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"NETWORK CENTRIC WARFARE – NORWEGIAN CHALLENGES"

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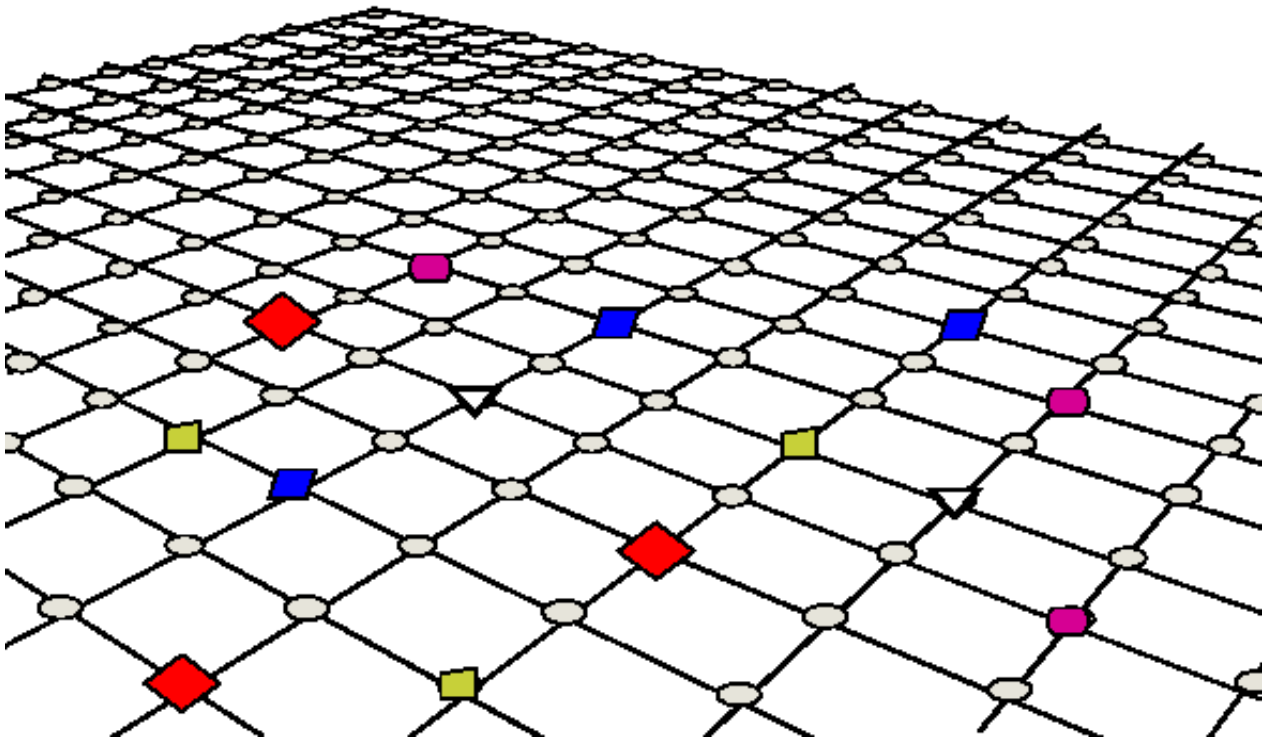

Chief of Defence Norway has decided that network centric warfare will be the basis for a study on the future development of the Norwegian Armed Forces. The decision was made due to the development of NCW within major NATO Allies and Norwegian partners. The purpose of this paper is to provide substantiation that the Norwegian Forces can, with difficulty, transform themselves into a truly network centric force. It will illustrate how obstacles related to Norwegian ambitions, Command and Control, technological requirements, interoperability, and finally, just ability to lead and command, can be overcome. It shows that the greatest challenge to NCW for Norway will be the contemporary mindset among its senior military leaders, and that this obstacle can be overcome.

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> It is the practical embodiment of what has been termed the Revolution in Military Affairs, with *network-based defense as a central concept*. Our military transformation will have to be achieved through a good combination of preparation and direction from above with creativity, renewal and development from below, both nationally and within the Alliance.
>
> Krohn-Devold MOD NO[1]

1 INTRODUCTION

Network Centric Warfare (NCW) is a catchphrase among officers when discussing the future of war fighting and the Revolution in Military Affairs (RMA).[2] Many use the expression without knowing the exact meaning, some even believing the expression relates solely to computers and information technology. In Norway, NCW translates into Network-Based Defense (in Norwegian "Nettverksbasert Forsvar – NBF"),[3] the word defence being politically directed. For this paper, I will use the US term NCW, which equates to the NBF. Both concepts are equivalent as we shall see through out this paper.

NCW is a concept, an idea, of how military operations can be conducted by linking military capacities through an information network. The concept is based on the idea of information superiority and the use of this superiority to gain increased situation awareness, increased tempo of decision making, increased tempo in operations, increased force protection and sustainment, and synchronisation of operations.

[1] Devold, Kristin Krohn (Minister of Defence, Norway). *"What we want and where we want to get to: Defence policy aims and priorities in 2003"*. Address to Oslo Military Society, Oslo 7 January 2003.
[2] RMA can be described as a "culminating event, a battle that employs the new systems, operational concepts, and organizations and that clearly demonstrates a dramatic change in the conduct of warfare". Welch, Thomas J. *"Revolution in Military Affairs: One Perspective"* [http://www.ndu.edu/inss/books/stcch6.html], National Defence University, Intro paragraph 6.
[3] Forsvarets overkommando (HQDEFCOMNOR). *Forsvarssjefens militærfaglige utredning 2003 – Konsept for netverksbasert anvendelse av militærmakt – Grunnlag ("CHOD NO Report 2003 – Concept for Networc Centric Use of Military Forces – Basis").* October 2002.

Some of the effects that might be achieved through network-based operations are:

- increased sharing of information and knowledge,
- improved teamwork,
- improved and simpler co-ordination and synchronisation; and
- distributed and virtual organisation.

These effects will be discussed in this paper.

NCW is meant to optimize human and organisational behaviour in an information-rich war fighting environment. The focus is on increased ability to collect, process and manage information. Human organization is made more effective by exploiting the increased potential embedded in information networks. In other words, the concept is built on individuals' and organizations' exploiting information produced by networks. The concept focuses on the interaction between processes, technology and an organizations professional competence (PTO) to achieve qualitative and quantitative superiority in the efficient execution of military operations.

Scientists from the United States define NCW as:

> "an information superiority-enabled concept of operations that generates increased combat power by networking sensors, decision makers, and shooters to achieve shared awareness, increased speed of command, higher tempo of operations, greater lethality, increased survivability, …. and to a degree of self-synchronization."[4] This translates information superiority into combat power by effectively linking knowledgeable entities in the battle space.[5]

This will, according to these scientists, require a major cultural change within the military in the way they fight wars. This cultural change may be so drastic that we may have to restructure

[4] Perry et al., *Measures of Effectiveness for the Information-Age Navy: The Effects of Network-Centric Operations on Combat Outcomes.* Santa Monica, Rand, 2002, page xiv.
[5] Three dimensional space, where fighting occurs.

military organizations, doctrinal procedures, and operations in order to fight effectively as an integrated entity on the modern battlefield.

Chief of Defence Norway (CHOD NO) initiated a pre-project on NCW in May 2000. Norwegian Defence Staff College (NDSC) / Doctrine Division was tasked to build competence on this topic. A report was delivered to CHOD in March 2001.[6] CHOD NO then decided, the same fall, that NCW would be the basis for a study on the future development of the Norwegian Armed Forces. The decision was made due to the development of NCW within major NATO Allies[7] and Norwegian partners.[8] This study was part of a series of studies,[9] which built on CHODs input to the next Defense White paper due 2004. The task was given to Defence Command Norway (DEFCOMNO). A NCW Working Group (NCW WG) was established with members from both the armed forces, and from industry (Teleplan, Ericsson, and Thales). In later phases of this study, industry will be heavily involved. A comprehensive report was delivered to CHOD in October 2002.[10] The aim of this report is to develop a Norwegian concept for NCW. The NCW WG has so far identified several issues[11] that will require further studies. In addition it was decided to establish the Norwegian Battle Lab Experiment (NOBLE), a small organisation whose purpose is to act as a "Think-Tank" on these matters.

[6] Forsvarets Stabsskole (Norwegian Defence Staff College). *Introduksjon til Nettverksbasert forsvar ("Introduction to Network Centric Warfare")*, Militærteoretisk skriftserie – nr 1, March 2001.
[7] Mainly the United States.
[8] Mainly Sweden.
[9] A series of studies are ongoing to make CHOD's inputs to the next Defense White Paper due 2004. These studies cover among others Information Operations, Command Concept for NCW, military education, Territorial Defense, Air Defense, NATO, Norwegian Security Environment, etc.
[10] Forsvarets overkommando (HQDEFCOMNOR). *Forsvarssjefens militærfaglige utredning 2003 – Konsept for netverksbasert anvendelse av militærmakt – Grunnlag ("CHOD NO Report 2003 – Concept for Networc Centric Use of Military Forces – Basis").* October 2002.
[11] Communication networks, linking of sensors, command system and structure, etc. among others.

1.1 Thesis Statement

The purpose of this paper is to provide substantiation that the Norwegian Forces can, with difficulty, transform themselves into a truly network centric force. It will illustrate how obstacles related to Norwegian ambitions, Command and Control, technological requirements, interoperability, and finally, just ability to lead and command, can be overcome. It will be shown that the greatest challenge to NCW for Norway will be the contemporary mindset among its senior military leaders, and that this obstacle can be overcome.[12]

The main research sources for this paper are in Norwegian. Classified sources cannot be used, however, the unclassified sources are sufficient to discuss the selected factors and to draw conclusions. Based on the five selected factors, a questionnaire was developed and distributed to the WG and selected Norwegian officers for comments and feedback. Before discussing the factors, the paper will briefly elaborate on the NCW concept and the Norwegian perspective on it.

1.2 The Network Centric Concept

The U.S. Navy has leaded the development of NCW, referring to it as "a fundamental shift from platform-centric warfare."[13] Traditional operations are considered platform-centric, in that aircraft, ships, etc., operate virtually as independent entities. This is in contrast to network centric warfare, which focuses on sharing information rapidly amongst different entities in order to

[12] Statement by some Norwegian officers.
[13] Alberts, David S., Garstka, John J. and Stein, Frederick P. *Network Centric Warfare: Developing and Leveraging Information Superiority,* 2nd Edition (Revised). Washington, DC CCRP Publications Series, 1999.

increase their ability as a whole to respond to threats and to let the commander respond more rapidly to that threat. NCW will change military hierarchical organization forever.

Could an operational commander be able to respond to a tactical problem, effectively bypassing the "chain of command"? Indeed, what is the chain of command in a network centric force? For example, in a network centric operation, it will be possible to quickly pass sensor data to permit one warship to shoot down an incoming missile while using another ship's radar picture.[14] This is already a reality within certain U.S. Navy formations. The U.S. Navy started a program to develop this capability, the program is called the Cooperative Engagement Capability (CEC):

> CEC is a system of hardware and software that allows the sharing of radar data on air targets among ships. Radar data from individual ships of a Battle Group is transmitted to other ships in the group via a line-of-sight, data distribution system (DDS). Each ship uses identical data processing algorithms resident in its cooperative engagement processor (CEP), resulting in each ship having essentially the same display of track information on aircraft and missiles. An individual ship can launch an anti-air missile at a threat aircraft or anti-ship cruise missile within its engagement envelope, based on track data relayed to it by another ship.[15]

The force multiplier effect of NCW is derived from the ability of advanced Command and Control Information Systems (CCIS) and information data links that rapidly communicate with one another. However, in order to exchange information and intelligence, systems must be interoperable. Interoperability is a key factor and is probably one of the greatest obstacles on the technical side to achieve a network centric force.

[14] Elinor C. Sloan, *"Revolution in Military Affairs? An Assessment of US Force Transformation"*, Department of National Defence, Canada, D Strat A, Project Report No. 2001/05.
[15] Cooperative Engagement Capability (CEC). [http://www.fas.org/spp/starwars/program/dote98/98cec.htm].

On the human side, we can translate information superiority into combat power, by effectively linking knowledgeable entities[16] in the battle space. As stated earlier, this drastically changes the way we fight wars and will require a major cultural shift within the military. By linking platforms and weapons into a network or grid, the commander will have a very good common operational picture (COP), thereby very good situational awareness. Timely decisions can be transformed into action, by a system in the network as shown in Figure 1.[17]

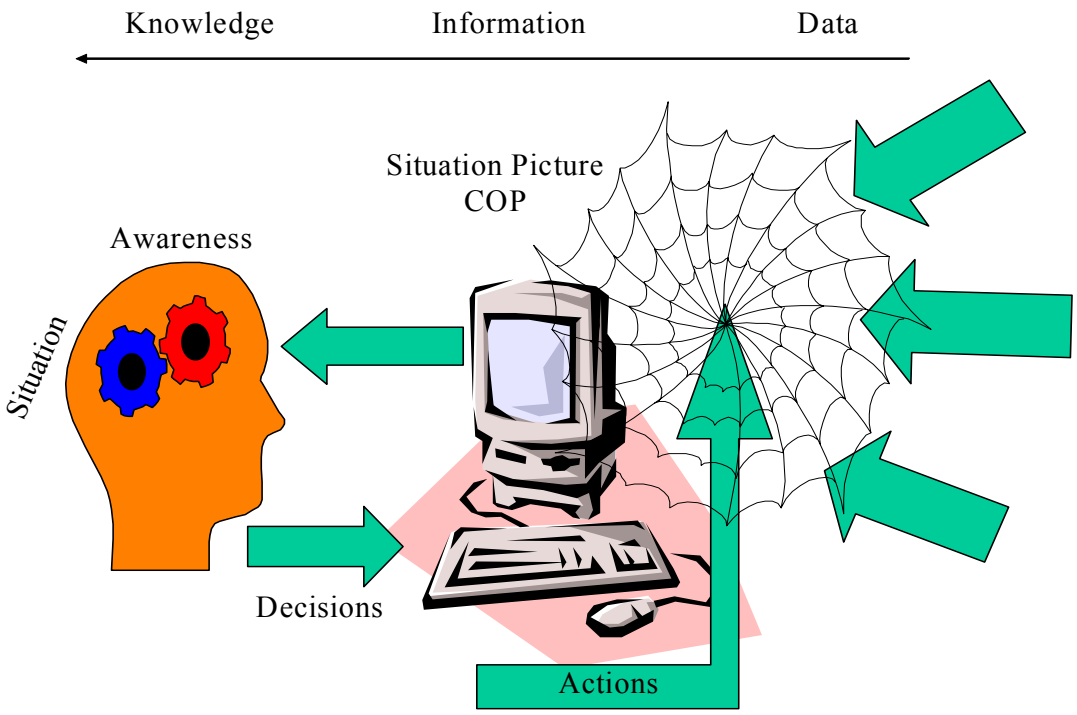


Figure 1 – The NCW Concept.

[16] Individual platforms and weapons systems with its own situation picture.
[17] Forsvarets Stabsskole (Norwegian Defence Staff College). *Introduksjon til Nettverksbasert forsvar ("Introduction to Network Centric Warfare")*, PowerPoint Brief, Kolsås, July 5, 2001.

