accomplished. This was estimated as a result of a discussion between the exercise director and the observer-controllers. Enemy destroyed: one tank, one AFV. No friendly casualties.
5.6.2 Observations

The operations orders briefing was superseded by collaboration by the three tank commanders. The outcome was a common apprehension of general conditions that had to be met and essential tasks that had to be solved in order to accomplish the mission. In combination with this a tentative allocation between the tank commanders and the sequence of the tasks to be conducted was agreed upon. As the platoon reached the attack by fire position a new collaboration took place on the radio net in order to distribute the targets. This was done only over the radiofrequency by voice communication. It was considered most efficient due to the fact that all tanks could observe the engagement area and the time was critical. It is standard procedure to primarily utilize voice communication as the main means when in an engagement or when close to enemy contact. One reason is that the tank commander is focused on observing the terrain with his periscope sight. Focusing on the TCCS will force the tank commander to lose his observation. As the enemy and the hostage appeared in the engagement area, the friendly fire commenced almost simultaneously, destroying the enemy targets. Having completed this, one tank started to advance to establish contact with the NGO, while two tanks begun advancing to take up a battle position to counter the threat from the remaining enemy quick reaction force. At this moment a major simulator failure occurred and the experiment was discontinued.

5.7 Summary

This chapter describes the conduct of the five combat missions carried out by the tank platoon. The Course of Events Tables offer the possibility of following the conduct of operations by events and hence, understanding the time space. The outcome and conduct will be analyzed in the following chapter but some general observations would be appropriate to note.

One phenomenon that can frequently be observed is that once contact with the enemy is established, the following combat actions are resolved within minutes. Hence, this would indicate that the time space for a commander to coordinate actions by decisions and orders may be limited; first he must observe and assess the situation and then act. Another observation is the collaboration that was conducted by the tank commanders before mission 2, 4 and 5. This did not take more time than ordinary briefings of operations orders, but gave the impression that a greater understanding of the mission and commander’s intent was achieved. This impression was confirmed during the after action review, when the tank commanders were asked to brief the task and purpose for the mission they had conducted.

A presumption, held by both me and the exercise director was that the tank commanders conducting the missions with self-synchronization would elect one of them to coordinate actions. This was not confirmed; neither by the observations nor when the tank commanders were asked at the AAR.

The questionnaire is not presented in detail but the compiled results and the questions related to them will be used in the analysis in chapter 6, in order to enhance the understanding of the outcome.
6 ANALYSIS

6.1 General

The purpose of the analysis is to examine the results of the five missions conducted in an attempt to gain insight in the effects when applying mission command at platoon level and if it would be feasible to implement self-synchronization as a method for C2 at sub-unit level units?

The analysis will be divided into three parts. Firstly the conditions for decision making (the goal, action, model and observability condition) will be examined. This will be an attempt to qualitatively study how this factor is represented. The implied purpose of this analysis is that they represent the preconditions for the ability to make sound decisions.

Secondly the outcome of the missions in relation to the performance measurements will be examined. This will describe the efficiency of the platoon during the missions. The difficulty of applying such an indiscrete analysis tool is that underlying factors for the result might be hidden since the focus would be on the sheer numbers. Hence, a part of this analysis will be dedicated to trying to expose factors that might have contributed to the figures.

Thirdly an analysis from the perspective of the dimensions of dynamic decision making will be utilized. The focus in this aspect will be to study the complexity of the missions, the feedback conditions, incorporating both delay and quality, the rate of change and the extent of delegation of decision making power. This analysis is aiming at revealing factors that might have been left out, such as a mission that might have been perceived more complex from the participants’ perspective than from the observers. The purpose is to establish if, and in that case, why this opinion is held.

Finally, the conclusions of the analysis will be discussed at the end of the chapter in two sections. The first section will deal with how we practice C2 and if we adhere to what is prescribed in the field manuals. The second section will treat the subject of how we could practice C2. This will result in a hypothesis about the possible application of mission command and self-synchronization at sub unit level. This hypothesis will then form the basis for a discussion in chapter 6 concerning ideas for further development of C2 methods.

The analysis is based on the data produced in the form of recordings and observations during the mission and the questionnaire carried out after the mission. The initial analysis of the data was discussed and further refined by conducting a seminar with seven company grade officers serving at the BTA and at the training company, who took part in the experiments. The purpose of the seminar was to reach a deeper understanding of the factors influencing the results of the missions in an attempt to cover blind areas.
6.2 The conditions of dynamic decision making

6.2.1 The goal condition

One way of separating the goal condition into sub-elements is to refer to the mission, the commander’s intent and the task(s). The communication of the mission at sub-unit level is regularly done as described in section 4.5.1, giving the sub-unit commanders the company mission and the specified task to be carried out by the sub-units. This method omits the commander’s intent at company level and at sub-unit level the platoon leader rarely submits a mission statement or a commander’s intent. Another technique is to explain the company commander’s intent and define what should be achieved with respect to enemy, terrain and friendly forces. The first method was applied in mission 1 and 3 while the second method was utilized in mission 2, 4 and 5.

The diagram in fig. 6.2.1 depicts how well aware the tank commanders were of the goal for the mission. The tendency is that in the flattened organization the tank commanders were more familiar with company and battalion mission and intent. This was also evident when the tank commanders were asked afterwards to explain the mission and intent of the platoon and company. The low awareness of battalion level mission and intent could be explained by the fact that this is rarely briefed to tank commanders when using restrictive control.

Taking the above into account, applying restrictive control will result in higher stress on the commander. He is the one who will facilitate that the unit acts in accordance with the goals; that is the purpose when he is managing the actions of his unit, whether it is a platoon or a company. This was discussed at the seminar. The opinion expressed there to the question of what unites the activity at the platoon and company level, the answer was:

- The goal, the endstate, what it is to look like when the work is done. \(^{98}\)

\(^{98}\) Seminar (Skövde, 2005-10-14).
The use of an endstate in order to express the intent was also a subject for the seminar discussion. The opinions aired referred to the discrepancy of when the battalion staff distributes endstates to the company commanders, though the meaning of the endstate is rarely expressed by the company commander to platoon leaders and tank commanders. However, the general opinion of the seminar was that this endstate has to be analyzed and the consequences for the sub-unit level must be clearly expressed by the company commander.

Hence, in the goal condition we can relate to the basis for mission command: The understanding and comprehension of the goal of the mission enables soldiers and commanders to improvise and exploit opportunities that arise. Another important factor that facilitates the implementation of mission command is the knowledge of a higher echelon’s mission and intent in order to act towards the common goal. The discrepancy of how we make use of the endstate or the commander’s intent will be reflected on the sub-unit commander’s understanding of the purpose of the mission and therefore, limits his ability to act in accordance with the common goal. This leads to the implied fact that utilizing restrictive control will put a higher demand on the company commander in order to unite the sub-units’ actions.

### 6.2.2 The action condition

When examining the data on the action condition they are divided into three sections: factors related to: (a) doctrinal command philosophy, (b) initiative, and (c) issues related to confidence and trust between the participants.

The doctrinal command philosophy for platoon level units prescribes the tactical commander, the company or platoon leader to choose between directive command and restrictive control. The results of a question where the participants are asked to evaluate the perceived level of the applied method are compiled in the diagram below (fig. 6.2.2). The tendency that directive command is generally dominant in the flattened organization is not surprising, since the command relationship within the flattened organization favored this method.

![Diagram illustrating the answers on the questions: To what extent did you perceive that restrictive control, respectively directive command, was utilized during the mission?](image-url)
Mission command is one of the basis for maneuver warfare, promoting subordinates to use initiative to exploit opportunities. Hence, the perceived level of the ability to take action within the given mission was examined.

