# 13th ICCRTS: C2 for Complex Endeavors

## IDC2 - a new C2 concept within the framework of a Network Based Defence Concept

Topics:1) C2 Concept, Theory, and Policy and 4) Cognitive and Social Issues.

Lt Col Anders Josefsson, Maj Joakim Marklund
Swedish Armed Forces Headquarters
Joint Concept Development and Experimentation Centre
Box 27805, 749 81 Enköping, Sweden
Phone: 0046-708457180
E-mail: anders.josefsson59@hotmail.com

Lars-Åke Hansson,
Swedish Defence Research Agency (FOI)
Stockholm, Sweden

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## Abstract

The purpose of this paper is to introduce a network based Command and Control (C2) concept for the design and development of C2 methods, developed with and for the tactical levels of command, in the Swedish Armed Forces (SwAF). The concept - Integrated Dynamic Command and Control ($IDC^2$) - contributes to the SwAF's ongoing transformation towards a network oriented capability.

The purpose of $IDC^2$ is to increase efficiency and adaptability in a networked C2 environment, ultimately to better realise operational outcomes. This is achieved through timely and adequate *holistic understanding*, within and between all levels of command, regarding what is to be achieved and why, greater *flexibility* in C2 and the choice of C2 method. $IDC^2$ emphasize improved dialogue to gain a deeper understanding, through new means of communication.

Integrated C2 involves synchronization of adequate C2 activities. Thereby, the synergy of the *collective intellectual capacity* contributes to a more comprehensive situational understanding, which supports adaptability and increased precision in the execution of operations.

The Manoeuverist Approach and Mission Command still remain central pillars of the SwAF Approach to Operations, and $IDC^2$ is a concept to improve the approach through a robust, network-based infrastructure for exchange of information in a non hierarchical way.


## Introduction

The C2 concept Integrated Dynamic Command and Control ($IDC^2$) is a Command and Control (C2) concept for the development of C2 methods in the Swedish Armed Forces (SwAF). The target audience is mainly officers involved in the development of units, methods and materiel. $IDC^2$ has been developed within the frame-work of Sweden's Networked Based Defence (NBD) concept (LedsystM 2004 – 2006).

The fundamental idea in the NBD is increased capability for co-ordination. The focus is moved from the capabilities of individual sub-systems to the capability of the whole system. This requires a network approach where human action and different resources are flexibly co-ordinated.

In a multinational context NBD will enable the linking together of decision makers and other actors, sensors, information systems and weapon systems, as well as multinational military, governmental, and nongovernmental agencies to achieve efficient and effective co-operation and enable efficient and effective command and control.

The $IDC^2$ concept is built on the foundations of Manoeuverist Approach and Mission Command. The concept has evolved in concordance with the ongoing international development of Effects-Based Approach to Operations (EBAO).

- The environment in which Sweden's Armed Forces operate is increasingly complex and dynamic. Hostility and opposition vary over a broad scale, from confrontation, through crisis to conflict. Appropriate military responses vary accordingly, from supporting peace and stability, however fragile, through to establishing security in

areas ravaged by anarchy and armed conflict. Military forces operate across a broad spectrum of tasks, from forestalling crisis and preventing confrontation from escalating, to resolving crises when they arise, and to achieving decisive success in Peace Enforcement Operations.

- The technological development with increasing bandwidth, greater processing power, larger datasets, smaller sensors and greater understanding of the dynamics of physical and virtual network behaviour will converge to allow new types of network connection. The communication architecture has changed from one-to-one communication towards many-to-many.
- The arising of the information age and the knowledge society, new social patterns and a deepened belief in the ability of the individual has brought about new social networks beyond traditional boundaries. Many lessons can be learned from successful information-age organisations. Any organisation dynamically dealing with a changing environment ought not only process information efficiently but also create new information and knowledge. Successful information-age organisations let the information flow more freely across formal organisational boundaries. In the knowledge society moral aspects are of increasing importance. A developed view on people and an increased value of the individual leads to both new opportunities and limitations in the conduct of military operations.