1.3 The Domain Model

In order to understand how information is able to influence military operations, a domain model[18] has been established, which explains the interaction of information, technology and military forces. The model consists of three domains; the physical domain, the information domain, and the cognitive domain.[19] The physical domain is the present environment military forces find themselves. The information domain is the medium where information is created, manipulated, and disseminated; it supports the communication between human beings. The cognitive domain exists in the human mind; here perceptions, awareness, comprehension, belief, values, and decisions are made. The cognitive domain is the one we try to influence though actions in other domains. Many wars and battles have been won or lost in this domain. For example, General Carl Gustav Fleischer's success in the Narvik campaign in 1940 was a mixture of his youth, his education, his life in general, and his military experiences. He showed outstanding leadership, courage and resolve; the general's cognitive domain. He passed one of the most important tests of an officer: the ability to lead his forces into victory on the battlefield.[20] The cognitive domain is an abstract domain, where among others, leadership, morale, attitude, comradeship, unity, level of training, experience, situation awareness and opinion are created. The different domains will be discussed throughout this paper.

[18] Alberts, David S., Garstka, John J., Hayes, Richard E. and Signori, David A. *Understanding Information Age Warfare.* Washington, DC CCRP Publications Series, August 2001. Pages 10-14.
[19] Forsvarets overkommando (HQDEFCOMNOR). *"CHOD NO Report 2003 – Concept for Network Centric Use of Military Forces – Basis".* Para. 3.3.
[20] Hovland, Torkel. *General Carl Gustav Fleischer – Storhet Og Fall ("General Carl Gustav Fleisher – Greatness and Fall")*. Oslo, Forlaget Forum, 2000.

The domains and the relations between them are shown in this figure.[21]

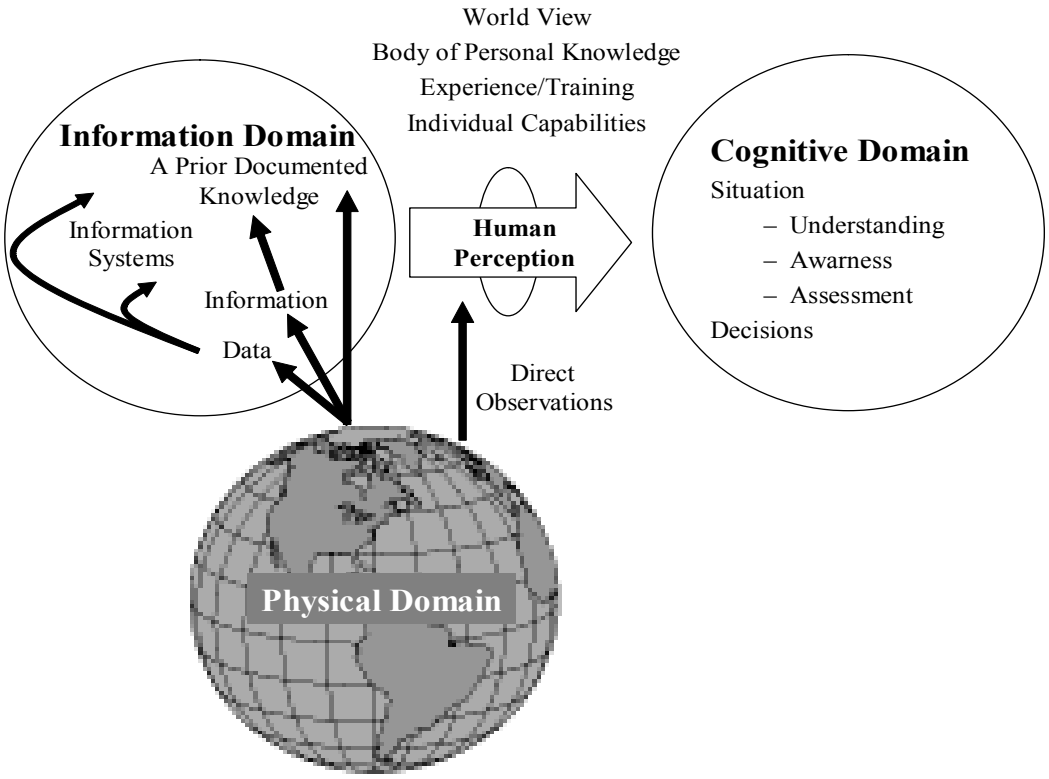


Figure 2 – The Domains.

1.4 The NCW Components

The 3 components of NCW are: sensors,[22] decision elements,[23] and effect elements.[24] All these functions will be discussed in detail and throughout the paper.

[21] Alberts et al. *Understanding Information Age Warfare….* Page 11.
[22] Components with sensor as main function.
[23] Components with decision as main function.
[24] Components with effect as main function.

1.5 US Army and NCW

The US Army has taken NCW a step further, from the initial work done by the US Navy. In their experimentation with the army of the future, they have made important progress, mostly by using Commercial Off The Self (COTS) products.[25] They have stated that: "information, a battlefield resource, as important as soldiers and weapons, and a combat multiplier, that will enable the US Army to dominate the 21st battle space against any aggressor… This will lead the Army to the 21st Century Army and the Army After Next".[26] Through the digitalization of the battlefield, a smaller force will be able to encounter a larger force; the traditional offensive / defensive force ration (3:1) may shrink considerably. More combat power will be achieved with fewer forces, better tempo and better precisions.

The US Army has introduced a Tactical Internet with 3D maps that provide enhanced situation awareness; the challenge, however, is information management. This gives the war fighter the ability to "visit" the battle space before the engagement, to do the Intelligence Preparation of the Battle Space (IPB),[27] to do war gaming and important assessments, as part of the Operational Planning Process (OPP).[28] The US Army will be able to make timely decisions and to reach inside the adversaries OODA loop.[29] For Norway, a slow process of commercially-based product development is underway.[30] This is a politically-influenced endeavour the Norwegian

[25] US. Army TRADOC / Army Training Support Centre. *Advanced Warfighting Experiment,* Fort Hood, Nov. 1997 (PIN 711000, TVT 22-74)
[26] Gen Reimer, Chief of Staff.
[27] IPB - An intelligence estimate used to describe the adversary and terrain.
[28] OPP - NATO established process, used to plan military campaigns at the operational level.
[29] OODA Loop - Boyd's sketch - observe, orient, decide and act. A model that explains the different stages in decision making.
[30] For instance, 15 years have been used to develop a Norwegian Multi Role Radio (MRR), the cost has been enormous. This is a product that is available COTS from other NATO partners.

Military probably have to live with. Norway has a research establishment,[31] however this establishment normally deals with long term research and projects. A real attempt has been made to do experimentation with COTS products, by establishing NOBLE. NOBLE is now established under direct command of Fells Operativt Hovedkvarter (FOHK)[32], as part of J7[33] / Concept, Development and Experimentation (CDE) Division. Any experimentation must have a focus on operations. There are still a few challenges to overcome before this organisation is a real tool for CHOD No. This organisation has just been established and is not yet "up to speed" / working to capacity.

1.6 What is a Network Centric Force

In summary, what is a network centric force? It is a force that exploits any feasibilities and effects, which can be achieved through the network-based concepts. These feasibilities and effects include: increased sharing of information and knowledge, improved ability to teamwork, improved and simplified co-ordination and synchronization, and finally, a distributed and virtual organisation.

A number of questions have been raised in this introduction which will be answered in this paper. Further, this paper will demonstrate that Norway can achieve a network centric force and why this will be a difficult task to achieve.

[31] FFI (Forsvarets Forskningsinstitutt) - Norwegian Defence Research Establishment.
[32] FOHK – Joint Headquarters. See paragraph 3.6.
[33] J7, the training and exercise division in the NATO J-structure.

2 NORWEGIAN AMBITIONS

There is strong scepticism and reservations against NCW in Norway. Many say that it is too early to adopt the idea of NCW, as the experimentation and development has just started. The will to change is low. However, we will have a closer look at statements made by senior leaders and within the armed forces, to prove that the Norwegian ambitions are high.

2.1 The Minister of Defence

The Norwegian Minister of Defence made clear statements[34] about Norwegian goals for NCW while attending the NATO conference in January 2003. She said that:

> Transformation is more than just new equipment; it is just as much about thinking in new directions and new ways….I was impressed by the way Joint Forces Command was able to get and to communicate real-time pictures and information. The use of off-the-shelves-technology was interesting, cheaper, and sometimes better than traditionally military-industry development….The information superiority gave the commanders and the troops unique situation awareness. The aim was to know more about the enemy than the enemy knew about themselves…. Such information supremacy, with a clear picture of the situation, both your own and the enemy, gives you a possibility to superior decision making, and to use your joint forces in an *effect based* operation in an impressing way. I realized, this is the future, and the key element to success for NATO forces.
>
> Hence, Norway is increasing the defense budget. The Norwegian Parliament has approved an increase of the defense budget that will account to about 7.5 per cent in real terms over the next two years. By 2005, one third of our defense budget will be spent on investments, and certainly, we no longer focus on size and numbers! Conventionally, military wisdom would dictate that the big battalions usually win. However, the numbers are no longer decisive; quality is.
>
> It is not problematical to be outnumbered in military capabilities of little relevance. Information dominance, enabled by the information revolution, effects-based operations, interoperability and precision, offset the value of high numbers. Furthermore, various military capabilities of the Allies must be shaped into a coherent fighting force. For that, you need joint training and exercises, interoperability and integration, both at a small and a large scale.

[34] Devold, Kristin Krohn (Minister of Defence, Norway). *"Transformation: Implications for the Alliance"*. Speech at the seminar OPEN ROAD 2003: US Transformation – Implications for the Alliance, Norfolk, 20 - 22 January 2003.

As such, the Norwegian ambitions to achieve a network centric force are high. The statement does not explicitly point towards this, but the statement above clearly shows that a network centric force is implicit in the new force. This was also underlined in an address[35] by the Minister of Defense to members of the Oslo Military Society in January 2003. She stated that:

> Military transformation, it is the practical embodiment of what has been termed the Revolution in Military Affairs, with *network-based defense as a central concept*. Our military transformation will have to be achieved through a good combination of preparation and direction from above with creativity, renewal and development from below, both nationally and within the Alliance.

This is, again, a very clear statement from the Minister of Defense.

2.2 Norwegian Defense Budget – Fiscal year 2003

To achieve these high ambitions, certain investments will need to be made. An important investment is to link different platforms and sensors. It has been decided that Norway will invest in Tactical Data Link 16 (Link-16).[36] Other investments for the fiscal year 2003 with relation to NCW include continued development of the Army Tactical CCIS and further development of the Joint Norwegian Command, Control and Information System – Phase II (NORCCIS-II).[37]

[35] Devold, Kristin Krohn. *"What we want and where we want to get to: Defence policy aims and priorities in 2003"*.
[36] Forsvarsdepatementet (Ministry of Defense). *Forsvarsbudsjettet 2003 ("The Norwegian Defence Budget 2003")*. [http://www.dep.no/archive/fdvedlegg/01/02/budsj008.pdf]. Oslo, October 2002. Pages 83-84.
[37] More details on Norwegian CCIS to follow in Chapter 5 – Technology.

2.3 The Chief of Defense

Through his approval of the September 27, 2002 report, *Concept for Network Centric Use of Military Forces – Basis,*[38] CHOD NO has accepted Norwegian ambitions for achieving a network centric force. The report describes in some details the Norwegian ambitions to achieve a network centric force. While all details of the report can not be covered in a paper of this size. The reports' main conclusions[39] state that to be able to realize NCW, the development of doctrines, operational concepts, tactics, organizations and equipment, must be seen in parallel.

This is not the situation today, the three services still lack jointness. Implementation of an effective NCW force requires much greater jointness and cooperation between Norwegian services. Procurement of equipment is focused on platforms, which results in a focus on the platform itself. The cost of platform centric force planning, result is less focus on other components in a NCW force, such as joint communication networks, linking of sensors and interoperability. Different projects must be seen under one umbrella, the joint umbrella. The projects must be put together in programs, so that it is possible to get the synergy from the different components. The synergy are vital, to be able to realize NCW capacities within the different areas. It is therefore necessary to further develop the platform-centric PRINSIX[40] model. Projects are planned, fractioned and then isolated. It is necessary, through stronger coordination of projects, to ensure that they are aimed more at joint capabilities and thereby makes it possible to achieve a network centric force. The Armed Forces total requirement for joint capacities must be the "leading star". Traditionally, to be able to fight a main battle tank (MBT) a MBT or an anti

[38] Forsvarets overkommando (HQDEFCOMNOR). *"CHOD NO Report 2003 – Concept for Network Centric Use of Military Forces – Basis".*
[39] Forsvarets overkommando (HQDEFCOMNOR). *"CHOD NO Report 2003 – Concept for Network Centric Use of Military Forces – Basis". ...* page 52.
[40] PRINSIX - Norwegian Project Management tool.

tank (AT) weapon have been used. Can we fight a MBT with other and less costly "weapons"? Is it possible to fight a modern MBT with an Electromagnetic Pulse (EMP)[41] delivered by a fighter plane or Fuel-Air Explosives (FAE)[42] delivered by a naval vessel? Procurement of joint capabilities must be seen in parallel with the development of technology, doctrine, tactics and organization. The aim is that the future components that will be interfaced in the fighting formations, suite the Norwegian network centric ambition.

2.4 Main Elements in Norwegian NCW Ambitions

In summary, Norwegian NCW implementation presumes the following:

- The development of operational and informational infrastructure must be seen as a whole.
- Future projects must aim at NCW, capacities and concepts.
- Norwegian NCW must be developed in a joint and combined framework.
- Norwegian NCW development must take into consideration existing organisation, equipment and infrastructure.
- The main aim of the Norwegian commitment to NCW is interactive experimenting through prototyping, field experimentation and simulations. Commander FOHK will be given the responsibility for the experimentation.
- The implementations of solutions that are being developed must be done at lowest possible level in the chain of command.
- NCW development of skills and education must be accomplished in educational institutions within the armed forces, with the Norwegian Defence Staff College in the lead. The NCW concept must also be made known in the civilian society.
- The Norwegian armed forces must develop and implement NCW in close cooperation with relevant foreign military institutions and relevant civilian institutions.

[41] Electromagnetic Pulse (EMP), a broadband, high-intensity, short-duration burst of electromagnetic energy.
[42] Fuel-Air Explosives (FAE) disperses an aerosol cloud of fuel which is ignited by an embedded detonator to produce an explosion. The rapidly expanding wave front due to overpressure flattens all objects within close proximity of the epicenter of the aerosol fuel cloud, and produces debilitating damage well beyond the flattened area. The main destructive force of FAE is high overpressure, useful against soft targets such as minefields, armored vehicles, aircraft parked in the open, and bunkers.

2.5 The Norwegian Vision 2014+

CHOD NO has initiated a series of studies, building towards CHODs input to the next Defense White Paper of 2004. The main document in these studies is *Vision 2014+*.[43] This paper also underlines the importance of NCW. It states that the NCW concept will enable the Norwegian Armed Forces to operate in a environment where personnel, communication systems, levels of command, sensors, platforms and units acts together independent of service, geographical location and level. All information systems will be interoperable across service, levels and Allied systems.

2.6 A Summary of the Norwegian Ambitions

As discussed, there is no doubt that both the political and military leadership is aiming at a robust Norwegian network centric force. The development and idea must, however, take into consideration current organizations, equipment and infrastructure. This might be a challenge. How fast are we able to transform and how bound are we to "cold war thinking"? Another main challenge will therefore be the will to transform and the change of mindset of senior military leaders. Finally, the question is always money. How much money are the politicians and the senior military leadership willing to spend on a network centric force?