Fig. 6.2.3. Diagram illustrating the answers on the questions:
- To what extent did you perceive that you had the capacity to act and take initiative to accomplish mission?
- To what extent did you experience that you exploited given opportunities?

Relating to the level of directive command applied within the two different organizational models, it is possible to notice a tendency of a higher ability to act and make use of possibilities that arises in the flattened organization. This view was confirmed during the after action review of mission 2. Two other factors that influence the ability to act is the trust you feel and receive from others in the organization. This should be especially noteworthy in the flattened organization, where coordination is founded upon mutual collaboration.

When investigating the level of trust given and trust received, one is able to note a tendency that the flattened organization promotes trust. The mutual trust between commander and subordinate is a precondition for mission command as stated in the doctrine.

Fig. 6.2.4. Diagram illustrating the answers on the question: Did you trust the others in the unit?

99 See section 5.3.2.
The evidence of trust between the actors within a hierarchical organization is not as obvious. The questionnaire does not cover this aspect, but it is interesting to notice that in this small group of nine officers, they all gave and received more trust when acting within the flattened organization.

Another aspect of this condition is to estimate the participants’ perception of their personal influence on the actions of the platoon. It was noticeable in mission 1 that the platoon leader was not considered to be the one to coordinate most of the activity, although this was a hierarchical organization. This is contrasted to mission 3 where the influence of the platoon leader is significant. In mission 2 and 4 two tank commanders considered themselves as the ones that coordinated the actions and in mission 5 one could expect one tank commander (GA) to have assumed control over the other two tank commanders.

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**Fig. 6.2.5. Diagram illustrating the answers on the question: Did you experience that you had the trust of the others in the unit, to act and take initiative?**

**Fig. 6.2.6. Diagram illustrating the answers on the question: To what extent did you coordinate the actions of the platoon? In mission 1 and 3 the platoon leader is represented by call sign FA.**
In the analysis, doctrine prescribes that restrictive control is the preferable method of C2. That this is the standard method when practicing C2 at sub-unit level was also expressed at the seminar:

> You are very controlled as a platoon leader with today’s techniques, it is difficult to act, the restrictions control your actions rigidly. I feel that I am confined to an exact route of advance, exact position of the ridge where to observe from and so on.\textsuperscript{100}

The restrictive control that the company commander practices seems to be reflected lower down in the organization, in the command relationship between the platoon leader and the tank commander:

> I think the tank commander relies heavily on the platoon leader, waiting for orders. [...] For the tank commander it is mostly about surviving in his box of 100 x 100 metres [the area that a tank commander has at his disposal in a platoon formation] until the platoon leader issues orders.\textsuperscript{101}

This condition could be related to fig. 6.2.3. That’s why the lack of capacity to take initiative and exploit opportunities given, may be reflected from the tank commander back to the platoon leader and this in turn will burden the company commander. The lack of initiative may mean that the final success of the company will depend entirely on his ability to manage the action of his company.

**6.2.3 The model condition**

The model condition (as described in section 2.6) could be related to the participants’ previous knowledge of friendly and enemy forces organization, equipment and tactics. To this condition one could also add the participants’ experience of resembling situations. All these factors will make it easier to comprehend the data received, be it on the TCCS, the radio net or observations within the tank crew, and put them into a context in order to create knowledge. The decision maker’s knowledge will then facilitate the ability to act proactively, to predict the development of the situation. The actual presence of a mental model is hard to confirm. At the seminar the participants were asked to explain what model they made use of to assess the situation.

> Depending on mission type, I assess the terrain and time available. You know, I define the terrain that is advantageous, the terrain I need to get to before the enemy, in order to have a good chance of destroying him.\textsuperscript{102}

Regarding the enemy conditions, no additional information was given in excess of the initial briefing on the enemy situation in the mission briefing. Hence, it is interesting to notice that the participants in mission 1, identical to those in mission 3, present different levels of knowledge. Explanation of this could be that the platoon leader in mission 1 and 3 may have, intentionally or unintentionally, omitted facts concerning the enemy. This might be confirmed by the fact that in mission 3, where the knowledge about the enemy was

\textsuperscript{100} Seminar (Skövde, 2005-10-14).
\textsuperscript{101} Ibid.
\textsuperscript{102} Ibid.
perceived as low, or very low, the C2 method applied was dominated by restrictive control. The need for a mental model among the subordinates is less important if the commander is to manage their actions.

![Graph](image)

**Fig. 6.2.7. Diagram illustrating the answers on the questions: What is your estimation of your previous knowledge about the enemy regarding organization, equipment and capabilities, and tactics, techniques and procedures?**

The level of experience from similar situations shows that the platoon leader (FA) was the least experienced participant in mission 3. An interview with him during the after action review revealed that he had never before conducted a combat reconnaissance mission with tanks.

![Graph](image)

**Fig. 6.2.8. Diagram illustrating the answers on the questions: Have you conducted similar operations before? If so, how many times? (In mission 1 and 3 the platoon leader is represented by call sign FA.)**

Comprehending the model condition, one may say that it was present in all missions. At the seminar the opinion was expressed that when utilizing restrictive control, the platoon commanders and the tank commanders were relying heavily on their superior commander, awaiting his decisions and orders. This decreased the importance of a mental model but also indicated a tendency to reactive behavior instead of proactive behavior. A tendency to gain control by restrictive control, when the commander lacks previous experience, might be indicated in mission 3 if one compares the perceived level of restrictive control as displayed in fig. 6.2.2 and previous experience as depicted in fig. 6.2.8. This conclusion was also confirmed at the seminar.
6.2.4 The observability condition

The observability condition encompasses the possibility of observing the system, the unit, and the capacity to observe the environment. Hence, observability can be broken down into the situational picture and intelligence received or obtained on enemy and friendly forces. The intent when conducting the tests, was that the conditions between mission 1 and 2, respectively 3 and 4, should be more or less the same with respect to information given to the tank platoon from higher command. In order to establish the presence of the observability condition the reverse relationship, the shortage of information in some areas was investigated.

Analyzing the diagram it is difficult to see any clear tendencies. The need for information on the enemy situation is more emphasized in the hierarchal organization, when comparing mission 1-2 and 3-4. In mission 5 the participants appear to need least information on the enemy, which can be explained by a rather detailed enemy briefing in the mission order. During the seminar the participants were asked how the TCCS contributed to the ability of observing the system.

The TCCS offers a tremendous advantage. Before the TCCS we did not have the friendly situation in detail and it [the TCCS] is a really good asset to get an overview of the observation sectors for the gunners’ and tank commanders’ sights.

Using this statement, it could be interesting to correlate the lack of information on the enemy situation and the lack of information on the friendly situation, in order to try to understand the magnitude of the information deficiency. Hence, since the TCCS did work in all missions, this indicates that subjectively in mission 1 and 5 the enemy situation was perceived almost as clearly as the friendly situation. In mission 2, 3, and 4 the enemy situation was perceived much more uncertainly. This can be confirmed by the perceived satisfaction, or utilization of the TCCS.

103 Seminar (Skövde, 2005-10-14).
As shown in the figure above, the satisfaction was relatively higher in mission 1 and 5 compared with mission 2, 3 and 4. For mission 1, this is confirmed by examining the figure below.

The diagram indicates no major tendencies so it would be possible to take this as a confirmation that the tank commanders have received or attained information on both enemy and friendly situations in order to observe the system and the environment.