The main challenges for the $IDC^2$-concept are to:

- Facilitate increased pre-understanding within the whole organization.
- Using the synergy of the whole organizations *collective intellectual capacity,*
- Provide decision makers with the comprehensive situational understanding at the right time.
- Synchronize C2 activities, in a way that minimises time delays within and between command levels.
- Achieve dynamic decision-making by embedded functions to continually search for *new ways* to succeed, as well as functions to *correct discovered flaws*.

The conceptual frameworks of $IDC^2$ are mainly within the Swedish brigade battle group concept and within an Expeditionary Force.

The $IDC^2$ concept consists of three components:

- A **conceptual context** describing the purpose of developing present-day C2, as well as the tenets for improving C2 and executing network effects based C2.
- A **C2 model** that states which functions will define C2. The model is a stable description that facilitates the development of specific C2 methods.
- A **C2 method approach** that illustrates how $IDC^2$ can be put to use by using the C2 model. Instances of C2 methods that are developed in this way are likely to vary by nature, depending on the command level, unit type, arena and area of operations.

In this paper we will present the conceptual context and the C2 model.

**The conceptual context**

Command and control (C2) is a *function* of the military system[1]. It is a function that is necessary to produce the military effects of a mission[2]. C2 provides to achieve desired effects by *direction, coordination, monitoring and evaluating* the military actions.

The purpose of IDC$^2$ is to increase efficiency and adaptability in a networked C2 environment, ultimately to better realise operational goals. This is achieved through timely and adequate *holistic understanding*, on all levels of command regarding what is to be achieved and why, greater *flexibility* in C2 and the choice of C2 method.
We have identified following fundamentals to achieve the key tenets *holistic understanding*, and greater *flexibility* in command and control:

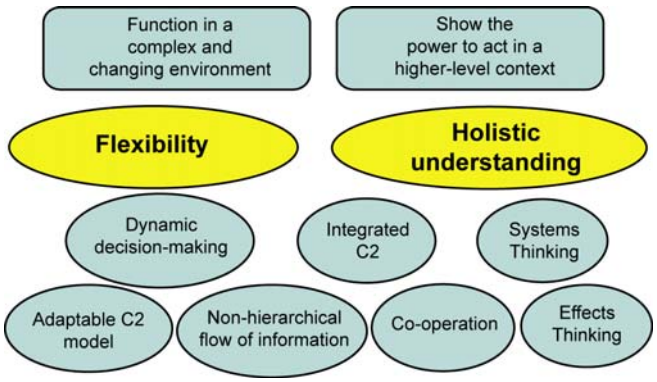


**Figure 1 The key tenets and the fundamentals for the IDC$^2$ concept**

*Holistic understanding*

Holistic understanding within the entire organization is one of the IDC$^2$ Key tenets. To understand how we can accomplish holistic understanding we must elaborate about information and knowledge.

In early texts on knowledge management, which did not sufficiently separate information from knowledge, we can find oversimplified figures as below.

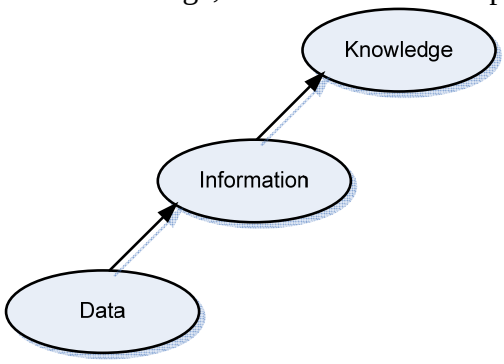


**Figure 2 The traditional hierarchy between data, information and knowledge**

[1] van Creveld, Martin L.1985, *Command in War*, Harvard University Press
2 Brehmer, Berndt . 2007, Understanding the Functions of C2 Is the Key to Progress, The International C2 Journal | Vol 1, No 1.