[43] Forsvarets overkommando (HQDEFCOMNOR). *Forsvarssjefens militærfaglige utredning – Strukturvisjon 2014+ ("CHOD NO Report 2003 – Vision 20014+").* September 2002, paragraph 5.1.

3 COMMAND CONCEPT IN A NETWORK CENTRIC FORCE

As part of the pre-project on NCW, a working group has been working with the command concept for NCW. A comprehensive report[44] was delivered CHOD NO in the autumn of 2002. This chapter is based on the conclusions in this report. The WG has based its work on two reports, *Introduction to Network Centric Warfare*[45] and *CHOD NO Report 2003 – Concept for Network Centric Use of Military Forces – Basis*.[46] However, the development of this command concept is also based on important international research, such as the American "The Command and Control Research Program – CCRP"[47] and the work by the Canadian researchers McCann and Pigeau.[48] The purpose of the command concept is to build the basis for a joint and overall understanding of how to execute command in NCW. As earlier stated, NCW is mainly about human and organisational behaviour. The concept focuses on the interaction between processes, technology and organisation (PTO). Major General Haugen has commented upon some scepticism against network centric development in a speech to the members of the Oslo Military Society in February 2003.[49] He stated that "NCW has been introduced as a central concept… This is a new concept, also outside Norway… I would dare to say that the main challenges in NCW are not restricted to

[44] Forsvarets overkommando (HQDEFCOMNOR). *Forsvarssjefens militærfaglige utredning – Kommandokonsept i netverksbasert forsvar – Grunnlag ("CHOD NO Report 2003 – Command Concept for Network Centric Warfare – Basis")*., September 2002.
[45] Forsvarets Stabsskole (Norwegian Defence Staff College). *Introduksjon til Nettverksbasert forsvar ("Introduction to Network Centric Warfare")*, Militærteoretisk skriftserie – nr 1, March 2001
[46] Forsvarets overkommando (HQDEFCOMNOR). *Forsvarssjefens militærfaglige utredning 2003 – Konsept for netverksbasert anvendelse av militærmakt – Grunnlag ("CHOD NO Report 2003 – Concept for Networc Centric Use of Military Forces – Basis").* October 2002.
[47] The Command and Control Research Program (CCRP) within the Office of the Assistant Secretary of Defense (C3I) focuses upon 1) improving both the state of the art and the state of the practice of command and control and 2) enhancing DoD's understanding of the national security implications of the Information Age. It provides "Out of the Box" thinking and explores ways to help DoD take full advantage of the opportunities afforded by the Information Age. For further details on the program, see link. [http://www.dodccrp.org/]
[48] McCann, Carol and Pigeau, Ross. *Toward a Conceptual Framework for Command and control*, Defence and civil Institute of Environmental medicine, July 1999.
[49] Haugen, Roar Jens (General Inspector of the Norwegian Army). *Status og utvikling i Hæren ("Status and Development in the Army").* Address to Oslo Military Society, Oslo 3 February 2003. [http://www.oslomilsamfund.no/foredrag/2003/2003-02-03-GIH.html]

new technology. It is more about organisation philosophy, concepts of operations and the change of mindset." The General touched upon one of the main elements of the NCW concept, but he is sceptic to the concept. He wants to wait with the NCW transition until the concept is more developed. This chapter on the command concept is the central position in this paper.

3.1 The Norwegian Command Concept in NCW

In NATO, with the principle of consensus,[50] command is defined as the "authority vested in an individual of the armed forces for the direction, co-ordination, and control of military forces."[51] Control is defined as that "authority exercised by a commander over part of the activities of subordinate organisations, or other organisations not normally under his command, which encompasses the responsibility for implementing orders or directives. All or part of this authority may be transferred or delegated."[52] In the Norwegian command concept, the definition of command and control has been developed further. In the Norwegian concept, command is the central concept in executing military operations, control is executed through the command system. To have the authority with the appurtenant responsibility is determined as an essential part of being in command. With mission command[53] as an important aspect, and the aim of command being to synchronize the total effect, command is defined as "the authority and the responsibility a military commander is given to create a shared intent and to transform this into synchronized actions with involved military forces".[54] In the new NCW command concept, command is, to

[50] Consensus: general agreement (Webster On Line) [http://www.m-w.com/cgi-bin/dictionary]. NATO members to arrive at mutually acceptable agreements on collective decisions or on action by the Alliance as a whole. General agreement / consensus from all member states. NATO Hand Book. [http://www.nato.int/docu/handbook/2001/hb0702.htm]
[51] NATO HQ. AJP-3 - *Allied Joint Operations, Ratification Draft 2.* Brussels, September 2001. Glossary, page 3.
[52] NATO HQ. *AJP-3 - Allied Joint Operations ...,* Glossary, p. 5.
[53] Mission Command, execution of mission based on the commander's intent and the subordinates initiative rather than detailed, written, operation orders.
[54] Forsvarets overkommando (HQDEFCOMNOR).*"CHOD NO Report 2003 – Command Concept for Network Centric Warfare – Basis"...* Page 9.

manage the execution of military operations. Control is seen as a separate task and is being managed through the command system.

3.2 Leadership

Leadership consists of a philosophy and the competence held by the commander. The combination of command and leadership must be in balance, and at the same time be adapted to the situation and the level where command is executed. Command is executed through leadership and a command system. In the Norwegian NCW Command concept, leadership is defined as "the commander's ability to influence a military organisation so that the mission is achieved."[55] As part of command, the concept states that leadership consist of a leadership philosophy, competence, and personal qualities. The leadership philosophy is mission command. Further, it is stated that competence within one's own profession is the basis for trust in leadership. The most important personal qualities that are described in the concept are initiative, adaptation, risk taking and comprehension. The transition to NCW will lead to changes within the selection of our future leaders, leadership education and training.

3.3 The Command System

To be able to execute command, one also needs a physical command structure, tools and means, that command is executed though. A command system (CS) is therefore defined as "those structures and those processes that are established to be able to transform intentions to action."[56] The command system is both physical that exists and something that needs to be done, both structures and processes. A command system can be described as some qualities, which

[55] Forsvarets overkommando (HQDEFCOMNOR).)*."CHOD NO Report 2003 – Command Concept for Network Centric Warfare – Basis"*...Page 9.
[56] Forsvarets overkommando (HQDEFCOMNOR).)*."CHOD NO Report 2003 – Command Concept for Network Centric Warfare – Basis"*... Page 9.

characterize the processes, a structure of components and the relation among them, see Figure 4 - The Characteristics of the CS. The most important qualities in a command system are situational awareness, the ability to make timely decisions, tempo, interoperability, flexibility, resilience and endurance. When it comes to the processes, the concept is based on the decision cycle (OODA-loop), but it has been developed to fit the information age command post (CP). The process has three steps, development of the situational awareness, sensemaking and management of the battle space, see Figure 3.[57]

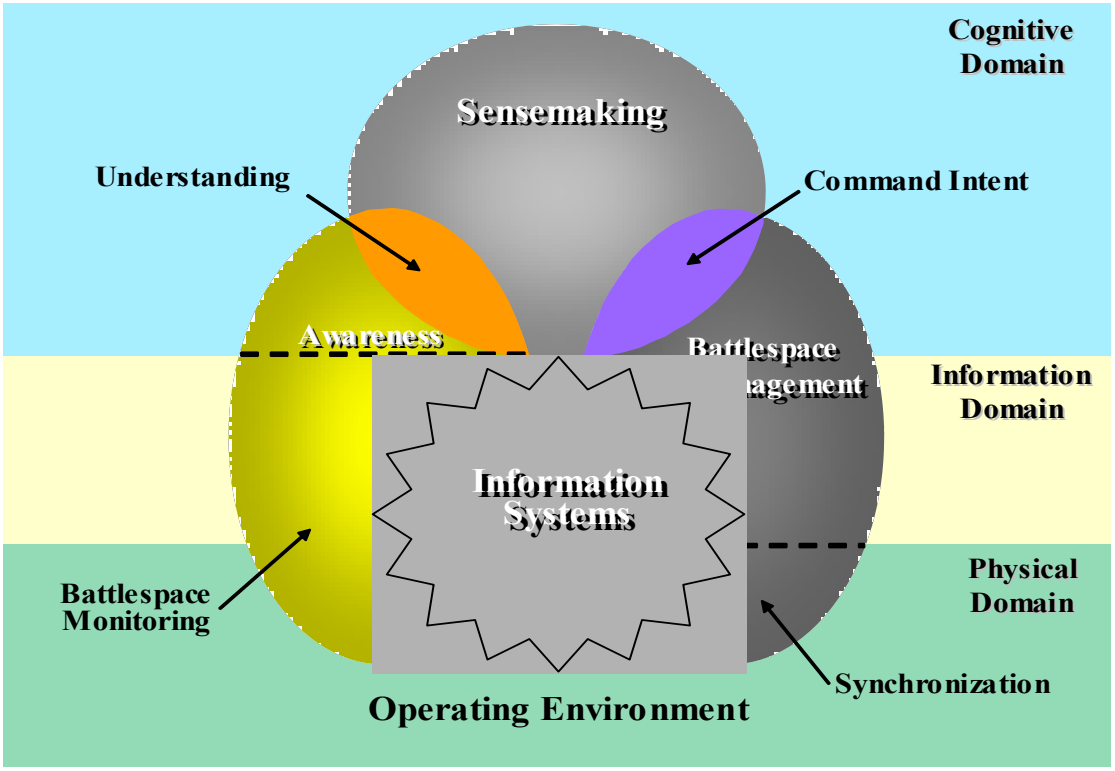


Figure 3 - Emerging View of C2 Process.

The principles for how these processes shall be established, are to balance the control span against tempo, secondly that each element has to add value into the processes, and finally that the focus must be on producing effects, not on effective processes itself.

[57] Alberts at al. *Understanding Information Age Warfare.* … Page 146.

3.4 Characteristics of a Command System

The model structure of the Command System (CS) consists of an information structure and different components that are connected to the main structure. The figure below shows the characteristics of the CS.[58]

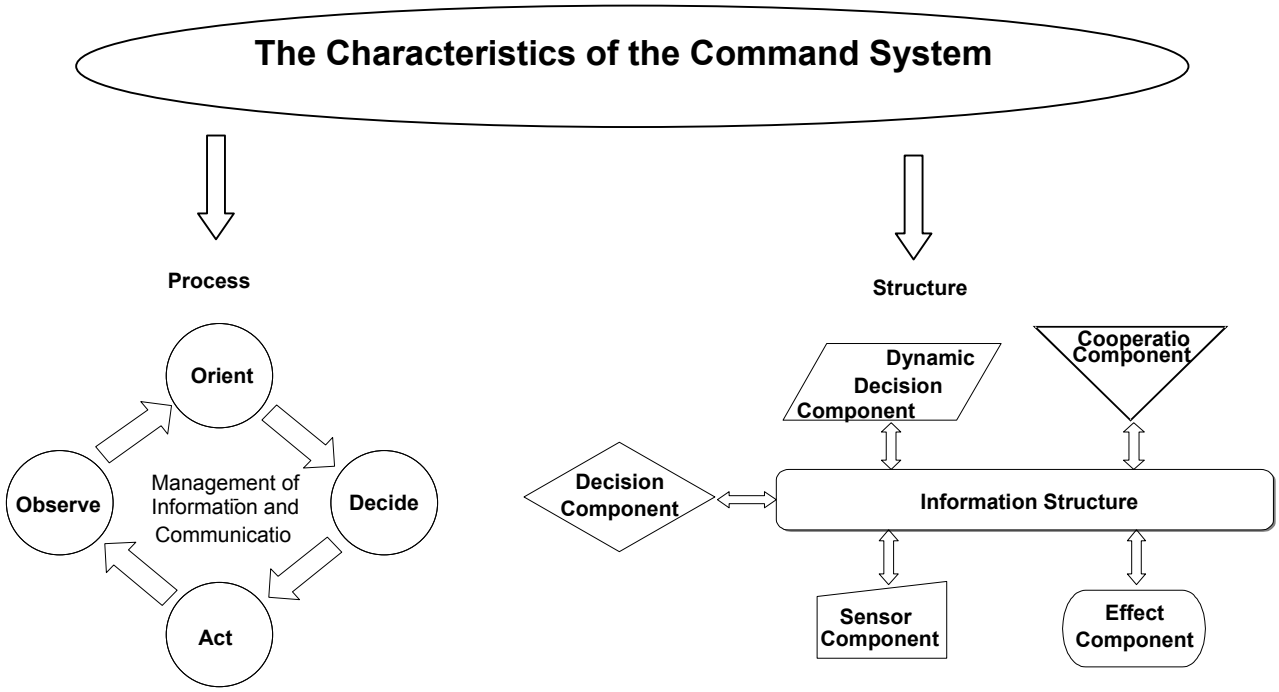


Figure 4 - Characteristics CS.

The information structure is seen as one structure. The different components in the structure are decision components (authority to make decisions), dynamic decision support component (information management and dissemination), cooperation component (liaison within

[58] Forsvarets overkommando (HQDEFCOMNOR).)*."CHOD NO Report 2003 – Command Concept for Network Centric Warfare – Basis"...* Pages 34-35.

the CS), sensor component (observation from external sources) and effect component (effects in the battlespace). The process (decision cycle) does not need further clarification.

The following paragraphs (3.4.1 to 3.4.6) are a short description of what the report[59] states as the qualities, and what kind of qualities a command system in NCW must have. It is important to note that the focus is on the command system, not only on the information system.

3.4.1 Situational Awareness

Situational awareness is translated into the command system's ability to give the commander and his/her staff an overview and understanding of the situation in the battle space. Situational awareness is related to the decision cycle. This awareness is necessary in order to be able to make assessments, estimates, etc., and to develop courses of action (COAs) and alternate COAs. However, the process of developing assessments, estimates and COAs is outside the focus area for situational awareness. This separation between situation awareness and the ability to develop COAs and thereafter make decisions is a matter of definition. In this case, the separation between these two was made before American scientists established the idea of sensemaking. In the book *Understanding Information Age Warfare,* [60] sensemaking is explained like this:

> Once an understanding of a situation that requires attention has been reached, individuals and organizations engage in a process best understood as *sensemaking*, in which they relate their understanding of the situation to their mental models of how it can evolve over time, their ability to control that development, and the values that drive their choices of action. In essence, they seek to accomplish three interrelated activities - generating alternative actions intended to control selected aspects of the situation, identifying the criteria by which those alternatives are to be compared, and conducting the assessment of alternatives.

[59] Forsvarets overkommando (HQDEFCOMNOR). "*CHOD NO Report 2003 – Command Concept for Network Centric Warfare – Basis". ...* Pages 16-19.
[60] Alberts et al. *Understanding Information Age Warfare….* Pages 141-142.