The tank commanders’ main sources for obtaining information have been the technical sensors of the tank, the TCCS, the radio net, and the tank crew. The opportunity for him to coordinate the information and make use of this as knowledge and as a basis for decision making, seems to be more or less the same, regardless of what organizational structure has been applied.
To summarize the conclusions, it could be stated that in all five missions the observability condition was present. The results show no tendency that the perceived opinion of the support of the TCCS is related to the different C2 methods. When utilizing restrictive control in mission 1 and 3, the highest and lowest levels of satisfaction with the TCCS are presented. When asked how the TCCS should be designed, a diversity of answers was presented: While a few participants found the system suited to its purpose, a large minority asked for a simpler man-machine-interface (MMI), referring to a more windows-like menu system, making it easier, for instance, to program the radios. Other suggestions were to replace the driver’s direction arrow display with a map, rendering it possible for him to see the waypoints. Another issue was the ability to display the laser measurements of all the other tanks in the platoon in order to acquire targets more easily.

Considering this, it is possible that some frustration arose from lack of experience with the system, but clearly enough, 45 percent of the participants stated that the MMI degraded their ability to use the system. Considering these results, one could however, assume that the lack of experience of handling the MMI of the TCCS probably influenced the observability and subsequently the performance of all the missions, regardless of C2 methods applied.
6.3 The performance measurements

By utilizing the performance measurements as described in section 4.6 and the mission data as presented in section 5.2-5.6, the results of the five missions can be compiled and the efficiency calculated as shown in the table below.

<table>
<thead>
<tr>
<th>Mission</th>
<th>Mission Accomplishment</th>
<th>Enemy tanks destroyed</th>
<th>Enemy combat vehicles destroyed</th>
<th>Friendly fatal tank losses</th>
<th>Total sum</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (restricted control)</td>
<td>0</td>
<td>3+3+3</td>
<td>1+1</td>
<td>-5</td>
<td>3</td>
</tr>
<tr>
<td>2 (self-synchronization)</td>
<td>10</td>
<td>3+3+3+3+3+3+3+3+3+3</td>
<td>1+1</td>
<td>0</td>
<td>33</td>
</tr>
<tr>
<td>3 (restricted control)</td>
<td>10</td>
<td>3</td>
<td>-</td>
<td>0</td>
<td>13</td>
</tr>
<tr>
<td>4 (self-synchronization)</td>
<td>10</td>
<td>3+3+3</td>
<td>-</td>
<td>-5</td>
<td>14</td>
</tr>
<tr>
<td>5 (self-synchronization)</td>
<td>10</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>14</td>
</tr>
</tbody>
</table>

Table showing the compiled results of the missions using the scores for efficiency.

Mission 1 and mission 2 were conducted under more or less similar circumstances. Also, mission 3 and 4 were conducted under basically the same structural conditions, but with a change of terrain. Mission 5 stands out from the other four, being of a more diversified nature, incorporating civilian hostages and NGOs intermingled with the fighting forces.

Comparing mission 1 and 2, using the stipulated performance measurement a major difference was identified in efficiency between the hierarchal organization, model (A), that was used in mission 1 and the flattened organization, model (B), that was utilized in mission 2. The significant difference in points can be derived not only from the different outcomes, with respect to mission accomplishment, but also the efficiency when establishing contact with enemy tanks during the final phase of the mission. There were recognizable differences in how the two organizations reacted: while model (A) tended to almost exclusively rely on the platoon leader’s ability to command and control the platoon\textsuperscript{104}, the model (B) did not have that restriction. This resulted in a loss of momentum for model (A) while the initial situation was identified and appropriate orders issued. As the platoon leader’s tank was destroyed, the platoon ceased to act efficiently. In model (B), the ability to respond to the enemy contact was not bottle-necked by one person, instead the three tank commanders countered the new threat on an individual basis at the same time as they identified the situation.

From this it is interesting to note two observations related to this mission: the importance of the platoon leader’s presence and management of the platoon, if the C2 philosophy is based on restrictive control. Another reflection is the fact that the model (B) organization scored the maximum sum for efficiency available by destroying all the enemy targets. The tank commanders did so by individually choosing targets and opening fire, without coordinating instructions. This could also be related to the maxim of promoting the idea that increasing the likelihood of winning a duel is by opening fire first. This tactic,

\textsuperscript{104} A tendency that was also expressed at the seminar (Skövde, 2005-10-14).
that was applied by tank commanders during the four-minute fire-fight, stands in contradiction to the ambition that the platoon should be considered as one firing unit that coordinately opens fire upon the enemy.\textsuperscript{105} The purpose of prescribing this procedure, is the attempt to mass fire upon the enemy.

When comparing mission 3 and mission 4 with respect to the performance measurement, the total sum achieved is almost the same, indicating that both models of organization are more or less equal in efficiency. An evaluation related to the characteristics of the mission might help us to further understand the outcome. When conducting the reconnaissance mission the intent was to get hold of the enemy situation in the specified area. In mission 3, with a relatively small area to scout, the platoon leader chose to advance with the platoon in a tight formation, emphasizing the need for mutual support in case of enemy contact. Implementing this scheme of maneuver did result in the destruction of one of the two enemy tanks present without friendly casualties.

In mission 4, a wider operations area was given to the platoon. Since no limitations in borders were given, the platoon faced five tanks and one AFV instead of two as in mission 3. But the wider area of operations balanced this and thus the density of enemy in mission 3 and 4 was roughly the same. The platoon initially advanced in a dispersed formation to an assault position. From the assault position, efforts were made to coordinate the attack toward the objectives. As the platoon got in contact, two enemy tanks were destroyed and an attempt to envelop the remaining enemy resulted in the loss of a friendly tank. It could be disputed whether or not this loss could have been avoided if a support by fire or bounding overwatch technique had been utilized when conducting the enveloping maneuver. Nevertheless, it points out the difficulty, even with a BMS, to coordinate fire with the maneuver when in dense terrain. The presence of a platoon leader might have helped to sort out the situation.

Mission 5 was conducted only once and with a model (B) organization and thus has no reference. This is a weakness but observing the conduct of the mission points out some interesting details. The mission was accomplished without friendly losses and all enemies that were observed were destroyed.\textsuperscript{106} The tank commanders now seemed to be more familiar with acting within the flattened organization. This is indicated by the frequent utilization of the TCCS to send overlays of plans on how to conduct the attack by fire on the enemy escort, and the collaboration on the radio net to finalize the plan and distribute targets before the attack. In a model (A) organization this should have been synchronized by the platoon leader. In this case, the tank commanders did their coordination, and my observation was that the effect was not degraded because of this.

This mission also incorporated a more complex battlefield environment with a civilian hostage situation and escorting an NGO to aid civilians. The coordination of fire, in order to avoid collateral damage, and the liaison with the

\textsuperscript{105} Försvarsmakten (2002b), p. 61.
\textsuperscript{106} The enemy reserve never came into action due to systems failure of the simulator.
NGO, were also tasked and conducted using self-synchronization without noticeable degradation of the effect.

6.4 The dimensions of dynamic decision making

6.4.1 Complexity

The difficulty of defining the complexity of a situation is discussed in section 2.5. One way of dealing with this is to focus on the goal.\textsuperscript{107} Thus, when trying to assess the complexity perceived, it will be related to what extent there was a goal for the activity and how well this was communicated and understood by the subordinates.