This way to define the relationship between data, information, and knowledge is questioned by many scientists. The Swedish scientist Stenemark writes: “Firstly, the image suggests that the relationship between data, information, and knowledge is linear. Secondly, the image implies that the relationship is asymmetrical, suggesting that data may be transformed into information, which may be transformed into knowledge, but it does not seem to be possible to go the other way. Obviously, this is incorrect, since we all on several occasions have used our knowledge to derive information, and to create data out of information.”
In the IDC[2]-concept we prefer to use the figure below to describe the relationship between data, information, and knowledge.

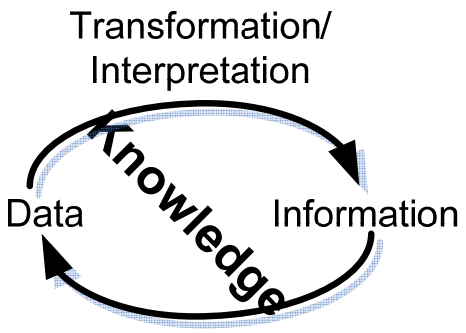


**Figure 3 Using knowledge to transform data to information**

As described in the figure above we consider data, information, and knowledge as interwoven parts. The three entities influence each other and the value of any of them depends on the purpose for which it is to be used. Both data and information require knowledge in order to be interpretable, but at the same time, data and information are useful building blocks for constructing new knowledge[3].
When data is processed, i.e. interpreted in the light of the user’s previous knowledge and experiences, the information does not “become” knowledge but it alters the existing knowledge by increasing or shifting the individual’s knowledge state, thereby opening new possibilities to act.[4]
“Knowledge is defined as what we know: knowledge involves the mental processes of comprehension, understanding and learning that go on in the mind and only in the mind, however much they involve interaction with the world outside the mind, and interaction with others. Whenever we wish to express what we know, we can only do so by uttering messages of one kind or another - oral, written, graphic, gestural or even through 'body language'. Such messages do not carry 'knowledge', they constitute 'information', which a knowing mind may assimilate, understand, comprehend and incorporate into its own knowledge structures. These structures are not identical for the person uttering the message and the receiver, because each person's knowledge structures are biographically determined. Therefore, the knowledge built from the messages can never be exactly the same as the knowledge base from which the messages were uttered.”[5]

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[3] Nonaka, I. and Takeuchi, H., The knowledge-creating company, Oxford University Press, New York, NY., 1995.
[4] Choo, C. W., The Knowing Organization, Oxford University Press, New York, NY., 1998.
[5] Wilson,T.D. “The nonsense of 'knowledge management”, http://informationr.net/ir/8-1/paper144.html

We can focus our attention to certain aspects of knowledge, making it focal. The focal knowledge can, sometimes and partially, be articulated and furnished with words or other interpretable symbols in the situation picture.
Since a piece of text or a symbol itself is not sufficient to exhaustively describe the knowledge to which it refers, the reader's pre- knowledge must be compatible with that of the writer in order to interpret and fully comprehend the implications of the text/symbol.
Whereas most people agree that data may exist outside humans, supporters of the community view of knowledge would argue that knowledge can never be separated from the knower and thus never stored digitally[6]. Computer support for knowledge management is thus, in a sense, impossible. We believe that the system of the $IDC^2$-concept will rely on well educated and well trained humans.
The value of knowledge and information, from an organizational point of view, is increased the wider it is spread within the organisation (e.g. *Blue Force Tracking*).
The organization shall apply the collective capability to process information. Consequently everyone shall have access to data as well as a possibility to process data and information. Collection of information starts with the unit that first comes into contact with the combat information object. The unit will then automatically start processing information received concerning the combat information object and will continuously feed and update information into the network. When all those units are linked in to a network they will spontaneously start processing and thereby enhance the value of information, instead of this being done by just a few higher level nodes, this is known as **distributed data processing**.
Distributed data processing is a prerequisite for a flexible and credible network built situation picture and an increased organizational knowledge.
Every command level determines what information it needs to gather in order to facilitate the situational understanding for timely and adequate decision-making.

Knowledge that is produced on higher command levels can be distributed in the same way and can be boosted by an adequate dialogue which is one of the most important tools in $IDC^2$. We will later in this paper discuss how we can accomplish the dialogue and when it can be done.