Sensemaking can be defined as the process of creating situation awareness in situations of uncertainty. It has two related aspects: to understand a situation and the available methods to assess, then the technologies to handle it.[61] The notion sensemaking has almost the same meaning as the German "fingerspitzengefühl", which can be translated into intuitive feeling. Situational awareness is influenced by the amount of information available, the quality of it, the competence of the personnel and the availability of the information. To which extent situational awareness is achieved will influence our ability to gain information superiority. Information superiority is defined as "the capability to collect, process, and disseminate an uninterrupted flow of information while exploiting or denying an adversary's ability to do the same."[62]

3.4.2 Decision Capability

The concept of decision capability characterises what happens after situational awareness is established and when the decision process starts.[63] The relation between situational awareness and decision capability is an inter-active process. During the decision process one has to go back, get new information and knowledge, which again will influence the assessments that are done. In this context, decision capability implies a capability to develop relevant prognoses and to generate timely decisions (courses of actions - COA).[64] The intuitive decision processes will be important aspects of this quality. These decision processes must be based on military experience, knowledge and comprehension in military historic and theoretical facts.[65] This will change the way decisions

[61] Persson, Per-Arne and Nyce, James M. *Technology and Sensemaking in the Modern Military Organization.* Swedish Army Command, Enköping, Sweden. [http://www.dodccrp.org/Activities/Symposia/7thICCRTS/Tracks/pdf/073.PDF]
[62] United States, Joint Chiefs of Staff, *Joint Vision 2020*, June 2000, [http://www.dtic.mil/jointvision/jv2020a.pdf] p. 8.
[63] Alberts et al. *Understanding Information Age Warfare….* Page 20.
[64] NATO HQ, Bi-SC Document. *Guidelines for Operational Planning (GOP).* Final January 2001. Para 4-19.
[65] Forsvarets overkommando (HQDEFCOMNOR). *"CHOD NO Report 2003 – Command Concept for Network Centric Warfare – Basis"….* Page 17.

are made. Even though most of us use some degree of intuition when to make decision, this quality is not fully exploited among military leaders of today.

3.4.3 Tempo

In command relations, tempo is the time used for gaining knowledge of the situation, until a decision is made and the execution is understood by the executing component. Our ability to exploit tempo is not purely connected to the quality of the command system. The time it takes to prepare forces, transport them and carry out the mission is often dependant on factors that are placed outside the command system. It is therefore important to scale capacities for the forces and the command system in relation to each other. The aim of tempo is to gain conditions for, and to manage events in the battle space.[66] This implies a very quick establishment of situational awareness, a quick processing of information and decision-making, dissemination of missions, orders and intentions. An overall aim is to be able to exploit the "windows of opportunity" that occur in the battle space, before they "close".[67]

The focus on tempo, has for the most part, been based on high-intensity war fighting, in which the need for high operational tempo is essential. However, in the future we might experience other scenarios that will set other tempo requirements. It is reasonable that tempo in a Crisis Response Operation / Peace Support Operation (CRO/PSO)[68] would be lower, as any adversary may be more loosely organized and may not have much high-tech equipment. For peacetime operations it is likely that the requirement for quality in decisions is greater than tempo. When a "window of opportunity" closes as a result of using time to make a decision, it will in this

[66] Alberts et al. *Understanding Information Age Warfare….* Page 58.
[67] Forgues, Pierre. *Command in a Network-Centric War*. Canadian Military Journal, Vol. 2, No 2 (Summer 2001), Page 25-26.
[68] NATO HQ. *AJP-3.4 - Non-Article 5 Crisis Response Operations,* 1st Study Draft. Brussels, 2002. Paragraph 0101.

instance be less important than taking a "wrong" decision. However, the requirement for tempo will depend on how fast an adversary is able to react. In such a case, our need for tempo becomes a relative variable. The aim will always be to get "inside" the adversary's decision cycle.

3.4.4 Interoperability

Interoperability concerns the degree to which we are able to exchange information in the command system, information that has the same interpretation by the user as for the source. To achieve seamless interoperability is very costly and is often connected to technology standards.[69] This will be discussed in more detail later. Interoperability also has a procedural and organisational aspect.[70] This is how we execute command and how Norwegian Armed Forces are organized. Examples of procedural interoperability concerns the way we conduct the planning process, language, acronyms, definition of concepts and doctrine. For organization, the NATO J/G/S staff structure[71] is a good example.[72] Interoperability makes it easier for personnel to understand each other independent units, levels and nations.

Interoperability is dependant on both economy and organizational culture. It is therefore useful to have a look at where interoperability will be required. Below is listed what is believed to be relevant;[73]

[69] Forsvarets overkommando (HQDEFCOMNOR). *"CHOD NO Report 2003 – Command Concept for Network Centric Warfare – Basis"*. … Page 18.
[70] Alberts et al. *Understanding Information Age Warfare….* Pages 57, 286 and 290.
[71] NATO HQ. *AJP-01(B) - Allied Joint Doctrine, Ratification Draft 2.* Brussels, October 2001. Page 4A-1 to 3.
[72] Principal staff functions within a headquarters of an Allied Joint Force to support a Joint Force Commander (JFC), J1-Personnel and Administration, J2-Intelligence, J3-Operations, J4-Logistics, J5-Plans and Policy, J6-Communications and Information Systems, J7-Doctrine and Training, J8-Resources and Finance and J9-Civil-Military Co-operation.
[73] Forsvarets overkommando (HQDEFCOMNOR). *"CHOD NO Report 2003 – Command Concept for Network Centric Warfare – Basis"*. … Page 18.

- internal in a Task Force
- between Task Forces (national)
- between national, allied and other relevant military partners; and
- between military and relevant civilian partners national and international.

This is also a concern for the U.S. Forces, as described in *Transforming America's Military*.[74]

3.4.5 Resilience and endurance

Resilience and endurance makes the functionality of the command system more durable over time and during different challenges to which this system is exposed. One aspect of this quality is to what degree the system is protected against weapon effects and electronic attacks. Secondly, is how the system manages to maintain whole or parts of its capacity, if parts of it are eliminated or being exposed to influence over time. A third aspect is the system's ability to prevent unauthorised use or misuse.[75] The last aspect, operations security (OPSEC), is probably the most difficult part of resilience and endurance. Security is time consuming and expensive, but crucial in NCW.

3.4.6 Flexibility

The Norwegian Armed Forces face many challenges at the moment. The force is still being restructured. It is therefore uncertain where operations will be conducted, which command relationships might be used, and what kind of missions the forces will be given. These facts demand a flexible command system that will ensure a reliable management of military operations.[76]

[74] Binnendijk, Hans. *Transforming America's Military.* National Defense University Press, Washington, D.C. 2002. Pages 162 and 223.
[75] Forsvarets overkommando (HQDEFCOMNOR). *"CHOD NO Report 2003 – Command Concept for Network Centric Warfare – Basis)* ... Page 18.
[76] Alberts et al. *Understanding Information Age Warfare*.... Page 206.

The Armed Forces will need a command system to execute command in all foreseeable areas of operation (AOR). Depending on the technology's ability to support the execution of command from Norway, the command system must be able, in part or as a whole, to deploy out of country. In connection with escalation and establishment of an operation, it will be of great importance that the system is scalable depending on the situation without losing functionality or capacity. Further, the system must be transportable, which again will influence its configuration. When the system is established in the Joint Operations Area (JOA), it will be necessary to move the system in accordance with the situation. The technological possibilities would influence the need for flexibility and mobility of the system.

In the future, Norway will more than likely have a limited number of forces. Our ability to adapt these forces to the actual situation will be important. Norway needs to ensure the forces get the maximum combat power relative to the capabilities. The command system must therefore make sure that there is the freedom of action in the way the reaction forces are organized. Our coalition partner's command structure is uncertain at the moment, and will be a factor we have to take into consideration, both when it comes to the way we organize ourselves and how we execute command. Our command system must be able to adapt to the choices our Allies select.[77]

3.5 Information Management

Information Management (Info Mgmt) is fundamental to NCW.[78] The decision maker will, without proper management of information, soon be overwhelmed with too much irrelevant information and the decision making process will be jammed. Information will have to be

[77] Forsvarets overkommando (HQDEFCOMNOR). *"CHOD NO Report 2003 – Command Concept for Network Centric Warfare – Basis"*. … Pages 18-19.
[78] Binnendijk, Hans. *Transforming America's Military*. ... Pages 168 - 169.

managed both by technology and by human beings. Major General Charles Thomas has stated that: "building the right software filters, the right profiles, so that we can provide the right information without overloading each commander, is one of our great challenges."[79] The command system and command tools must make it possible to manage the vast amount of information available to the headquarters. Professor Mackubin Owens of the US Naval War College points out that "possessing a mass of data does not mean that the decision maker understands their significance or what to do with them."[80] Based on the Commander's Critical Information Requirements (CCIR),[81,82] competent senior staff officers must manage the information flow and make sure the commander has enough correct information to make timely decisions.

3.6 The Command Structure

Traditionally, command structures have been presented as an organisation chart.[83] This may hinder the establishment of flexible and adjustable structures. The network based command structure is a component based structure model, which does not focus on a chain of command.

The Norwegian C2 structure is being adjusted to the new reality. HQ Defence Command Norway (at Huseby, Oslo) will be disbanded at the earliest opportunity and in any case no later that December 31, 2004. The Defence Staff (DS) will be established and co-located with the Ministry of Defence (MoD). The logistic management structure will be drastically reduced.

[79] Forgues, Pierre. *Command in a Network-Centric War*. … Page 28.
[80] Owens, Mackubin. T. *Technology, the RMA, and Future War.* Strategic Review, 26-2. Spring 1998, Page 69.
[81] CCIR: Commander's Critical Information Requirements. At the outset of an operation, possibly even prior to deployment, the commander will begin to formulate questions to which he will require answers in order to conduct the operation successfully.
[82] NATO HQ. *AJP-3 - Allied Joint Operations, Ratification Draft 2.* Brussels, September 2001. Para. 5006.
[83] Alberts et al. *Understanding the Information Affair…Page 163.*

Earlier, all three services had their own logistics command; this has now been restructured to one Joint Logistic Command (FLO). The existing defence commands (FKN and FKS), the three Naval Districts (SDN, SDV and SDS) and the Army's four District Commands (DKN, DKT, DKSV and DKØ) will be abolished. The Joint Headquarters (FOHK) will be located at Jåtta in Stavanger, co-located with the NATO Sub-regional Headquarters. Regional Command North (LDKN) will be established at Reitan, Bodø and Regional Command South (LDKS) will be established in Trondheim. FOHK and the regional commands are all joint headquarters. The lower command level in the Army will also be restructured. All 14 territorial regiments will also be disbanded, many of them with several hundred years of history. Restructuring has also been done in the Navy and the Air Force. This has resulted in a "slimmer" structure, but Norway will still have up to 8 levels of command in the Army. The Norwegian command structure will look like this after restructuring:

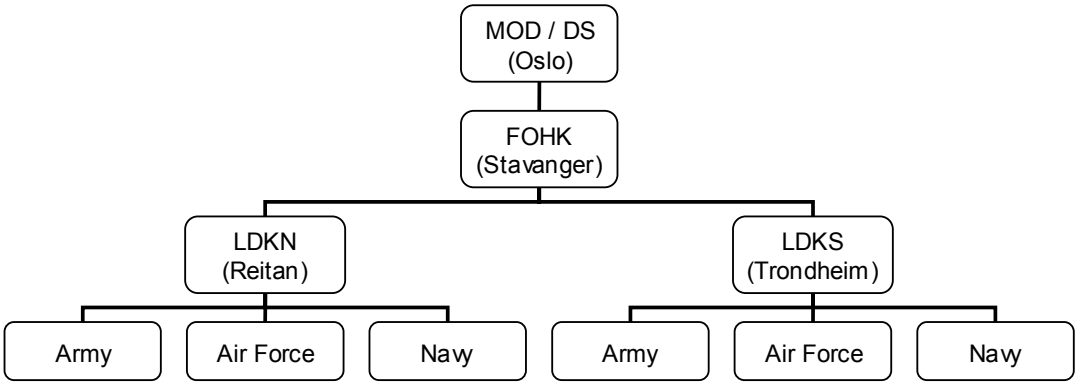


Figure 5 – C2 Structure after restructuring.

3.7 Command Tools - Norwegian CCIS

To be able to execute command and control in NCW, situational awareness is crucial. Without a "real time" Common Operational Picture (COP), proper decision-making in a network centric force is very difficult. Through making timely decisions in NCW and using a manoeuvre approach; use of manoeuvre warfare: "with the goal of paralyze the adversaries' ability and will to fight, by attacking from a favourable position".[84] The goal is to reach inside the adversaries' decision loop (OODA loop).[85] The COP is delivered by a Command and Control, Information System (CCIS). The Norwegian Armed Forces CCIS family consists of four different systems:

- NORCCIS II - Norwegian Command and Control Information System -Phase II.
- NORTaC C2IS - Norwegian Tactical Command and Control Information System (Army).
- SjøTas - Sjøforsvarets Taktiske Arbeidsstasjon (Naval). At the operational level the Navy also uses the NATO Maritime Command and Control Information system MCCIS.
- NEC CCIS - Northern European Command - Command and Control Information System (Air Force).

In addition, the police and customs authorities, in close cooperation with the Navy and Coast Guard, have invested in a Coastal Operations and Surveillance System (COSS). This CCIS was, by the end of 2001, implemented and supports the police and customs authorities in enforcing the Norwegian participation in the Schengen-treaty.[86] There are also other CCIS at the tactical level; these will not be described. As described in Chapter 6 – interoperability, this replication of

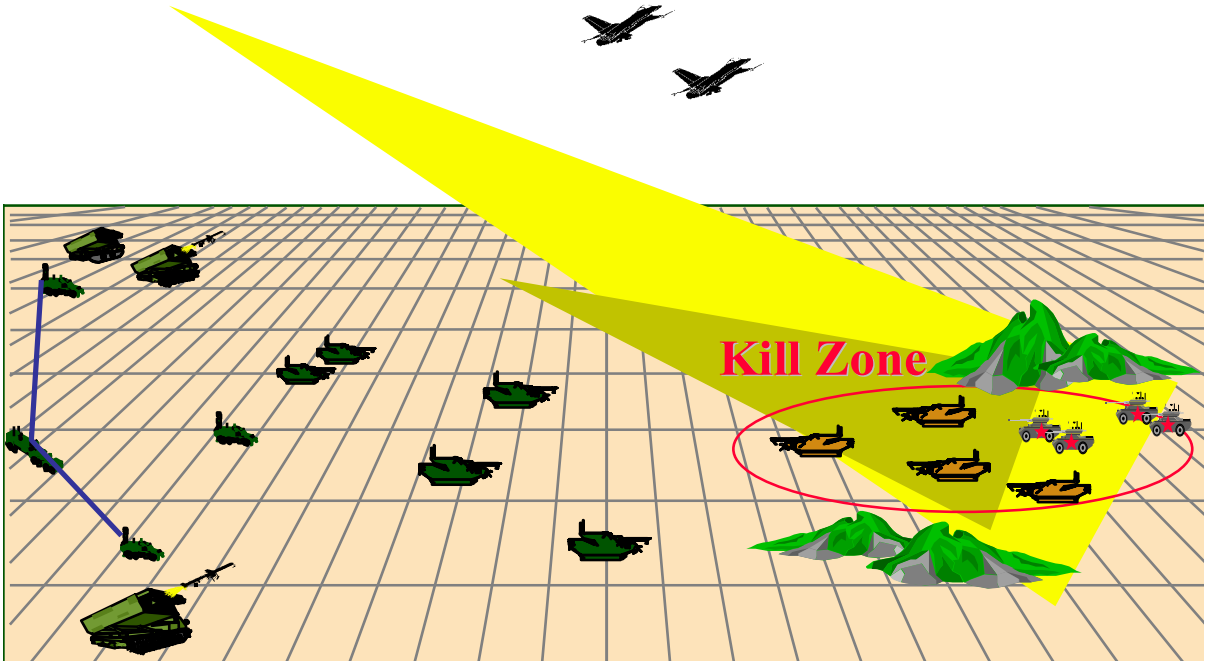
[84] Forsvarets overkommando (HQDEFCOMNOR). *Forsvarets fellesoperative doktrine ("Armed Forces Joint Doctrine"),* February 2000. Part A, para. 2.13.2.
[85] Forgues, Pierre. *Command In A Network-Centric War, …* Pages 25-26.
[86] Schengen-Treaty: Norway as a Non-EU member, has signed a treaty with the EU, to join common borders with the EU. Once checks at common borders are completely abolished, the holder of a uniform visa is entitled to stay in the Schengen-treaty member states for a maximum of up to 90 days per six-month period during the visa's period of validity. [http://www.auswaertiges-amt.de/www/en/willkommen/einreisebestimmungen/schengen_html].

system is a challenge when it comes to interoperability. The main CCIS will be described in more details in Chapter 5 - Technology.