The goal condition as discussed in section 6.2.1 indicates a tendency that although the level of awareness of the platoon mission was more or less equally high regardless of the organizational structure, the awareness of the superior commander’s mission and intent was comparatively higher in the flattened organization. One explanation for this could be referred to the fact that all three tank commanders were present at the operational orders briefing in mission 2, 4 and 5, whereas in mission 1 and 3 only the platoon leader was briefed by the company commander. The platoon leader then briefed the tank commanders in the platoon. One conclusion of this, when considering complexity from the perspective of the need to establish a goal, is that the tank commanders in mission 1 and 3 experienced a higher degree of complexity compared to mission 2, 4, and 5. On the other hand, in mission 1 and 3, the platoon leader managed the tank commander’s actions, so they could rely on his ability. The question is if this resulted in a perceived decrease in complexity? Referring the situations to the Law of Requisite Variety, one can assume that in mission 1 and 3, the platoon leader’s ability to meet the demands of the situation was crucial, while in mission 2, 4 and 5, the three independent tank commanders, experiencing a greater freedom of action, had the ability to cope more easily with the environmental demands. On the other hand, new complexity is added in mission 2, 4 and 5 because no formal control establishment for friendly actions was instituted. When interviewing the tank commanders about the most complex element in the mission, at least one commander in each mission stated the unawareness or uncoordinated actions by friendly units as the most complex factor interfering in the mission. This was regardless of organizational structure applied in the mission.

6.4.2 Feedback delay and feedback quality

The problem of the actuality of input information in the TCCS was discussed during the seminar. The delay in feedback on the friendly situation was generally overcome with a consciousness of the TCCS capability and by using optical contact to confirm the friendly positions. The information on the enemy was also addressed. There was a discrepancy in the methods of using the TCCS with respect to distributing targets and enemy situation. The general opinion was

\textsuperscript{107} The relationship between the presence of a well communicated goal and complexity is discussed in section 2.5.
that the TCCS could be used for reports on the enemy, but in a contact the engagement of the enemy was to be the most prioritised process.

The aspect of the work environment was also addressed and the general opinion was that the tank commander loses control of the situation if he focuses on the TCCS. This means that there is a competition between the tank commander’s will to watch the TCCS display, in order to get updated on the overall situation, and when doing so, he risks losing the updated situation received by looking into his sight. At the seminar a company commander aired his views that subordinates tend to focus too much on the TCCS and thus lose the feedback from the environment where the enemy is a clear and present threat.

I have a feeling that sometimes the C2 function is entirely conducted by using the TCCS, or when the platoon is advancing, to disregard the actual terrain and try to accomplish the mission on the TCCS. It is noticeable in the voice traffic and the scheme of manoeuvre. The platoon advances along a straight line instead of utilizing concealment and protection offered by the terrain.

If this is true, it must be regarded as a major fault in the technique. The enemy will always be present in the terrain and this information is only sometimes input into the TCCS. Despite this, the fastest way to destroy the enemy is by target acquisition in the sight in order to eliminate. Thus, with regard to feedback delay on enemy situation, the smallest delay with respect to the enemy situation will always be because of observation. In this respect the TCCS can only be a guidance to acquire what area the enemy was last observed.

When trying to understand the feedback quality and the feedback delays that were perceived by the tank commanders and platoon leaders one could refer to fig. 6.2.11, in order to understand what the main sources of information were.

Considering those circumstances, the quality of the feedback could be regarded in the perspective of the feedback delay. Hence, while information received through observations by the tank crew in a sight could be referred to as having a relatively short delay, in the TCCS positional data on friendly units it could be delayed by up to 30 seconds. Other data transmitted are dependant on the same delay factors as voice communication on the radio net: the ability and motivation by the transmitter to send the message. The quality of the feedback, for instance enemy positions, is dependent on the quality of the observation and the ability to correctly communicate this.

The answers comprised in fig. 6.2.11, point at a tendency that similar sources are used in the missions in the search for information of the system’s actual status; the status of friendly and enemy positions and actions. This however, does not imply that the feedback delay and quality of the feedback will be the same between the missions: hence, in a hierarchal organization, the tendency for feedback delay is incorporated in the structure; the report from the subordinate must be transmitted to the commander for decision and the decision must be relayed back to the subordinate. This time delay might have been crucial during the second part of mission 1 as the platoon was in enemy contact, resulting in

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108 Exercise director at the seminar (Skövde, 2005-10-14).
one friendly tank casualty. In the same manner, the shorter feedback delay might have worked advantageously for the platoon conducting mission 2 when dealing with the same enemy.

6.4.3 Rate of change

An attempt to analyze the mission from this perspective could be examining if the participants thought the incoming flow of information disturbed their working routines.

![Diagram illustrating the participants' perceived level of disturbance in the working routines due to incoming information.](image)

Fig. 6.4.1. Diagram illustrating the participants' perceived level of disturbance in the working routines due to incoming information.

Fig. 6.4.1 indicates a higher degree of disturbance due to incoming information in mission 1 and 4. The figure does not reveal if the incoming information is exactly related to the rate of change in the process to be controlled. But examining the radio traffic in mission 1 and 4 indicates that the voice messages transmitted over radio between the tanks are related to changes in situation. The two friendly casualties in mission 1 and 4 could be regarded as important changes in the situation and hence call for actions. Here it is difficult to interpret if it is the speed, the rate of change in the process to be controlled, or the amplitude i.e. the magnitude of the change, that plays the key role. It is however, possible to assume that mission 1 and 4 were perceived as more demanding by the control process of the system when dealing with the incoming information.

6.4.4 The extent to which decision making power can be delegated

In mission 1 and 3 the delegation of decision power was left to the platoon leader. The company commander did not interfere in the actions of the platoon except in mission 1, when ordering the platoon leader to break off the attack and issuing the task of defending battle position. Hence, one could say that although the company commander did not exercise the regular management of the actions of the company, the platoon leader instead assumed this role. In mission 1 and 3 there was a hierarchical organization defining the decision making power as being with the platoon leader.
In mission 2, 4 and 5 the delegation of decision power was extended to the tank commanders. In these scenarios the C2 process of the platoon primarily consisted of the goal and spontaneous, iterative procedures of collaboration between the three tank commanders. In this flattened organization, the decision making power was equally dispersed among the three tank commanders – self-synchronization was utilized.

6.5 Joining the analysis into a hypothesis

6.5.1 A summary of the analysis

A general analysis of the missions, with regard to the performance measurement concludes, that generally more enemies are destroyed when acting with a flattened organization. This could be related to the circumstances in the flattened organization, where the participants experienced a higher level of mission command and perceived a greater capacity of taking initiative with an enhanced degree of utilizing the opportunities that arose.

Friendly losses occur in both organizations but it might be implied that in a hierarchal organization, this is due to the time it takes to respond to the threat, while in a flattened organization this is due to difficulties in coordinating the friendly maneuvers and avoiding fratricide. The problem of coordinating the friendly actions was also pointed out by the participants during the after action review of mission 2 and 4.

The possibility of utilizing self-synchronization as a method for C2 could be indicated by the fact that mission 2 and 4 were accomplished with better or almost the same score as mission 1 and 3; if calculated with the performance measurement developed. But when trying to measure the effectiveness of the two different C2 methods utilized, the answer is multifaceted. The analysis of the goal condition clearly indicates that breaking down the essence of the mission and presenting a commander’s intent to the tank commanders generally gives a higher overall understanding of how the platoon mission is related to the higher echelon’s mission. Since very few coordinating instructions were issued from the superior commander throughout all five missions, the initial briefing was the only guidance that was at hand when carrying out the missions. When relating this to the fact that the tank commanders perceived the possibility of acting and taking initiative to exploit given opportunities higher in all cases when the model (B) organization was utilized, indicates a tendency that if the purpose, commander’s intent and purpose of the mission is generally known, it enables and promotes subordinates to act. It would not be unreasonable to see this relationship between a clearly defined, communicated and understood goal and an increased perception of capability to take initiative and exploit opportunities as described in when analyzing the action condition (section 6.2.2). This is not a revolutionary conclusion; it is the essence of mission command and directive command. But what is interesting is that this fact is rarely considered when practicing C2 below battalion level in these types of units in the Swedish army.
6.5.2 On the adherence to the prescribed method of C2

The conclusion of this discussion is that we want to practice maneuver warfare and thus theoretically adhere to mission command. But at sub-unit levels restrictive control prevails. It is prescribed in field manuals as a derivate of mission command but with the present technique of employing it, it is difficult not to refer to it as a centralized command. The company commander is the key player in the team and the efficiency of the company relies on his capability to continually manage the actions of the company. The roles of the platoon leaders are habitually restricted to a control function. At platoon level, when the platoon leader acts more independently, it is not unnatural that the way he utilizes C2 is a resemblance of how the company is managed. The execution of C2 in mission 1 and 3 expresses this. Based on my previous experience and the observations of mission 1 and 3, I would state that we generally do adhere to what is prescribed in the field manuals; we do utilize restrictive control at tank sub-units.