*Integrated C2*

During our experiments we have found that Integrated C2 can boost the holistic understanding. Integrated C2 involves the synchronised execution of adequate C2 activities, in a way that minimises time delays within and between command levels. Thereby, the synergistic effects of the *collective intellectual capacity* and capability of the entire organisation can be utilised to:

Improve conditions for situational understanding, jointness and precision,

Allow more time for planning and execution over a wider range of command levels.

Integrated network based C2, requires that every stakeholder:

Takes responsibility for his/her actions and shows the power to act,

[6] Galliers, R. D. and Newell, S., "Back to the Future: From Knowledge Management to Data Management", in Proceedings of ECIS 2001, Bled, Slovenia, 2001, pp. 609- 615.

Has access to, and shares information,

Is prepared to have a dialogue at all times.

Interaction and dialogue between units will enhance the systemic coherence. To make this happen the information must be accessible and understandable at the right time and with sufficient quality to make high quality decisions possible at the right time.
The correlation or low-level fusion of information objects within the process of managing the situational picture is not carried out continuously. Continuous correlation of all information would require permanent and ever increasing resources, in particular bandwidth, and correlation is therefore only initiated when needed. This is known as **situation-initiated information correlation.**
Organizational knowledge is a result of the systemic coherence and will be created through a continuous dialogue concerning tacit and explicit knowledge[7]. While new knowledge is developed by individuals, organizations play a critical role in articulating and amplifying that knowledge.
The complex and dynamic environment within which the units are working understates that units and individuals must be innovative in order to carry out any foreseeable tasks. Innovation can be understood as a process in which the organization creates and defines problems and then actively develop new knowledge to solve them.
Eva Jensen, 2006[8], elaborates on the collective sensemaking which this is all about. In the military organization, each and every individual arrives at his or her view of what is possible to achieve in the apprehended situation, an *individual sense*. This is achieved through interaction with the other individuals in the same unit or in other units. Sensemaking is never a truly individual activity. Information and opinions are exchanged. Individuals influence, and are influenced by, other individuals. Together a group of individuals in a unit creates a more or less clear and elaborate *shared sense*. The commander has a special role here, because it is he or she who ultimately decides on the course of action, and thus what sense is to be made of the situation.
Jensen also elaborates on meaning of *shared knowledge.* To arrive at a good and high degree of shared sense, is probably facilitated by a high *degree of shared knowledge*. The more each member of the command team has to explain to, and teach, the others to convey his or her own understanding, the slower and more cumbersome the process, because it requires explicit communication where implicit understanding should have been enough if the team members had a greater amount of shared knowledge.
We have found out that it is the same interdependency between *shared knowledge* and *shared sense* when we have interactions between units. Our first conclusion is that interactions between units will increase the *shared knowledge* and the *shared sense* and that will enhance the systemic coherence. Our second conclusion is that *shared knowledge* will facilitate a smooth interaction between units.

Established thought models, or mental models as Peter Senge[9] says, and pre-conceived notions may have a negative and limiting influence on both holistic understanding and decision making. During our experiments we have found that openness of mind is required to

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[7] Nonaka,, Ikujiro. Feb., 1994, *A Dynamic Theory of Organizational Knowledge Creation***,** Organization Scien*ce*, Vol. 5, No. 1
[8] Jensen, Eva (2006). Good Sensemaking is More Important than Information for the Quality of Plans. Bilaga 2 till FHS 433/6:5
[9] Senge, Peter. *The Fifth Discipline,* 2001, ISBN 91-7610-212-2.

counteract these influences. We should continually be prepared to expose the assumptions that underlay our opinions[10]. A systematic, critically reviewing dialogue regarding for example Direction and Guidance, End States and Mission Conduct Outlines promotes openness in C2.