3.8 Ad Hoc Organizations – Task Forces

As described earlier in this chapter, the NCW organisation is more dynamic than today's armed forces. As earlier mentioned, the U.S. Navy has called NCW "a fundamental shift from platform-centric warfare." Today's operations or traditional operations are considered platform-centric, platforms; that operate as entities. This is in contrast to network centric warfare, which focuses on passing information rapidly among different entities to increase their ability as a whole to respond to threats and to let an appropriate commander respond to the threat. This will lead to a new way of organizing military forces. Permanent organisations will, for the most, be disbanded, and will be replaced with temporary ad-hoc organisations, dependant upon mission and situation.[87] Compared with the current organisation, sensors and platforms will be separated to a greater degree. The units still have to be multi-functional, and will have to make all its functions (sensors, weapons, etc.) available to other components. Establishing ad-hoc organizations, task groups, battle groups, etc. is not new in Norway. The new idea is how this is done in an information grid. Once a decision is made, an appropriate commander can take action within seconds and effectively mass weapons in the battle space against a kill zone, like shown in Figure 6.

[87] Forsvarets overkommando (HQDEFCOMNOR). *Forsvarssjefens militærfaglige utredning – Strukturvisjon 2014+ ("CHOD NO Report 2003 – Vision 20014+").,* September 2002. Para. 4.3.1.


Kill Zone

tactical level will continue to be relevant in the future. Further, the focus on mass, both personnel and equipment, resulted in voluminous military organizations. The limited ability to collect, disseminate and exploit information, restricted the control span, which made the organisation difficult to manage. The consequences of the developments we see today are two levels of command: one strategic / operational (political / military), which develops intentions, and one tactical, which makes decisions based on these intentions and executes the actions which will give the desired political effect.[90] The future Norwegian command structure in a network centric force might look similar to these models:

Figure 7 – Possible New Command Structure.[91]

[90] Forsvarets overkommando (HQDEFCOMNOR). *"CHOD NO Report 2003 – Command Concep*

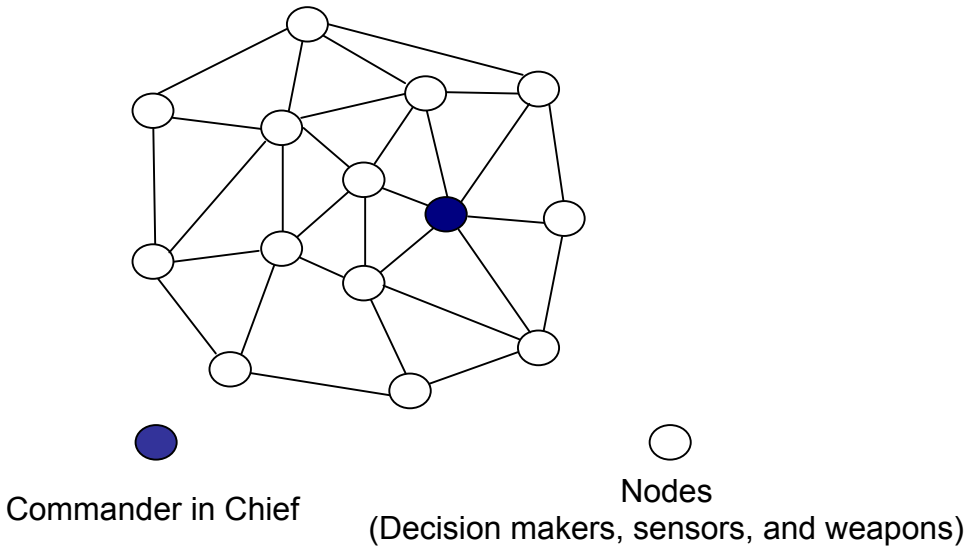


Figure 8 – Possible New Command Structure.[92]

A command structure like the ones described above, may encounter considerable resistance in the officer corps, especially among the senior leadership. The main reason is most likely the lack of knowledge of the NCW concept. The implementation of the concept will require a total re-education of the Armed Forces and its leaders.[93] United States scientists have stated that:

> Change in C2 organization is crucial to achieving the benefits available in the Information Age. This can be expected to be a long pole in the tent because of the cultural impediments as well as the perceived high cost of getting it wrong.[94]

3.10 Possible Changes in the Norwegian Command Structure and System

The current Norwegian command system is described in paragraph 3.4. With the transformation to NCW, at least one level can be disbanded.[95] Regional Command North (LDKN) at Reitan, Bodø and Regional Command South (LDKS) in Trondheim, can be disbanded.

[92] Forsvarets overkommando (HQDEFCOMNOR). *"CHOD NO Report 2003 – Command Concept for Network Centric Warfare – Basis"* ... Page 33.
[93] Forsvarets overkommando (HQDEFCOMNOR). "*CHOD NO Report 2003 – Command Concept for Network Centric Warfare – Basis"*. Para. 5.3.2.
[94] Alberts et al. *Understanding the Information Age Warfarer…Page 162.*

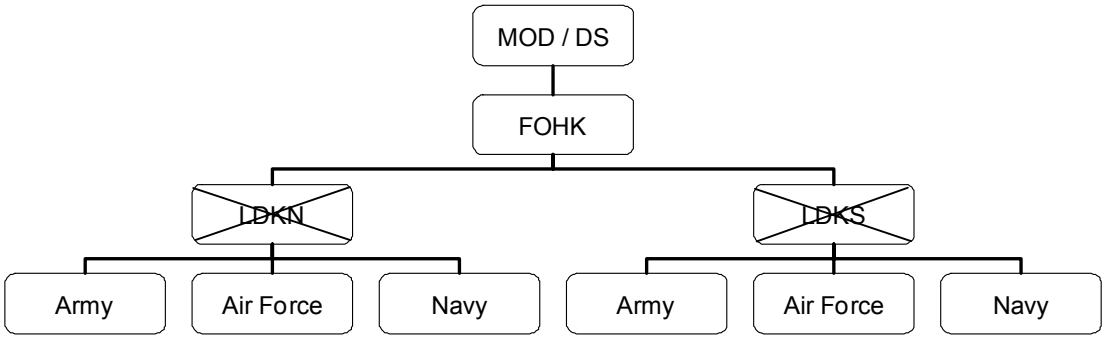


Figure 9 – Disband one Command Level

This might be the future Norwegian command system.

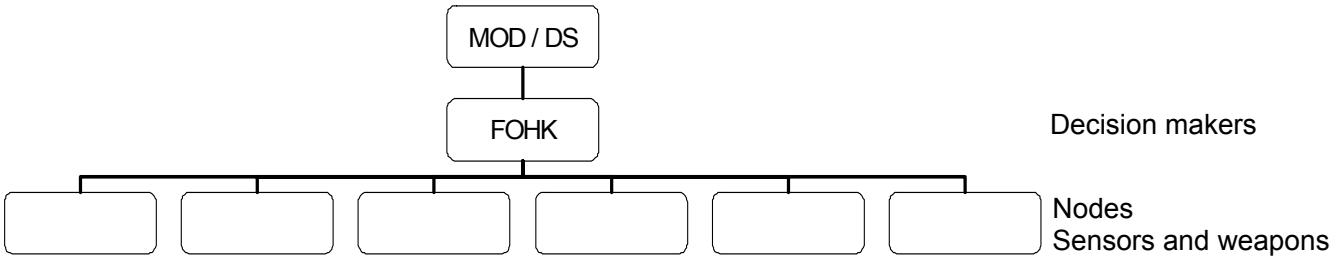


Figure 10 – Future No. Command Structure.

However, the regional commands provide employment in the sparsely populated parts of Norway, especially the Bodø command. During the last restructuring of the different headquarters and regiments, there was a heavy debate in the Storting[96] about number and localisation of

[95] Forsvarets overkommando (HQDEFCOMNOR). "*CHOD NO Report 2003 – Command Concept for Network Centric Warfare – Basis"* Page 40.
[96] The Storting, Norway's national assembly, was constituted at Eidsvoll in 1814, but its roots are far older.

headquarters and units. Employment in sparsely populated parts of Norway, especially Government employment, is of great importance to some of the political parties and the politicians from these areas of Norway. CHOD is not always heard when it comes to restructuring the Armed Forces. For war fighting, it makes sense to organize the command structure as shown in Figure 10. For peacetime management, however this will probably not be possible. The regional commands are probably not necessary for peacetime management. At the tactical level the Army and Home Guard districts, the naval stations and the air bases, are necessary for peace-time training and education. In peacetime these levels are managed by the General Inspectors for the three services (Army, Navy, Air Force and Home Guard),[97] The discussion of peacetime management requires a paper of its own and will not be discussed here.

3.11 Willingness to Change

The report[98] points out that there may exist barriers that could prevent or hinder a transformation to a new command concept. In comparison to the civilian society and the organisational forms that exist in there, an organisational barrier between the two societies will be built, if the Armed Forces are not able to adjust its organisation. The report further states that the Armed Forces probably has to adapt to the requirements and standards that exist in the civilian world, to be able to recruit, develop and keep the necessary personnel. It is uncertain if the requirements that are listed for personnel in the command system will be accepted by the personnel that are to serve in the Armed Force (officers, civilian, enlisted and privates), if the changes are different form the standards in the civilian society. Such a development could reduce

[97] The Home Guard is not recognized as an own service in Norway (Territorial Force).
[98] Forsvarets overkommando (HQDEFCOMNOR). "*CHOD NO Report 2003 – Command Concept for Network Centric Warfare – Basis"...* Page 41-42.

the admission of qualified personnel. One can argue if this statement would have any influence of recruitment to the Armed Forces.

The new command concept requires a new way of projecting authority. This is not only defined by the hierarchy, but where the command group[99, 100] also is capable of accepting new organizational forms based on situation (situational decided / ad hoc organization). The command group will in some situations have to abandon authority. In this new command concept, the leader shall reflect the organisations norms and values as wide as possible. It has two important consequences, namely that:[101]

- Leaders accept that full consensus and uniformity is not achievable. That every decision maker in the organisation will have a broader bound when it comes to displaying authority based on the commanders intent, own knowledge, judgement and competence. To make this happen, one needs to build enough personal self-reliance with each staff member, and to get acceptance that it is legitimate to make decisions on your own.
- Leaders have to re-define their own role, to focus as much as possible on the establishment of values, visions and basic rules. In a process, where each staff member's competence is "released", it is not meant that the leader disappears, but rather that the focus is turned in another direction.
- Leaders have to earn confidence among the staff members, both oral and in writing. The staff members' must have the confidence, that what you write or say, will be followed by action. The lack of this confidence is often connected with the lack of internal communications within the Norwegian Armed Forces, this is considered a main barrier for the development of the organization.

The military culture is cemented in battle elements and staff elements. This separation is based on traditions, exercises and experience. The elements represent a substantial part of the military culture. A change in the separation will therefore be encountered by resistance from the military culture. The existing separation of these elements, is a product of the technology and the

[99] NATO HQ. *AJP-01(B) - Allied Joint Doctrine, Ratification Draft 2*. Brussels, October 2001. Para. 0611.
[100] The Command Group would normally consist the JFLCC, the deputy/chief of staff and principal staff officers. Occasionally it may include high ranking host nation liaison officers and, in non-Article 5 CROs, senior officials from the UN or other international organizations.
[101] Forsvarets overkommando (HQDEFCOMNOR).*"CHOD NO Report 2003 – Command Concept for Network Centric Warfare – Basis"* ... Para 5.5.1.

possibilities for information exchange, which was present for military exploitation at the time the elements were developed. Weapon platforms have for generations had sensors or been dependant on the operators senses. In the information age, the sensors can be de-connected form the platforms, in many cases also manned platforms. By this, the personnel will not encounter risks and dangerous situations. An analysis which consists of the most substantial aspects and expected barriers in the Armed Forces, will contribute to uncover if the culture will make up barriers for the implementation of the new command concept.

When discussing command structure, command system and command levels, economy also become an important factor. For years, the Armed Forces have experienced a disconnection between tasks and economical assignment, shown in the annual Norwegian Defence Budget. This disconnection will result in difficult priorities, especially between management and procurement. Without investment of money in the new command system, the command concept for NWC will not be realized.

In summary, a number of barriers exist, which might prevent or complicate the transition to the new NCW command concept. Some of them have been discussed in this Chapter. The conclusion is to accept that there are barriers and to treat them jointly. Even if the Armed Forces continue to keep its distinctive stamp and in certain situations will require a special form of leadership, the Norwegian military cannot allow ourselves to hold on to old traditions.

3.12 The Norwegian Command Concept - Summary and Conclusion

The implementation of NCW will change the way the armed forces have been and are organized. In addition, it will influence the authority between different units and levels of command. This concept focuses on the management of military operations, and is a development of mission command, as described in the joint doctrine.[102] In addition, the concept introduces a few new definitions and ways of thinking. If the Norwegian Forces are to adapt to NCW, the concept must be rooted in the Armed Forces senior leadership, among CHOD and his staff (FOL).[103]

The notions that will be implemented with this concept will consist of some old Norwegian and NATO notions combined with notions developed out of the NCW concept. It is not a big difference in the definition, it is the notions that are slightly changed. In a transition period, one have to be aware when we use the Norwegian term "Command", which corresponds with the notion "Command and Control" in NATO. When the concept uses the notion "Command System", this corresponds with the notion "Command and Control System – C2S".[104]

The Armed Forces Joint Doctrine states[105] that from a military perspective, it is a clear relationship between the operational nucleus,[106] basic functions[107] and the operational concept. These relationships are translated into *The "inner" doctrinal Loop*[108] as shown in Figure 11.

[102] Forsvarets overkommando (HQDEFCOMNOR). *Forsvarets fellesoperative doktrine ("Armed Forces Joint Doctrine"),* February 2000.
[103] Forsvarets Øverste Ledelse – FOL. An integration of the Chief of Defence (CHOD NO) and his strategic functions in the Ministry of Defence. The DEFCOMNO will be shut down (August 2003), and a Defence Staff (DS) will be established to support the CHOD as head of the Armed Forces. The MoD will carry on as a government office.
[104] Forsvarets overkommando (HQDEFCOMNOR). *"Armed Forces Joint Doctrine".* … page 27.
[105] Ibid. Part A, pages 41and glossary.
[106] Operational Nucleus, collective term for the core operational functions: act, Protect and maneuver.
[107] Basic functions: C2, Firepower, Mobility, Protection, Intelligence and Logistic.
[108] Forsvarets overkommando (HQDEFCOMNOR). *"Armed Forces Joint Doctrine"*, Part A, para. 2.10.3.