6.5.3 Conclusions on new methods of C2

Some of the laboratory experiments in this work indicate that at least the same result or a superior result can be achieved in an platoon organized without a platoon leader. Does this imply that the organization works better without a formal leader? Three experiments were conducted in a flat organization. The purpose of this was to understand how self-synchronization works at sub-unit level. The results indicate that it is possible to utilize self-synchronization, at least to some extent. But when introducing self-synchronization one could raise the problem of defining who is in command. According to the Law of Armed Conflict, a person responsible for his subordinates must command all members and units.109 The command structure must at all times be in compliance with this regulation, even if working in an ad hoc combat command environment. Hence, if the chain of command is defined and accepted by the unit, the law is obeyed. The problem is marginalized in the cases presented in this paper, since the company commander is the one issuing the orders and hence he is to be responsible for his unit.110

Another challenge when utilizing self-synchronization, and maybe also when carrying the concept of mission command far, is the ability to allocate resources, such as indirect fire support. One way to deal with this could be to use a sort of anarchistic direct fire support, practiced by some infantry battalions in the mid 1990s.111 The essence of this concept is that all sub-units that call for fire get direct fire support and the supporting artillery unit supports the units in the order they receive the calls. The method had been tested and approved at exercises but it will present some challenges. Firstly, fire support is often a limited asset. The risk of spending it will be major. The second is the difficulty of prioritizing targets. Thirdly, the risk for fratricide will probably increase, since it will enforce a meticulous situational awareness with respect to friendly units.

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110 Broström (interview, Stockholm, 2005-10-11).
111 This was a method taught to me as I underwent the company commander’s course 1995-1996.
Another way to deal with this is to prioritize calls for fire at battalion level or when appropriate for a company commander. This is the way it is regularly conducted, and will not severely conflict with the theory of self-synchronization. If the battalion commander finds it suitable to delegate the direct support to a company commander who is exploiting an opportunity, it would be in line with directive control. Hence, by doing this, the battalion commander’s allocation of resources will facilitate the company commander’s decision making process and consequently increase the subordinate’s ability to perform within the action condition.

One of the preconditions for utilizing mission command is a high level of training and experience of the commanders at all levels. This is not to be disputed, but one question arises: how do we foster tank commanders and platoon leaders in the spirit of mission command and initiative if we constantly apply restrictive control, relying heavily on the ability of the company commander? Paraphrasing the question, what sort of officers do we foster if we practice mission command above battalion level, but not at lower levels?

6.5.4 Returning to the questions and developing a hypothesis

The first chapter introduces two questions to be penetrated: 1) Compared with present C2 methods, what are the effects when applying mission command at platoon level? and 2) Could it be feasible to implement self-synchronization as a method for C2 at sub-unit level units?

Initially the first question will be addressed. The analysis of the data produced in the five missions identifies several benefits when applying a more mission orientated command. This is because the possibility of fulfilling the observability condition has been greatly enhanced with the introduction of the TCCS. This enhances the observation of the system by an automatic production of the friendly situation presented as icons on a digital map display. Observations of the environment, i.e. the enemy can be vocally broadcasted and after an input in the TCCS also graphically displayed. The younger tank commanders confirmed that they regularly used the TCCS in combination with voice communication to relay information on spotted enemy, whereas the older were more sceptical to their capacity of managing inputting into the system fast enough, and at the same time be able to conduct the other duties of a tank commander. The model condition is present, confirmed by the junior commanders.

The quality of the mental model could be dependant on experience and the training of using one. Directive command promotes the practice of using a mental model since it distributes the decision making to some extent to the platoon leaders and tank commanders. Hence, an increment in this function would be a function of the ability to practice it. The level of action could be said to be a function of the decision power delegated to junior commander. One way of delegation is by utilizing directive command, the results of the mission show that it is a feasible way. The seminar held the same opinion.
I think that action will be initiated faster with directive command. Because if we get in contact with the enemy along the street, I have to, as a platoon leader, first take the decision where to deploy the other tanks, but if I have described the objective beforehand, the tank commanders will act. Otherwise, I have experienced situations where the tank commanders are waiting for a command, or an order.\textsuperscript{112}

The result of introducing a more mission oriented command at sub-unit level should also be theoretically substantiated. The Law of Requisite Variety, points out that an enhanced survivability of the system will be gained. The platoon (and the company) would be more fit to react to changes in the environment if the goal is clearly communicated and understood. This would make the system more variable and hence increase its stability.

In chapter 2 of this work, the Swedish perception of maneuver warfare and the adoption of mission command is described, separating the mission command into two methods to utilize at sub-unit levels: directive command and restrictive control. Two key elements in maneuver warfare are mission command and initiative. Interdependent as they are, it is hard to perceive a condition where subordinates take initiative without being fostered in the spirit of mission command. Field manuals state that restrictive control, being a derivate of mission command, is to be implemented at platoon level, referring to constraints in time and resources which demand a conduct of battle drills that degrade the freedom of action at sub-unit level. In the seminar the general opinion expressed a desire that subordinates should take initiative and exploit the opportunities that arise, showing a proactive behaviour.

Constraints in time and resources are two factors that are said to govern the preference of restrictive control in favour of directive command. The question of resources could be referred to as a need to centrally coordinate the assets available in order to gain maximum efficiency. This could be relevant on the one hand; the risk of spending the resources in an anarchical organization must be considered. On the other hand, if the commander, issuing the mission also stipulates the assets to support the accomplishment of the mission, or if he chooses to support the subordinate commander that gains the initiative and exploits an opportunity, then what is the dilemma? The time dimension could also be disputed as a criterion for not applying directive command: The experiments do not indicate that efficiency in time was gained due to the application of restrictive control. If directive command was used, one was able to see a gain in time once the operation commenced, due to the fact that the subordinates were aware of what had to be accomplished, and so were more able to respond efficiently to unexpected situations. The question of how we will train officers to be masters of mission command if we do not practice it at sub-unit levels is a paradox that is left unanswered.

Some conclusions can be presented to the second question, regarding the feasibility of introducing self-synchronization. The results of the experiments indicate a tendency that by employing directive command, and even by removing the platoon leader, will promote initiative and exploitation of

\textsuperscript{112} Seminar (Skövde, 2005-10-14).
opportunities. The tendencies also show the possibility of employing self-synchronization but factors identified, to some extent inhibit this. The seminar addressed the question in this way:

When applying self-synchronization, one loses the coordination, and with coordination meaning the possibility of massing the fire of the platoon at one enemy, the simultaneousness when starting an advance.\footnote{Seminar (Skövde, 2005-10-14).} On the other hand, restrictive control restrains the initiative and action from subordinates.\footnote{Ibid.}

Furthermore, the seminar also put forward the suggestion of introducing self-synchronization in the training. The purpose should be to train the tank commanders to act more independently, utilizing the goal of the mission as the primary means of control. This is already reflected in the tank crew training when conducting simulator training.\footnote{One exercise, that is repeatedly conducted, is \textit{King of the Hill}. The essence of this exercise is putting the tank commanders against several enemies and the one order is to destroy the enemy and survive.} Presenting an answer to the question is that we should not disregard the inherent capability of junior commander’s ability to solve problems in collaboration, if the goal is clearly expressed and understood. But, one must consider that conducting operations with self-synchronization as the primary method of C2, will require extensive training in both the technical means to employ it, in this case the TCCS, as well as in the ability to operate in platoon and company size units without a commander issuing the orders. The last requirement would probably need a change in attitude towards a more proactive behaviour.