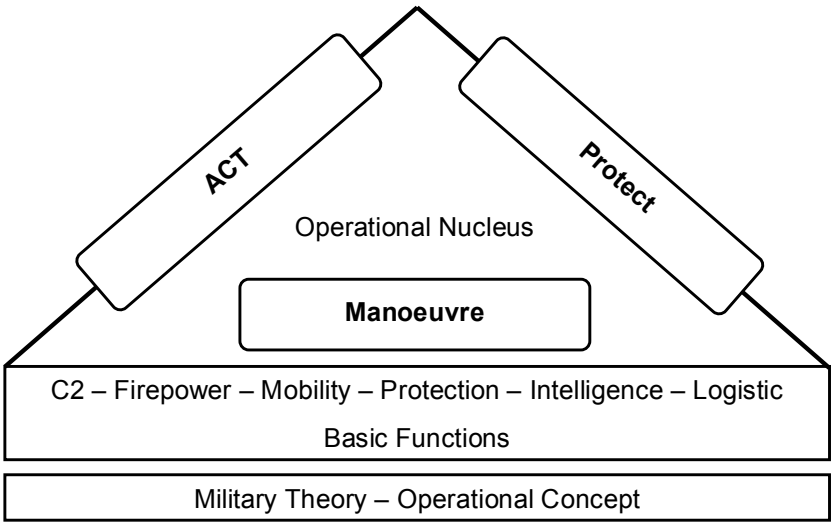


Figure 11 – The "inner" Doctrinal Loop.

The core operational functions; act, protect and manoeuvre are aimed at the use of military forces (OPP), the basic functions is aimed at the development of Armed Forces (Structure Planning).

The division of the notion command and command system, which has been discussed in this chapter, means that command is the central element when it comes to management of military operations. The command system (CS) is a subordinated function and a tool to support command. Implicit, command will be the element that joins the three core operational functions (act, protect and manoeuvre) a commander uses when he / she execute military campaign. The command system (CS) will be the support function for command, and is therefore a basic function. It is therefore necessary to make an adjustment to *The "inner" Doctrinal Loop*, as shown in Figure 12.[109]

[109] Forsvarets overkommando (HQDEFCOMNOR).*"CHOD NO Report 2003 – Command Concept for Network Centric Warfare – Basis").* … Page 38.

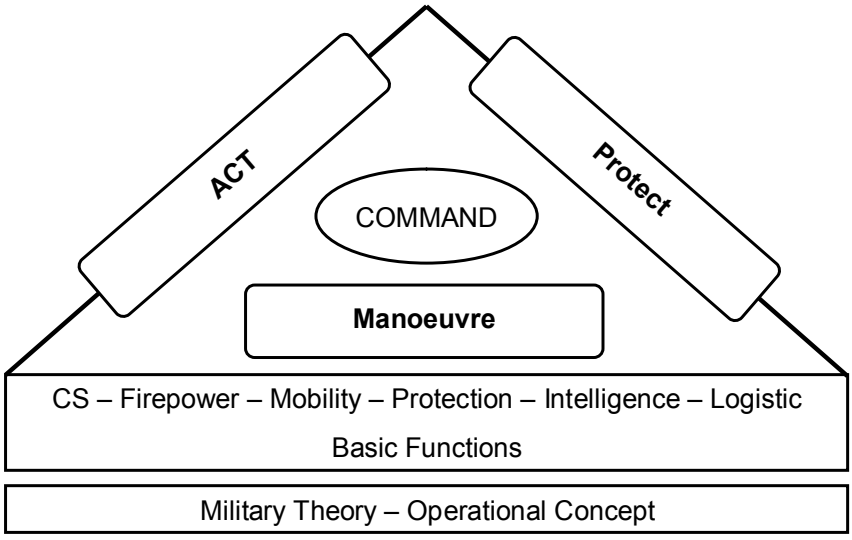


Figure 12 – adjusted "Inner" Doctrinal Loop.

Doctrinally, the most distinct consequence of the concept is that command is being put forward as the most important factor when it comes to management of military operations. A transition to NCW concepts will require a change of both how we select our military leaders and how we educate and train the leaders and units. A network centric force with a drastically improved situational awareness will result in an increase in the decision components span of control, compared to today's organization. This will also result in a more streamlined command structure, with the elimination of command levels. A very flexible command structure is necessary to have full effect of NCW. Further the report emphasizes that a lot of barriers must be overcome to be able to get full effect of NCW. The new concept requires a new form of execution of leadership, where the organization also is able to accept new ways of organizing (situational decided or ad hoc organization) and where the leader in certain situations is forced to abandon power.

4 ABILITY TO LEAD AND COMMAND IN NCW

As already discussed, the ability to lead and command in a NCW environment is essential. A study has been initiated by CHOD/MOD to discuss and to purpose a possible revision of the current Non Commissioned Officer (NCO) and Officer promotion system, a report has been made by a working group. A study has also been done regarding the educational system. This study was done a few years ago, long before the NCW concept was initiated.

The following is a description of the current status of the selection system for officers, and the current educational and training system. It is also a description of desired leadership and command qualities in NCW. As earlier discussed, there is possibly a need for change in the way we select commanders, and how we train and educate in NCW.

4.1 Status current of the educational system

To become an officer and a commander, the first step is to qualify for a NCO /sergeant course or the Officer Candidate School (OSC) and graduate. After completion of this education, the cadets become a NCO, with the rank of sergeant. The next step is to qualify for the War Academy Part I and II. Then, the next step is to qualify for the Norwegian Defence Staff College (NDSC) - basic course, at the rank of captain, and further the NDSC - advanced course, at the rank of major. This course might be done at an Allied College. The last step in the military system is the National Defence College, at the rank of lieutenant colonel or colonel. Civilians can attend the staff college (both courses) and the Defence College. So far, the system does not include any academic degrees, but studies are underway to adapt to an academic system for the education of

officers. The current system can be compared to international military educational systems as shown on this figure.

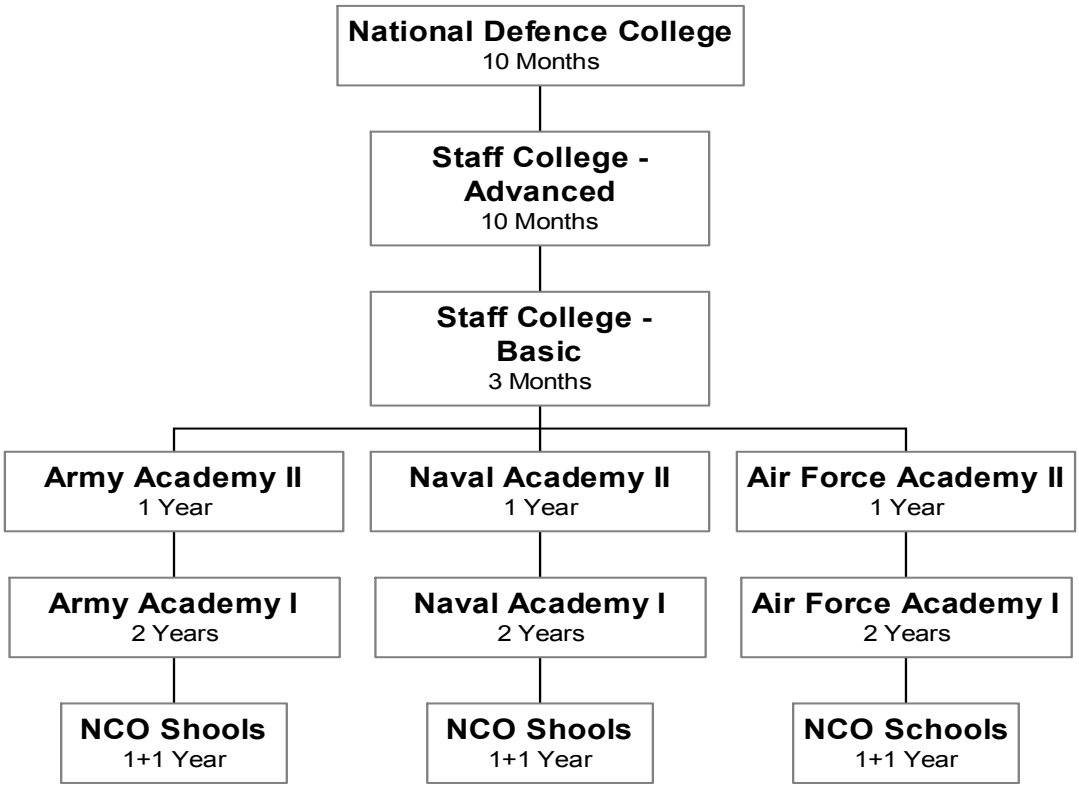


Figure 13 - No. Educational System.

Each service has their own educational system up to Academy II level (5 years study). The NCO Schools consists of one year studies and one year practical education (1+1 year) and the students are promoted to Second Lieutenant after completing studies. The Academies consist of two and one year's studies divided by on-the-job training. Staff Colleges are joint institutions. Graduation from the Staff College – Advanced Course is at the moment a Baccalaureate Degree; this will in the future be achieved after Academy II. A Masters Programme is under development for the Staff College – Advanced course.

The current educational system, in general, probably does not need to be changed when the Armed Forces transfers to the NCW concept. However, the NCW concept must be in focus, and the students / future commanders must be trained and educated in operating and commanding in a NCW environment, from the NCO level and all the way upwards.

4.2 Status of the current selection system

The Vernepliktverket[110] does the initial military classification of all Norwegian males. The Norwegian Constitution[111] obliges all males to do one year of military service, however, only approximately 50 % complete military service. The initial selection is based on a health profile and skills profile. Simple tests are conducted. The selection for NCO education and further officer education is more detailed. In addition to a health and skills profile, it is also based on psychological tests and proficiency reports. Specialists like fighter pilots, special forces, etc. will have to go through more intensive tests, related to their speciality. The general selection system for officers is aimed at finding the right leader, a leader that can lead personnel and groups of soldiers. (section, platoon, company/squadrons, etc.). The current system is aimed at leadership skills and selecting the right personality, finding the right person based on the existing leadership model. This may not be the command and leadership package needed in a NCW concept.

As earlier described, the ability to command in NCW must also be based on the commander's intuition and situational awareness. Tempo, the ability to get inside the adversary's decision cycle, is important. This will probably require more command and leadership qualities

[110] Vernepliktverket - The Norwegian Recruitment and Conscripts Office.
[111] Grunnloven av 1814 *("The Norwegian Constitution 1814"),* § 109.

than most of the current Norwegians commanders have. However, this is a study in itself and can not be discussed in greater details in this paper.

4.3 Status of the current training system

The current training system is, for the most, based on leading personnel, the section, platoon, and company, in battle. Most of the training is focused on these formations. With new computer and simulation technology, this training has become very efficient and realistic. Even battalion commanders can be given realistic and good training in this simulated environment, but the training is still aimed at the last decade's battlefield and not at the NCW battle space. The commanders and staff officers at higher formations, up to the operational level, are trained through command post exercises (CPX), computer assisted exercises (CAX) or field exercises. Planning is done by using the operational planning process (OPP)[112], then the headquarters executes the plan through a CPX, sometimes also by CAX or leading live formations. At the NDSC Advanced Course, the two main exercises the students are exposed to are executed in the same manner. Even if the operations at the operational level are truly joint in nature, the focus is on platforms.

The NCW concept has not yet been fully introduced to the forces. When introduced, it will take time until the Armed Forces have transitioned into a fully network centric force. Many obstacles will have to be overcome, because we have always been indoctrinated to follow the chain of command, and this chain is almost a sacred thing.

[112] NATO HQ, Bi-SC Document. *Guidelines for Operational Planning (GOP).* Final January 2001.

4.4 Experimentation - Future Simulation and Training

The Norwegian Defence Research Establishment (NDRE) has established a research project on decision support. The project focuses on the human being's ability to make decisions, using their intuition. So far, the students at the NDSC have been exposed to this project, as part of the research. The aim is to develop a computer based decision support trainer. Other audiences will be trained when this project is finalised.

So far, CAX training and simulation facilities have been introduced at the tactical level in all three services. A joint staff trainer at the operational level has yet to be introduced. Use of a live headquarters for such a facility is a possibility, however, the headquarters will have to take care of their normal duties. The trainer might interfere with daily duties. The NDSC have for some years used the facilities of former Allied Forces Northern Europe at Kolsås, close to Oslo. This Major NATO Command (MC) was disbanded some years ago. The command bunker and operations rooms are still used for CCIS courses and NDSC exercises. Most of the technical infrastructure is in place and NORCCIS-II is installed in the bunker. A modernization might be required, with a computer based trainer to facilitate CAX. This would make an ideal training centre for NCW, at a relatively low cost. The most expensive part will probably be the computer-based trainer.

The CAX training and simulation facilities at the tactical levels in the services will probably be able to adjust to NCW as soon as the concepts have been introduced and necessary modifications have been done to the trainer. A connection to the joint trainer will have to be made to simulate NCW, but these will likely be challenges when it comes to interoperability. A joint

staff trainer at the operational level is necessary to be able to transition into a truly network centric force.

As earlier mentioned, the Joint Command has been given the task to conduct experimentation and simulation. This is in addition to the efforts made by NDRE. Technology development demands rapid experimentation and exploitation of COTS by war fighters, to be able to find new technological approaches to the challenges inherent in the NCW concept.

4.5 Ability to Lead and Command in NCW – Summary and Conclusion

Based on the conclusions in Chapter 3 - Command in NCW, and the discussions made in this chapter, a change in the selection process will have to be made. The design of a new selection process will require a study by a competent military institution. The focus of the selection must be the ability to command in NCW, based on the commander's intuition and situational awareness.[113]

As described, a study has been done regarding the military educational system. This study was done before the NCW concept was initiated. In light of the NCW concept, it might be useful to initiate a new study.

The existing training and simulation system must be changed and developed. A NCW training centre at the operational level must be established, and linked to the training centres at the

[113] Forsvarets overkommando (HQDEFCOMNOR). *"CHOD NO Report 2003 – Command Concept for Network Centric Warfare – Basis"*. … Para. 5.3.1, 5.3.2.

tactical level. This must be prioritised and is the key when it comes to achieving a truly network centric force.

Experimentation and simulation done by warfighters is an important supplement to the research and development done by bureaucratic institutions. The use of "simple" solutions by using COTS will cut down on the time required to develop new solutions for the NCW concept.

5 TECHNOLOGY IN A NETWIORK CENTRIC FORCE

Technology is not the most important part of NCW. Technology is, however, important when it comes to situational awareness and giving decision makers the basis for timely management of the battlespace.

To be able to execute "command and control" in NCW, situational awareness is crucial. Without a near "real time" Common Operational Picture (COP), proper decision-making in a network centric force is very difficult. As earlier mentioned, making timely decisions in NCW and using a manoeuvre approach, the aim is to reach inside the adversaries' decision loop / OODA loop. The COP is delivered by a CCIS to achieve this. Let us first have a closer look at the Norwegian CCIS. The following is a more detailed description of the main CCIS in Norway.

5.1 Command Tools - Norwegian CCIS

The Norwegian Armed Forces CCIS family consists of four different systems. As in most countries, they were all developed separately by using different companies. At the very start of development, Norwegian companies were used and everything was developed from scratch, COTS were probably not even considered. Again, this was a political decision. The four CCIS are:

- NORCCIS II - Norwegian Command and Control Information System -Phase II.
- NORTaC C2IS - Norwegian Tactical Command and Control Information System (Army).
- SjøTas - Sjøforsvarets Taktiske Arbeidsstasjon (Naval). At the operational level the Navy also uses the NATO Maritime Command and Control Information system MCCIS.
- NEC CCIS - Northern European Command - Command and Control Information System (Air Force).

In addition, the police and customs authorities, in close cooperation with the Navy and Coast Guard, have invested in a Coastal Operations and Surveillance System (COSS). This CCIS was implemented end of 2001 and supports the police and customs authorities in enforcing the Norwegian participation in the Schengen-treaty.[114] There are also other CCIS at the tactical level these will not be described. However, it is necessary to describe the main CCIS in more details.

5.1.1 The Joint CCIS – NORCCIS II

The NORCCIS II is the Norwegian Joint Forces Command, Control and Information System. This is the main CCIS in Norway and is mainly used at the operational level. It provides excellent capabilities in the area of Combined / Joint Operational Picture (COP) and planning, and demonstrates impressive capabilities in allied interoperability. NORCCIS II has been in operational use with the Norwegian Armed Forces since 1992, and is now our most widely fielded Command and Control Information System. In addition to national use, there are NORCCIS used in KFOR[115] and at SHAPE,[116] AFNORTH[117] and NATO HQ,[118] ISAF,[119] and NO LNO CENTCOM.[120] Even governmental institutions like MOD and some embassies are now using this CCIS for situational awareness.

Presently, the NORCCIS II supports planning and execution of Joint (Land and Naval) operations at the strategic and operational level, including deployed HQs. It provides the COP, a

[114] Schengen-treaty, Norway as a Non-EU member has signed the treaty with EU to join common borders with the EU. Once checks at common borders are completely abolished, the holder of a uniform visa is entitled to stay in the Schengen-treaty member states for a maximum of up to 90 days per six-month period during the visa's period of validity. [http://www.auswaertiges-amt.de/www/en/willkommen/einreisebestimmungen/schengen_html].
[115] Kosovo Force.
[116] Supreme Headquarters Allied Powers Europe, NATO Strategic Command, Mons, Belgium.
[117] Allied Forces Northern Europe, Regional Command, Brunssum, Netherlands.
[118] Headquarters North Atlantic Treaty, Brussels, Belgium.
[119] International Stabilisation Force Afghanistan.
[120] Norwegian Liaison - U.S. Central Command, Tampa, Florida, the USA.

fused representation of the theatre of operations, based on relevant, accessible information. A graphic display of all friendly, neutral, and hostile forces (air, land, and naval) together with relevant maps and overlays, including:

- Recognized Air Picture (RAP). The RAP is provided to NORCCIS II via a Link 1 feed.
- Recognized Land Picture (RLP). Utilizing information from own and external sources to build, maintain and disseminate the RLP.
- Recognized Maritime Picture (RMP). Utilizing information from maritime sources ranging from shore based commands to units at sea, to build, maintain and disseminate the RMP.

5.1.1.1 NORCCIS II – Modules

The NORCCIS II system is based on a set of integrated modules and is continuing with to new modules integration. The following modules have been implemented at this time:

- Naval Database
- Land Database
- Crisis Management (CM)
- Order of Battle Manager (OBM)
- Situation Display / Map system (MARIA)
- Military Message Handling System (MMHS) and Directory System
- Message Processing (IRIS)
- Planning Module (NATO OPP)
- WEB Publishing Tool
- WEB Portal
- E-mail and MS Office

The data model used in NORRCIS-II is an ATCCIS[121] derived data structure. There are made extensions to support Joint and Naval requirements and to support specific ADatP-3 and OTHT-Gold messages.[122] The NORCCIS is continuously being upgraded and new modules are being developed to meet future requirements.

[121] NATO agreed data structure, ATCCIS- Army Tactical Command and Control System.
[122] NATO agreed technical specification for formatted messages.

5.1.1.2 NORCCIS II - WEB Portal

The NORCCIS II WEB Portal provides support to C2 data consumers, which may be users on connected systems. The following applications are available:

- COP - Bulletin Board
- WEB publishing - NewsFlash
- File browsing - Outlook
- Janes Online

5.1.1.3 Situation Display / Map System (MARIA)

In addition to handling COP functionality, the Situation Display / Map System contain tools for:

- Radio / Radar Propagation
- Terrain and 3D Analysis
- GPS (Ground Positioning System) input
- Drawing of tactical graphics in accordance with NATO APP-6 (A)[123]
- Parsing and plotting of NBC messages in accordance with ATP-45[124]
- SAR (Search and Rescue) planning and execution

To display and exchange COP information, NORCCIS II is compliant with NATO standard symbolism and message standards such as AdatP-3 and OTHT-Gold. During a 2001 NATO exercise, the NORCCIS COP was extended to support ATO (Air Tasking Order), LCTC (Link Contact) and TBM (Theatre Ballistic Missile) Tracks (BMISL).

The Order of Battle Manager (OBM) module provides the users with a graphical representation of all units registered in the operational database and their respective organizational

[123] NATO Standardization Agreements (NATO STANAG), *Allied Administrative Publications-6 (AAP-6) - NATO Glossary of Terms and Definitions.* [http://www.nato.int/docu/stanag/aap006/aap6.htm]
[124] NATO – Allied Tactical Publication.

structures. The OBM is integrated with the Land and Naval Modules and the COP / Situation Display and also shows the CE (Combat Effectiveness) for each unit based on personnel and equipment status (from the databases).

5.1.1.4 Scalability

Due to its modularity, it is easy to customize NORCCIS II for various sizes and types of HQs. For instance, the Norwegian Special Forces (No SOF) currently deployed to Afghanistan, use NORCCIS II on a single laptop, the while large HQs utilize several hundred tower-based computer work stations.

5.1.1.5 Intranet

The NORCCIS II Intranet is based on an unclassified IP network (Norwegian Defence Digital Network - NDDN and commercial assets) with the Thales TCE 621 IP-Crypto for NATO SECRET communications. NATO has also recently procured this crypto device. The NORCCIS II Intranet is connected to NATO Initial Data Transfer System (NIDTS) / Crisis Response Operations in NATO Open System (CRONOS) through a firewall and a mail guard, providing WEB and e-mail access.

5.1.1.6 Bi-SC AIS Compliance

The NORCCIS II Software is Allied Command Europe's Automated Command and Control Information System (ACE ACCIS) platform compliant. It is technically straightforward to introduce NORCCIS II functionality into ACE ACCIS / Bi Strategic Command Automated Information System (Bi-SC AIS) or other NT4.0[125] / W2K[126] based systems. Norway has recently nominated NORCCIS II as a candidate for the ACE ACCIS OPSFAS.[127]

NORCCIS-II is likely to become the backbone information provider of situational awareness in a Norwegian network centric force. It is regularly updated with new functionality and will easily meet the requirements for NCW. The following covers a short description of the CCIS that are used at the tactical level.

5.1.2 Army CCIS – NORTaC C2IS

The Army is developing Norwegian Tactical C2IS – NORTaC C2IS. This project consists of three sub-projects:

- Command Post communication equipment.
- Staff support
- ODIN II – Artillery Fire Control and Coordination

Phase 1 of the main project will be implemented in the Norwegian Army soon. These projects will give the Army's tactical units a system that consists of the following main parts:

[125] Windows NT is a Microsoft Windows Operating System for professional use.
[126] W2K is software for e-mail handling/mail servers.
[127] New Joint CCIS for NATO.

- Applications to support the management of operations, fire control and coordination, and logistics management
- Support applications, such as a map system, office support, battle log and Order of Battle

The system uses existing communication infrastructure for transfer of information, including Tactical Data Communication (TADKOM), Multi Role-Radio (MRR) and Norwegian Defence Digital Network (NDDN).

A project to expand the system, Phase II, is also under development. This project includes the following applications:

- Intelligence
- Logistics
- Engineering
- Communications
- Manoeuvre (including a Battlefield Management System – BMS, down to individual soldiers)
- An update of the information structure and shared applications in phase I of NORTaC C2IS
- Information management
- An update of Command Post (CP) communication equipment. This might include fibre optics or wireless communication in the CP, integration against Link 16 and HF radio.
- Interoperability aimed at the data model and replication mechanism. (Interoperability with NORCCIS II and the system for message exchange).
- Second-generation fire control and coordination.

After the functionality in Phase II is implemented, NORTaC C2IS will enable NCW in the Army at the tactical level.

5.1.3 Naval CCIS - SjøTas

The naval CCIS, *Sjøforsvarets Taktiske Arbeidsstasjon (SjøTas)*, is a CCIS for the navy's vessels. The information structure is based on PC's in a network, with semi-automatic exchange of messages using radio. SjøTas is interoperable with NORCCIS II, but SjøTas will be replaced with NORCCIS II in th2002 Tm(C)Tj0890.f

joint structure. Today, the research and development of these sensors are managed by the three services; this cannot be accepted in the future. If the sensors are not interoperable with each other, the development will have been too costly. The study concludes that the research and development of sensors must be gathered in one organisation. Today, this will best be achieved in the NORCCIS II development organisation.

After studying the report, which gives a comprehensive overview of all sensors within the Norwegian Forces,[128] it is obvious that the lack of sensors at the tactical level in the army is alarming. Intelligence, Surveillance, Target Acquisition, and Reconnaissance (ISTAR) capability in the army is almost totally deficient. However, the Norwegian Army is looking into the possibility of developing an ISTAR battalion.[129] This will drastically increase the recognised land picture (RLP). The danger is great that Norway will develop this unit by using national industry. COTS products are probably available in most Alliance nations. For instance, the Canadian Defence and Research Establishment – Valcartier (DREV), is developing an Intelligence, Surveillance, Target Acquisition, and Reconnaissance (ISTAR) kit for mounting on the Canadian Forces (CF) Griffon (Bell 412 EP) helicopter. The project is called Electro-Optical, Reconnaissance, Surveillance and Target Acquisition (ERSTA). This project will give the CF Army a very good ISTAR capability. DREV has other projects that might be of interest for the Norwegian Forces. Common Operational Picture 21 (COP 21), Intelligence and Knowledge Management System and Situation Analysis Support System (SASS) are just some of the projects under development. This is an example on COTS, which are available within the Alliance. The

[128] Thales. *NBF analyse av arven – utgave 2 ("NBF Analysis of current CCIS and sensors"),* Thales Project KD4503/-04/-05, Oslo, February 19, 2003.

[129] Bjerke (Col.). *Future Norwegian Army Development.* Norwegian Army Staff, Brief at The Washington Conference 2003, April 2003.

tendency in Norway, as many other nations, is to "re-invent the wheel". A lot of money is spent on research, development and procurement of capabilities that already are available in other nations.

Sensors will increase the situational awareness and contribute to increased tempo in operations. A study[130] has revealed that a lot of sensors might easily be integrated in an information grid to increase situational awareness. The conclusions in this study states that sensors must be an integrated part of the CCIS, however not all sensors will cost effectively be integrated in the NCW information grid. Based on the study, CHOD will have to make a prioritised choice.

5.3 Communication

The communication network is also an important part of NCW. The communications systems the Norwegian military presently uses are Tactical Data Communication (TADKOM), Multi Role-Radio (MRR) and Norwegian Defence Digital Network (NDDN).

The following communication solutions are available today and can briefly be described as:

- eXtended Wide Area Subsystem (XWAS). An infrastructure with mobility and high capacity. Used where high and flexible geographic coverage is necessary.
- Wide Area Subsystems (WAS). Infrastructures with good mobility, used where regional and flexible coverage is necessary. Will be used to connect communication infrastructure in the role as LAS and MS.
- Local Area Subsystems (LAS). Infrastructure with very good mobility which are used where only local coverage is necessary. Typically used in user terminal to give them mobility within a limited geographical area.
- Mobile Subsystems (MS). A radio based infrastructure, used where it is necessary to have flexible geographical coverage, but only limited capacity. Typically used in user terminal to give them mobility in connection to the network.

[130] Thales. *Analyse av pågående og planlagte prosjekter ("Analysis of current and planned project"),* Thales Project KD4503/-04/-05, Oslo, February 28, 2003.

In light of the current systems and the anticipation that the future will require separate communications nets for different purposes, the communication infrastructure in NCW will have to consist of a net of nets. This means that Norway has to connect the different existing nets in a much tougher manner than today, and that a migration to fewer nets will have to take place in the future.[131] One of the requirements that have been stated for the NCW concept is mobility. This must be the basis for further development within Norwegian military communication structures.

5.4 Investments in NCW Capabilities

In the Defence Budget for 2003, important future investments are made to achieve a network centric force.[132] In the chapter titled Future Projects, the investment in a Tactical data link 16 (Link-16) is described. The paper states that if Norway is to be a bivalent and effective partner in NATO, it is necessary that the Armed Forces are being adjusted to the Alliance both technologically and doctrinally. Through procurement and the upgrade of existing platforms along with realistic exercises, the Ministry of Defense wants to ensure that the forces and weapons system meets NATO requirements. As a step towards the transition to NCW, it is planned to procure Tactical Data Link 16 (TDL 16). This will be a shared system for the transfer of real-time data between units.[133] The procurement of TDL 16 for communication and transfer of real-time data between fighting formations, is important when comes to effective and safe multinational operations. Interoperability with coalition partners is also very important. TDL 16 will give Norwegian Forces a complete capacity to be part of coalitions with other NATO partners.

[131] Binnendijk, Hans. *Transforming America's Military. ...* Page 113.
[132] Forsvarsdepartementet (Ministry of Defense). *"The Norwegian Defence Budget 2003". ...* Page 83-84.
[133] Forgues, Pierre. *Command in a Network-Centric War. …* Page 25.

TDL 16 will be a joint capability for the Armed Forces. Terminals will be integrated on different platforms, for instance the new Skjold class Missile Torpedo Boats (MTB), the new Fridtjof Nansen class frigates, F-16 fighters, DA 20 Jet-Falcon (EW airplane), Norwegian Advanced Surface-to-Air Missile System (NASAMS), 6th Division Tactical Command Post (TACCP), etc. TDL 16 will contribute to operate integrated, and is a very important factor to achieve a network centric force. The procurement program consists of three projects. The main project aims at the implementation of TDL 16 in the Armed Forces, the two sub-projects aims at procurement of TDL 16 to the new frigates and the F-16 fighters. The Ministry of Defense has stated that it is important that the decision to procure TDL 16 for the new frigates and F-16 fighters is made as soon as possible.

The procurement of TDL 16 is a very important step towards NCW. Without a data link between the decision makers, sensors and platforms, Norway is not able to achieve a network centric force. This investment also makes us interoperable with NATO and coalition forces.

5.5 Technology – Summary and conclusion

Technology is an important part of the NCW concept. Communication between systems is of great importance when it comes to achieving a network centric force. Sensors must be connected to the information grid, systems and sensors must be interoperable and the communication solutions must be based on mobility. It is not acceptable that national CCIS not are interoperable and that Norway not is able to communicate and participate in information sharing in the information grid, with its Allies.

6 INTEROPERABILITY

Interoperability was touched upon in Chapter 3. However, this chapter is mainly about technical interoperability. As stated, to achieve NCW, situational awareness is a key to success. The CCIS will give us this, but it is a necessity that the different systems, sensors and platforms are able to exchange information. The CCIS will have to collect information from all these sources to build the Common Operational Picture (COP), the picture that gives the commander the necessary situational awareness. Not only internally in Norway, but also with Allies and coalition partners.