From this a hypothesis can be derived stating that it would be feasible to utilize directive command at sub-unit level tank units. This would increase the combat efficiency of the unit and its initiative would be more featured. To promote the training of directive command, exercises conducting operations with self-synchronization as a method of C2 would be beneficial. These would strengthen the junior commanders’ ability to utilize the superior commander’s goal as the basis of their actions. A spin-off effect of this would be an increased capability in senior commanders to define and communicate clear goals to their subordinates.

The hypothesis presents some possible shortcomings: (a) the ability to coordinate support, both mutual and direct (b) the possible initial time delay for analysis and orders for platoon leaders, and (c) an increased risk of fratricide if self-synchronization is utilized. These shortcomings will be further discussed in section 8.1.
7 APPLYING THE HYPOTHESIS, A DISCUSSION

7.1 General
The discussion in this chapter aims at exploring the results of the analysis and testing the relevance of the conclusions for application when defining a functional method for C2 for sub-unit level. Initially, the Law of Requisite Variety and the VSM will be related to the conditions of future military operations. Secondly, some conclusions of the MOUT-study 2010\textsuperscript{116} conducted at the Army Combat School\textsuperscript{117} and results of the seminar will be combined with the analysis presented in chapter 5. Then the concept of C2 for US Army units conducting operations in Iraq will be used as a reference to compare the conclusions of this paper. Finally, a summary of the discussion will be presented.

7.2 The future is here - cybernetics and MOUT
The future operations area for the Swedish Army will be focused on missions abroad. This is clearly advocated from strategic level\textsuperscript{118}. Experience of recent conflicts points out an increasingly important requirement for the capability of being able to conduct operations in built-up areas and hence, this competence is to be prioritized\textsuperscript{119}.

The characteristics of urban terrain increase the challenges of the operations and some factors contributing to a more complex environment are; a probably higher density of non-combatants, terrains of high-rise blocks offering a three dimensional deployment, physically being more difficult to overlook, reduced capabilities of relaying radio traffic and shorter engagement distances. The terrain also severely limits the possibility of acting with the company as one unit and the company commander’s ability to exercise restricted control when the subunits are advancing on different axes of advance, covering more than one or two streets is very limiting\textsuperscript{120}. To further increase the complexity, the urban terrain consists of many bottlenecks, which can easily be reinforced by destruction and engineering.

Referring this to the \textit{Law of Requisite Variety}, the more complicated terrain would indicate an increment in the stress put on commanders at sub-unit levels to cope with the environment in order to maintain the stability of the system, to keep control and direct activities to achieve the goal. The Viable System Model being a model of a system of systems might give some guidance to a theoretical model of how to cope with this challenge. In the company, its commander represents the system 5 (policy making). Since it is possible to further divide the systems into subsystems of platoons, the platoon leader will represent system 5.

\textsuperscript{116} MOUT: Military Operations On Urbanized Terrain.
\textsuperscript{117} Walliden (correspondence, 2005-09-26 and telephone interview, 2005-11-01) and Markstridsskolan (2005-03-30).
\textsuperscript{118} Regeringen\textsuperscript{s} proposition 2004/05:5, p. 69-70.
\textsuperscript{119} Ibid., p. 54.
\textsuperscript{120} This was a distinct conclusion when conducting a major MOUT exercise in Stockholm 1999 where the author participated as the S3 of the 3rd Mechanized Battalion, 7th Armored Regiment.
at this lower level. Separating the platoon, the tank commander represents the system 5 of the tank crew. Hence, one way of making the system able to cope with the increased burden of facing a more complex environment would be to make use of the capabilities of the leaders representing the system 5 at the company’s sub-units. This would create a higher degree of variety and thus make the company and platoon more viable. With the present C2 method, the role of the platoon leader acting as system 5 and defining the goal for the platoon is limited, and the opportunities for the tank commander are even smaller.121

7.3 Some thoughts on C2 when conducting MOUT

Acting in a more complex environment where the possibility of keeping the company massed, indicates that new methods may be needed. The study on MOUT conducted at the Army Combat School,122 has come to some conclusions on C2; the commander must not be a burdened with more technology to facilitate the C2. Already with the present technology, the tendency is that he is in need of an assistant to operate the technical C3I-instruments in order to track friendly forces and call for fire support. In conjunction with this, the study opts for another solution where geographical position would influence the C2. Here a platoon leader would coordinate all the actions of the units entering his 300 x 300 m area of responsibility. Therefore, a more ad hoc task organization would be implemented. The perceived impediment of this concept is the traditional Swedish C2 culture. The one major conclusion is that some sort of BMS, incorporating the possibility for squad level units to communicate, is necessary to facilitate an adequate C2 method.123

The head of the study expresses the importance of a BMS as:

Directive command ought to be feasible if the commander is to be able to communicate his intent graphically through the TCCS124.

This also indicates a possibility of using the policy; the goal to facilitate C2 at this level. This would possibly result in lifting some burden off the company and platoon commander during the conduct of the operation.

How to utilize C2 when operating with tank sub-units in MOUT was also a topic of the seminar. When discussing the effects of utilizing restrictive or directive command this statement reflects the general opinion.

Restrictive control will probably tie down our capacity to act, an enemy tank will pin down our units and actions until someone reaches a decision. But if directive command is utilized, one will immediately try to envelop the enemy… probably this will initiate action faster.125

If this is taken into account, one could conclude that directive command may be the preferable C2 method. The possibility of massing the fire of the tank platoon

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121 This could be explained by the fact that the general ambition is to act with the company united as one unit.
122 Markstridsskolan (2005-03-30).
123 Wallden (correspondence, 2005-09-26).
124 Ibid.
125 Seminar (Skövde, 2005-10-14).
is pretty small, and even smaller with the company in urbanized terrain. Hence, the major advantage of restricted control, the ability to simultaneously mass fire from several units, comes to naught. Then there is the argument for the need of centralized coordination to avoid the risk of fratricide.

I claim that with TCCS, one could utilize directive command to its utmost. What needs to be clarified are borders between units and additional coordination. Deviations from these [i.e. changing of borders] could be settled through voice communication on the radio during the operation. [...] What is needed is a goal, an expression of what we want to achieve.  

As indicated in the MOUT-study, the ability to establish and maintain a clear situational picture of friendly forces, communicated to all units, down to squad level and below for infantry units, is of utmost importance to avoid fratricide. The ability for the TCCS to fulfill this demand might be questioned due to the scale of the map when operating in urbanized terrain, making the symbols too clumsy to be adequate. This has to be investigated further.

To summarize the discussion, it would be reasonable to conclude that in urbanized terrain, directive command is the preferable C2 method in order to promote initiative. To facilitate this, an adequate BMS is required. The proposal of self-synchronization in the form of ad hoc commands that are governed by the geographical positions of the units is one perspective on how to deal with the challenge of coordinating MOUT.