6.1 Interoperability in a Network Centric Force

The Norwegian Minister of Defence gave some clear statements[134] about the importance of interoperability with allies in the January 2003 address to members of the Oslo Military Society. She stated that:

> We must have "Battle Labs," like the Norwegian Battle Lab Experiment (NOBLE) at Bodø Main Air Station, we must have joint training with allied units like the training sessions we now run in the north, and in fact, we must focus on "joint" aspects in all that we do. Where technology is concerned, we must place the main emphasis on *interoperability*, on ensuring that our forces and those of our allies can "talk to one another". Only through the development of common concepts and doctrines, *interoperable* materiel and joint training can we work efficiently together in an operational setting.
>
> The requirement for high mobility and deployability and for *full interoperability* with our allies is fundamental.
>
> If only some Allied nations were to commit themselves to a process of comprehensive military transformation while others were to hang back, *NATO forces would no longer be interoperable*.

[134] Devold, Kristin Krohn (Minister of Defence, Norway). *"What we want and where we want to get to: Defence policy aims and priorities in 2003"*.

This statement by the MOD is very clear; Norway has to be interoperable with other NATO members and coalition partners. The NCW WG has also given a similar statement. In their report[135] they have stated that: "it is not appropriate the Norway develops its NCW concept in isolation. The Armed Forces must combine forces with its Allies and partners to ensure interoperability. The Norwegian development must build on earlier gained competence and experience, this to prevent duplication of effort and to save money."[136] Interoperability is also highlighted as an important factor in *Vision 2014+*.[137]

Finally, the need to be interoperable is also stated in Norwegian joint doctrine. "Our Forces will never operate in a vacuum and independent of surroundings. … In such situations, both our Allies and the civilian part of the Total Defence will make demands on the Armed Forces interoperability."[138]

6.2 Current NATO Standards and Challenges

The NATO standards for data transfer and communication are the responsibility of NATO Communication, Command and Communication Agency (NC3A). The NATO Policy document for the architectural development of system and technical views is the NATO Allied Data Publication 34 (ADatP-34). The NATO C3 Technical Architecture (NC3TA) is:

> The minimal set of rules governing the specification, interaction, and interdependence of the parts or elements of NC3 Systems whose purpose is to ensure interoperability by conforming to the technical requirements of all NC3TA Volumes. The NC3TA identifies

[135] Forsvarets overkommando (HQDEFCOMNOR). *"CHOD NO Report 2003 – Concept for Network Centric Use of Military Forces – Basis"*.
[136] Forsvarets overkommando (HQDEFCOMNOR). *"CHOD NO Report 2003 – Concept for Network Centric Use of Military Forces – Basis"*. ... Para. 1.8.
[137] Forsvarets overkommando (HQDEFCOMNOR). *"CHOD NO Report 2003 – Vision 20014+"*, … Para. 5.1.
[138] Forsvarets overkommando (HQDEFCOMNOR). *"Armed Forces Joint Doctrine"*. Para 16.7.8.

> the services, building blocks, interfaces, standards, profiles and related products and provides the technical guidelines for implementation of NC3 Systems.

NC3TA sets the overall standards. ADatP-34 describes the specific formats and standards for formatted messages, which make the exchange of information between different NATO CCIS possible. These formats and standards are continuously being developed and changed. Some NATO members develop their own specific formats and standards, based on national requirements. Some of these standards might not be available to other NATO member due to national security classification. Norway has for the last two years tried to improve its interoperability with other Allies by participating in the United State initiative, Joint Warrior Interoperability Demonstration (JWID). This demonstration allows the participating nations to improve interoperability drastically, to exchange information between systems and to demonstrate each other's CCIS and communication solutions. JWID a CCIS "think-tank" when it comes to interoperability and situational awareness. Norway will again participate in JWID 2003. It is important that this participation continues, to be able to gain the necessary interoperability in a network centric force.

6.3 Technological challenges

Technological development is very fast. Different technological standards among operating systems, technical architecture, etc. for computers and within information technology make for big challenges when we discuss interoperability. Most nations tend to develop their own CCIS, using national industry. These projects are very often complicated and time consuming. Before the system meets the users, it is already technologically "out of date". COTS products must be used to be able to keep track with the technological development. CCIS must be based on modules, which can easily be incorporated in a CCIS "Plug-and-Play" architecture. An increased

cooperation with other nations must be established. It is not necessary to "reinvent the wheel", as other nations or companies have already developed CCIS and communication solutions.

The data models used in Norway must be ATCCIS[139] compliant. The CCIS must support both NATO agreed and specific ADatP-3 and OTHT-Gold messages.[140] CHOD is making a big effort to be interoperable within Norway and with the Alliance. The main problem, however, is the United States. They often develop their own standards which in some instances carry national security classifications.

6.4 Doctrinal challenges

The first Armed Forces Joint Doctrine[141] was issued three years ago. Following the joint doctrine and based on this, the service doctrines have now been developed. The doctrines were developed without the knowledge of the NCW concept and not taking into consideration this concept. The doctrines are based on mission command and the manoeuvre approach. However, most of the research was done 3 to 4 years earlier.

It is quite obvious, even if some of the NCW reports conclude that minor changes to the doctrines are necessary, that the doctrines have to be revised according to the conclusions laid out in the main report on NCW.[142] I change to doctrine has also been described in paragraph 3.12 in this paper. These revisions have to be done as soon as possible. As usual, the lack of manpower at the institution responsible for developing doctrines, the NDSC, will slow the process a few years.

[139] NATO agreed data structure, ATCCIS- Army Tactical Command and Control System.
[140] NATO agreed technical specification for formatted messages.
[141] Forsvarets overkommando (HQDEFCOMNOR). *"Armed Forces Joint Doctrine"*.
[142] Forsvarets overkommando (HQDEFCOMNOR)*."CHOD NO Report 2003 – Concept for Networc Centric Use of Military Forces – Basis"*.

If this is prioritised, as it should be, the CHOD will have to allocate more resources to the NDSC. It is important to start as soon as possible, because transformation will take some time. The sooner this transformation takes place, the better.

6.5 Jointness in the Armed Forces

Norway has for some years aimed at jointness within the Armed Forces, striving to make the Norwegian Forces truly joint. The three major national headquarters are now joint.[143] A major transformation of the advanced military educational system (NDSC) has taken place. In 1995 the different service staff colleges were incorporated and made into one joint advanced course. Even the basic course at the NDSC has been joint since 2001. The Norwegian Joint Doctrine states that: "to be able to achieve full exploitation of the Armed Forces, must the different tasks the mission consists of, be executed by the capacity best suited, regardless of service."[144] Further the doctrine states that: "the doctrine's main idea is the necessity of joint effort. On the modern battlefield, only forces with the ability and capacity to carry out synchronized and coordinated operations in all dimensions will have the possibility to survive."[145]

But are the Norwegian forces really joint? There are still a lot of barriers between the services. Jointness must be a main topic in the basic officer training, and further education. Jointness is a key to success in the future battlespace, or else, we will not be able to achieve a network centric force. Again, to obtain the necessary situational awareness, jointness is one of the

[143] See paragraph 3.6 for further details.
[144] Forsvarets overkommando (HQDEFCOMNOR). *me*

success factors. The commander needs the common operational picture (COP) to be able to get the necessary situational awareness, and to make timely decisions.

6.6 Summary and Conclusion Regarding Interoperability

Interoperability is one of the keys to success in NCW. This is the only way the commander can get the necessary situational awareness, and thereby be able to make timely decisions and act within the adversary's decision cycle. One will not only be dependant on national systems, but in most cases also Alliance systems. The work with interoperabroperab

7 NETWORK CENTRIC WARFARE - CONCLUSION

Some nations are already partially operating as a network centric force. The latest example of this was reported on CNN April 8, 2003, on Day 21 of OPERATION IRAQI FREEDOM.

> A B-1 bomber[146] patrolling over Baghdad on Monday was ordered to quickly get to a "priority leadership target" and launched specially designed bombs on a building thought to contain Saddam Hussein, U.S. officials said Tuesday. A U.S. aircraft collecting intelligence over Baghdad obtained the intelligence, and transferred it the coalition headquarters. Acting on directives from forward air controllers (FAC), the U.S. warplane dropped four 2,000-pound bombs at 3 pm Monday (7 am EST) in the Mansour neighbourhood of Baghdad.
>
> Sources said the explosion killed nine people, wounded 13 and destroyed an apartment and a restaurant. U.S. officials told CNN they do not know whether Saddam or one of his two sons, also suspected to have been in the building, died in the strike. The B-1's crew told reporters Tuesday that they were patrolling the Iraqi capital when they heard about (got the grid reference) a high priority leadership target. They reached the target 12 minutes later and unleashed a payload designed to limit collateral damage in an urban setting, they said.[147]

This is an example of a CS with very good situational awareness, able to act within minutes from a long distance, ordering effects into a kill zone, operating inside his adversary's decision cycle. CCIS, sensors and interoperability are an important contribution to this, but most important is the commanders' ability to command.

7.1 Ambitions for NCW

In NCW, the Norwegian will is there; but the ability is not yet proven. Both the current Minister of Defence and CHOD have stated that NCW is a top priority. Money has been invested in a Norwegian NCW concept, but money is also a limitation for a small nation. A challenge will

[146] Strategic long range bomber.
[147] CNN.COM WORLD. *Strike on leadership target.* Washington, Tuesday, April 8, 2003 [http/www.cnn.com/WORLD/meast/sprj.irq.strike/index.html

be to take into consideration current military organization, equipment and infrastructure. Norway cannot afford to invest only in new equipment and infrastructure. Some of the "inheritance" from the Cold War will have to be incorporated into the network centric force. It will always be a question about money, how much money the politicians and our senior military leadership are willing to use on this concept. Ambitions may be high, but if the implementation of the NCW concept meets resistance from our senior military leaders, this will severely slow down the implementation.

7.2 Command in NCW

Here lies the real challenge, the "critical vulnerability" for Norway's ability to transition into a truly network centric force. Changes will have to be done in the CS. The new CS introduces new definitions and ways of thinking; it will influence the authority between different units and level of command. The new command concept for NCW focuses on the management of military operations, and is a further development of mission command. A key to successes will be the organizations ability to root the concept among the Armed Forces senior leadership. The command concept introduces some new notions, the difference in definitions are not big. There is a need to update the current Armed Forces Joint Doctrine. A transition to NCW concepts will change the current NCO and Officer selection systems. It will also influence the decision components span of control and result in a more streamlined command structure, if command levels are eliminated. Barriers have been described, the new concept requires new ways of organizing based on situation and that a commander in certain situations must abandon power to be able to fight an adversary.

7.3 Ability to lead and command in NCW

The future commanders are not yet selected and educated. Some of our senior commanders might have the necessary qualities to command in the NCW concept; most do not have the right qualities. Based on the conclusions in this paper, a change in the selection process is called for. In light of the NCW concept, it might be useful to initiate a new study of the military educational system. A NCW training centre for staff officers at the operational level must be established. This centre must be linked to the centres at the tactical level. This is a very important part of developing the ability to command in NCW. Warfighters must be allowed to do experimentation and simulation, to develop the concept and find simple solutions using COTS. This will cut down the time required to develop and procure new solutions for a network centric force.

7.4 Technology

Technology is a great challenge. The development in this field is so rapid that the "normal" project management system does not have the capability to follow the technological speed. COTS and the warfighter's experimentation and simulation are the key to success. Communication between systems is of great importance and sensors must be connected to the information grid. Interoperability is a key between systems and sensors. The communication solutions must be based on mobility. It is not acceptable that national CCIS not are interoperable and that Norwegian Forces not is able to communicate and participate in information sharing, with its Allies.

7.5 Interoperability

The key to situational awareness and the basis for timely decisions is interoperability. To be able to exploit the NCW concept the commander needs to have situational awareness. Not only national systems, but in most cases also Alliance systems will need to be interoperable. The work with interoperability will cost money and must be given priority. Detailed studies of current equipment, standards and infrastructure will have to be made. In addition prioritizing must be done. Everything does not need to be interoperable, the cost and money available will finally decide the level of interoperability.

7.6 Synthesis NCW

The purpose of this paper has been to prove that the Norwegian Forces can, with difficulty, transform themselves into a truly network centric force. I have illustrated how obstacles related to Norwegian ambitions, command, technological requirements, interoperability and the ability to lead and command, can be overcome. It is always a question of money, and the amount of money the politicians willing to spend on NCW. However, the greatest challenge to NCW for Norway will be the contemporary mindset among its senior military leaders. As shown, this obstacle can be overcome, but a lot of hard work lies ahead.

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NCW GLOSSARY

Abbreviation or Acronym	Full Name
ACE ACCIS	Allied Command Europe Automated Command and Control Information System
AOR	Area of Operation
AT	Anti Tank
ATCCIS	Army Tactical Command and Control System
ATO	Air Tasking Order
Bi-SC AIS	Bi Strategic Command Automated Information System
BMISL	Theatre Ballistic Missile Tracks
C2IS	Command and Control, Information System
CCIR	Commander's Critical Information Requirements
CCIS	Command, Control, Information System
CDE	Concept, Development and Experimentation
CE	Combat Effectiveness
CEC	Cooperative Engagement Capability
CHOD NO	Chief of Defence Norway
CM	Crisis Management
COA	Course of Action
COP	Common Operational Picture
COTS	Commercial Off The Self solutions
CP	Command Post
CRO	Crisis Response Operation
CS	Command System
DDS	Data distribution system
DEFCOMNO	Defence Command Norway
DS	Defence Staff
EMP	Electromagnetic Pulse
FAE	Fuel-Air Explosives
FFI	Forsvarets Forskningsinstitutt *("Norwegian Defence Research Establishment")*
FLO	Forsvarets Logistikkorganisasjon *("Joint Logistic Command")*
FOHK	Fellesoperativt hovedkvarter *("Joint Headquarters")*
FOL	Forsvarets Øverste Ledelse *("Armed Forces Superior Leadership")*
GOP	Guideline for Operational Planning
Info Mgmt	Information management
IPB	Intelligence Preparation of the Battle Space
IRIS	Message Processing (software)
ISTAR	Intelligence, Surveillance, Target Acquisition, and Reconnaissance
JOA	Joint Area of Operations
LAS	Local Area Subsystems

LCTC	Link Contact
LDKN	Landsdelskommando Nord-Norge *("Regional Command North")*
LDKS	Landsdelskommando Sør-Norge *("Regional Command South")*
MARIA	Situation Display / Map system
MBT	Main Battle Tank
MCCIS	Maritime Command, Control, Information System
MMHS	Military Message Handling System and Directory System
MoD	Ministry of Defence
MRR	Multi Role-Radio
MS	Mobile Subsystems
NATO CRONOS	Crisis Response Operations in NATO Open System
NATO OPP	NATO Operational Planning Process
NBF	Nettverksbasert Forsvar *("Norwegian term - Network-Based Defense")*
NCO	Non Commissioned Officer
NDRE	Norwegian Defence Research Establishment
NDSC	Norwegian Defence Staff College
NEC CCIS	Northern European Command - Command Control Information System
NIDTS	NATO Initial Data Transfer System
No SOF	Norwegian Special Forces
NOBLE	Norwegian Battle Lab Experiment
NORCCIS II	Norwegian Command and Control, Information System -Phase II
NORTaC C2IS	Norwegian Tactical C2IS (Army)
OBM	Order of Battle Manager
OODA Loop	Boyd's sketch: Observe, Orient, Decide and Act.
OPP	Operational Planning Process
OPSEC	Operations Security
OSC	Officer Candidate School
PRINSIX	Norwegian Project Management tool
PSO	Peace Support Operation
PTO	Process, technology and organisation
RAP	Recognized Air Picture.
OPP	