### 7.4 C2 practiced at sub-unit level in operations in Iraq

At this stage it would be of interest to try to reveal the relevance of the previous conclusions by comparing them with methods applied during ongoing operations in urbanized terrain in Iraq. A description of the importance of the understanding of the goal of the operation in order for the subordinates to initiate appropriate actions can be expressed as:

We ask soldiers and Marines to make judgments and command decisions that in previous wars were reserved for senior officers. A corporal standing guard in Baghdad or Fallujah can make a decision that affects the strategic outcome of an entire campaign.  

Taking this perspective into account, the importance of having a clearly defined, expressed and communicated set of goals, in order to facilitate the subordinates to take appropriate actions is obvious. Further, the complexity of the urbanized terrain demanding junior officers to act independently is articulated as:

Urban battles are isolated, compartmentalized affairs where small units must be self contained, autonomous entities that perform complex tasks without external help.  

Again, acting independently requires a clearly defined goal in order to take actions that are in accordance with the commander’s intent.

126 Seminar (Skövde, 2005-10-14).
128 Ibid., p. 16.
To investigate the aspect of this sub-unit level, the operations officer¹²⁹ of a US armored task force participating in Operation Iraqi Freedom, was asked to give his view on their methods of C2 practiced. The answers apply to both MOUT and rural areas. They have both types of terrain, as well as large palm groves no different than forests.¹³⁰

C2 is utilized in a different way than in a high intensity environment. Operations are not tied up to synchronization on battalion level, instead the company commander has a greater freedom of action of how, when and where the company conducts operations within the company area of operations. Hence, the C2 method utilized is mission tactics¹³¹, both at company and platoon level and the reasons for applying this method and the expected attitude from subordinates was explained as:

_We are so spread out on any given day that close supervision is impossible. Junior leaders are expected to show initiative, look for a fight, and then report. We 'pile on' extra combat power if there is a fight. Flexibility is critical to effective operations._¹³²

One question regarded the squad’s mandate to take action, and if it is encouraged to take initiative and act using the commander’s intent as the primary guideline.

_Yes, this is the primary means of command and control. Each platoon has a task and purpose for its mission, and is free to accomplish the purpose in any way that makes sense within the rules of engagement and commander's intent._¹³³

Are squads/sections/platoons tightly controlled or is mission tactics applied? At sub-unit level the relation between using directive command in relation to the operations plan is explained as:

_We don't have any infantry, so we never move with less than a tank platoon, either in tanks or in armored Hummers. That is about 15 soldiers. Mission tactics are in place for regular patrols. For specific missions like raids we have very specific plans for each platoon, although during execution mission tactics take precedence. Things always develop differently than the plan, particularly if the bad guys decide to run or start shooting._¹³⁴

In order to apply directive command in an environment where the friendly forces situation is important to avoid fratricide, a BMS called Blue Force Tracker (BFT) is used. The BFT gives a good friendly units situational picture but has some weaknesses such as not being good for communication because it can be slow at some times.¹³⁵

The conclusion is that mission tactics are used to a major extent at sub-unit level. This is facilitated by the BFT in order to establish a friendly situational

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¹³⁰ Creed (correspondence, 2005-10-12).
¹³¹ US Army term synonymous with directive command.
¹³² Creed (correspondence, 2005-10-12).
¹³³ Ibid.
¹³⁴ Ibid.
¹³⁵ Ibid.
picture. Operations are not synchronized as for a high intensity conflict. Instead
the focus is to synchronize at battalion level in order to ensure that sufficient
support can be provided and that the companies meet the commander's intent.\textsuperscript{136}

\textit{We don't synchronize each individual patrol, but instead provide focus for one or two
weeks out, as appropriate for the security situation.}\textsuperscript{137}

\section*{7.5 Conclusions}

The challenges MOUT presents, in the form of the specific terrain conditions,
the possible fragmentary battle space, the likely presence of non-combatants
will put a higher stress on any military system that is going to operate in this
environment. The theories of cybernetics specify that a system must meet the
Law of Requisite Variety in order to maintain its stability. When viewing the
tank company and its sub-units in correlation with the Viable System Model,
one can define the system as a recursive system, separating the company into
platoons and the platoons into single tanks. Hence, the sub-systems could be
identified as copies of the company from a system theoretical point of view.
With this said, the system 5 (policy) is the key element to control the system. In
order to support the company system 5, the company commander and the tank
commander’s ability to act as system 5 could be utilized. The more demands the
environment puts on the company commander, the more he should utilize the
systems 5 at lower level. System 4 (sensor) is comprised of all units in the
company that have a capability of observing and broadcasting the observations.
System 2 (coordination) could in this case be referred to all activities to
coordinate the actions at all levels, the TCCS being the most important asset.
The system 3 (control) could be referred to as the collaboration and issuing of
directives primarily facilitated by radio voice communication. This will allow
the muscles, the system 1 (action), the fire and movement of the tank units to
bear on the enemy.

Returning to the system 5, the analysis in chapter 5 indicates that the goal is the
primary control function of the organization. This is also implied in the field
manual, by stating that if the superior commander has neglected to define a task
for a subordinate, he in turn should define a task in accordance with the
superior’s intent.\textsuperscript{138} Hence, the importance of communicating and understanding
the objective and the intent is clear. The understanding of the superior
commander’s intent includes an analysis of it, breaking it down, which in turn
results in an intent that is valid for the sub-unit. By doing this, the sub-unit
commander, the platoon leader and the tank commander create a goal for their
activity enabling them to proactively act, instead of awaiting orders to act.

The conclusions of the seminar and referring to the MOUT study, the proffered
C2 method is directive command. The applicability of this C2 method on sub-
unit tank units is confirmed by the way US Army units in Iraq use the mission
tactics. The American way of doing business, encouraging junior leaders to act
and using the commander’s intent as the overarching instrument for control,

\textsuperscript{136} Creed (correspondence, 2005-10-12 and 2005-10-24).
\textsuperscript{137} Creed (correspondence, 2005-10-24).
points out a way of adapting to the environment that characterizes MOUT. The seminar unambiguously expressed a common opinion that it was the desire that junior leaders showed more will to take initiative and act, instead of relying on the company commander or platoon leader. The importance of initiative could not be underestimated; it is one of the foundations of maneuver warfare, mission command being another and the interaction between indirect and direct comprising the third. One way of promoting initiative is to define the mandate for the subordinates and make it clearly understood what is expected of them and what is desired that they achieve – not to explicitly tell them how to do it. This is the essence of directive command. These conclusions stand in some contradiction to what could be interpreted in the field manuals and doctrines, where restrictive control is said to be the preferable method of C2.139

The presence of the TCCS is the one system that will enable the sub-units of the company to act in accordance with the principles of directive command. The TCCS enables commanders at all levels to track the friendly units. By facilitating a common situational picture and displaying the friendly units, the risk of fratricide is reduced and the ability to operate in dense terrain is improved. Hence, the TCCS enables the tank commanders to use the time that before was spent tracking friendly units optically to observe enemy units and activity.

The level of training of the TCCS and the attitude to the system are critical factors, defining the potential for the units of the company to act proactively. In order to predict and assess the development of the situation and exploit opportunities the commanders at all levels must be familiar with and make use of the potential of the system. When defining the issue to be explored for this work, the question of why the prescribed methods have changed so little in spite of the introduction of the TCCS. This could be because of the fact that the potential of the new technology has not yet been explored, based on the theory that technology is interpretively flexible. This means that the utilization of technology is a function dependent on the background and intentions of the organization, the actors within the organization and the context in which the technology is developed. My conclusion of this is that the potential of the system is not fully explored. The basis of this statement is (a) the declared opinion on the seminar that there is a lack of adequate training, and (b) there is not only a difference in proficiency when handling the TCCS but also an outspoken discrepancy in willingness to use the TCCS140:

It [the usage of the TCCS] is very individual. I have seen those who do it [distribute targets and geographical positions of spotted enemies], and those who don’t. The older the platoon leader is, the less he makes use of the system [the TCCS]. If one feels comfortable with it, it is used.141


140 This was also manifested during the training of company commanders at the Army Combat School 2001-2003. The major factor for not willingly utilizing the TCCS in the training was the assessed overall proficiency of the company commander students. Hence the focus of the training was to establish a basis of how to command a unit.

141 The BTA instructor at the seminar (Skövde, 2005-10-14).
8 Final discussion and closing remarks

8.1 Strengths and shortcomings of this paper

The empirical data produced comprises five tank platoon missions. The limitation of data has been dealt with in three different ways; firstly, the analysis has been further explored and developed in a seminar discussion in order to verify the internal and external validity of the conclusions and promote further understanding. Secondly, the conclusions have been compared with present standard operations procedures utilized by an US army tank unit fielded in an ongoing MOUT. Finally, representatives of the 7th Armored Regiment and the Swedish MOUT Study 2010 have scrutinized the conclusions of the paper.142

The possible shortcomings highlighted in section 6.5.4 also deserve to be discussed. The ability to coordinate support, both mutual and direct when utilizing self-synchronization is relatively obvious. The platoon leader coordinates the mutual support between tanks within the platoon regularly. During his absence, this function will rely on the collaboration of the tank commanders. Tendencies that the tank commanders can solve this were shown during mission 3, 4 and 5. The ability to rapidly concentrate fire and coordinate the movement to exact time and space will however still be present when applying self-synchronization as a method for C2. An even more difficult problem when employing self-synchronisation is the ability to coordinate direct support. A theoretical solution, utilizing an anarchical direct fire support method has been discussed in section 6.5.3. The question is if this will satisfy the need to preserve assets and limited resources, in order to concentrate them where they are most needed. Utilizing directive command, however, will not suffer from the same disadvantage. In this case, the superior commander then has the ability to prioritize the direct support to the sub-unit commander who has the most advantageous situation to make use of it.

One can also suspect an initial time delay to occur before actions can be conducted, due to a more thorough analysis by the company commander and platoon leader, resulting in a commander’s’ intent. Although the tank commanders’ initial collaboration in mission 2, 4 and 5 does not indicate this, it might be true when applying this method in the field environment. The simulator does not present the frictions that may occur in the real world. However, once the operation has begun, it is probable that a higher understanding for the goal, communicated in the commander’s intent, will increase the possibility for subordinates to act and exploit given opportunities.

The risk for fratricide was considered higher when utilizing self-synchronization. The motive for this is that it puts a higher demand on the tank commander’s awareness of the friendly situation. The delay in the TCCS update may contribute to this problem. Applying directive control this could be solved

142 Nilsson, Jonas O., Major, Ar, 7th Armored Regiment and Wallden, Mats, Major, Army Combat School (Study MOUT 2010).
by defining areas of operations for the platoons, in the way we practice between companies today.

Considering these shortcomings of the hypothesis, the most important reason would be to avoid fratricide. Hence, if adequate measures to decrease the risk for fratricide are taken, the hypothesis may be relevant.

Relating the hypothesis to the conduct of operations described in section 7.3 and 7.4 strengthens the relevance of the hypothesis. However, although it would be an error to disregard the limitation in the quantity of data, the purpose or the work is not to be forgotten. Considering the few missions, this paper has aimed at a critical analysis and tentative conclusions paving the way for further experiments in order to develop appropriate methods for C2.

8.2 Future areas for exploration

This paper has only touched on some aspects of mission command at sub-unit level, which have been based upon rudimentary scenarios and made use of a tank platoon’s achievements.

This paper offers an analytic framework on how the work can be conducted. My suggestion is to increase reliability by increasing the amount of empirical data.

Two considerations should then be taken into account. The time available for training is limited. Hence, it could be profitable to make use of the ordinary training events that field units in the BTA conduct, in order to produce data for a more thorough investigation. In this aspect the newly operational CV 90\textsuperscript{143} platoon simulator could be used for data production.

Based on these investigations, it would be possible to establish a reliable hypothesis. This could then serve as a base for further exploration of the possible application of directive command at task-organized sub-units, comprising both tanks and infantry, conducting military operations in urban terrain. Secondly, the future of self-synchronization and its application also presents some challenges. This incorporates an exploration of the possibilities of developing ad hoc command structures, not from a hierarchal perspective but from a geographical view: to discover the ways of letting the sub-unit leader assume command over all units within his/her geographical area of operations.

The BTA is a feasible instrument for producing and recording data. But in order to further test the results, the next step would be to take the hypothesis to the field. One way of doing this would be to make use of a MOUT training facility and the STA.\textsuperscript{144}

\textsuperscript{143} CV 90: Combat Vehicle 90. Standard IFV of the Swedish Army armored infantry units.

\textsuperscript{144} STA: Stridsträningsanläggning. A mobile field combat training facility with simulator equipment and evaluation instruments.
8.3 Closing remarks

By examining five missions of a tank platoon this paper presents a hypothesis that states that the advantages that may be gained by using directive command at sub-unit level prevail over the negative effects. One important precondition for this is the higher commander’s ability to establish and communicate the goal to be accomplished.

The essence of this paper could be summed up in the quotation:

The nature of war will not change but the character of war has changed. We must master mission tactics, that is to say what to achieve and why, never how. [...] and we must prepare for mistakes, because mistakes will occur. [...] and we must get the appropriate technology to do this, starting at small unit level and working up, not at the strategic level, but the tactical level: The White House can see the roof of every building in Baghdad but the Marine lying on that roof waiting to enter can only find out what is inside by sticking his face around the corner.145

The core of the control theories presented in this paper is built around the Law of Requisite Variety, pointing out that the basic need to control a system lies in being able to meet the dynamic changes of the environment. The essence of this paper has revolved around coping with this dynamic environment, the nature of war. The exploration has been done by applying the theories of cybernetics and by focusing on the goal as an instrument for control within the system. In this some the challenge has been to identify the effects when applying mission command in the concept of directive command at sub-unit level. Using the tank platoon as an object has been an attempt at utilizing the operational BMS, the TCCS, in order to focus the development of C2 methods from bottom up, instead of using the top down perspective.

The opening chapter presents two examples where the goal is described in comprehensive terms for a subordinate commander. “Move fast to Forward Position Nine, and stop them there” and “Move! Destroy.” The two examples have some similarities; the same brigade commander issued them at roughly the same time and in the same geographical area. The outcomes of the two examples are reverse; in the first example, the Syrian assault was stopped dead and in the later example, the Israeli reconnaissance company ceased to exist after the initial enemy contact. This could imply that vague descriptions of the goal may provide guidelines but the vaguer they are, the more responsibility is transferred to the subordinate commander in the interpretation of what exactly is to be achieved. This may indicate that if the interpretation of the goal is left to the subordinate commander, the quality of his ability to do this will be decisive for the outcome of the combat. The latter example also illustrates that we must be prepared for mistakes. By accepting that subordinates make mistakes we will promote the initiative will to act to achieve the objective, not waiting for explicit orders. The only way to minimize the risk of mistakes is what is expressed by all officers that have participated in this work; training, more training and extensive training.

145 Hammes (correspondence, 2005-10-12).
8.4 Expression of gratitude

This work could not have been accomplished without the genuine support offered by the officers serving at the 7th Armored Regiment and the Army Combat School. Ingrida Leimanis and the Foreign Languages Section at SNDC have provided most valuable support in making this paper worth reading. Finally, my work has been indefatigably guided and encouraged by LtCol Per Arne Persson PhD, at SNDC. His commitment has been inestimable.
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