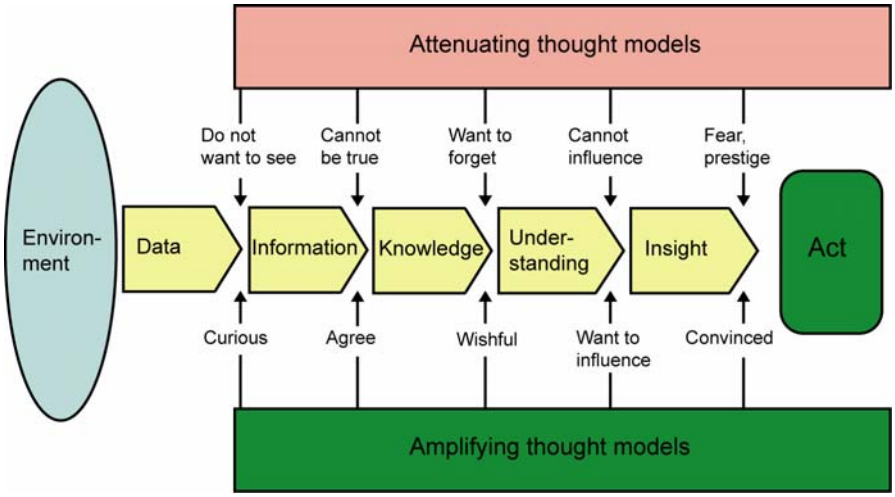


**Figure 4 Influence of the thought models**

The three most important conclusions about integrated C2 are that:

- Integrated planning will lead to a deeper understanding of what is to be accomplished and a mutual commitment to the actions required to reach the goals.
- Integrated C2 (including situation assessment) will lead to mutual understanding and an enhanced collective awareness.
- Integrated assessment including also the lowest hierarchical levels:
  - will reflect the local situation,
  - will allow room for attention at higher command levels, and
  - will constitute always relevant local and subjective assessments even though they do not represent an absolute truth.

*Non Hierarchic Information Flow*

During our experiments we have found out that a non hierarchic information flow facilitates timely information access for every participating unit in the ongoing operation. This requires good individual understanding about the system and the methods that are applied. Individual capability to process information and to contribute to the collective creation of knowledge and situational understanding is a central for this concept. One important part of the concept is the access to information on every command level regardless of the organisational hierarchy.

Communication is one important cornerstone to establish non hierarchic information flow and we describe communication as the transferring of information or ideas between individuals through some sort of channel. All communication has a purpose, conscious or unconscious. The functions of communication are the information function, the action function, the emotive function and the social function. Different situations demands different types of communication. For example when you are in a leadership situation you need the emotive

[10] Isaacs, William *Dialogue*, 2000, ISBN 91-89388-20-8

function to put emphasis in your message and to be able to interpret the emotions of your subordinate.
All communication is a subject to delay, distortion and noise to some degree.
In order to be able to communicate, we foresee a technical network that allows a non hierarchical distribution of messages. A network, in the broadest sense, that is a collection of nodes linked in various ways to one another. Individual users at these nodes can utilise these links to transmit and receive information and data, the type of which depends on the nature of the network and the requirements of the users, to and from other participants in the network. This resource-sharing may require a direct connection from the sender to the receiver. However, networks can often take advantage of their overall connectivity to allow users to reach one another's assets wherever they might reside in the overall system, whether the path is direct or passes through other users along the way.
There are two main types of communication that we will need in the future battle space.
*Direct communication* is characterised by an unbroken link between parties and some sort of co-ordination in time and space. The information exchange is done through a communication channel which is independent of the actual content. Direct communication requires a focus on the informational need as well as the parties. The initiating part has to identify the counterpart as well as the information that needs to be exchanged. Direct communication has advantages regarding the emotive function of communication but often exclude other actors than the foreseen.
We must be able to have easily connected direct communication over organizational boundaries in order to be able to communicate time-sensitive messages and messages that express emotions.
*Indirect communication* is characterised by the lack of a clear link between the parties and the lack of synchronisation in time and space. The information exchange is done through a third party, a proxy. The consequence of this is that focus need only be placed on the actual informational need rather than on the parties involved. The party with an informational need doesn't have to identify or know the provider of the information and vice versa.
The more information about the situation individuals can get by indirect communication the more time the individuals can use direct communication to be creative, to build new knowledge and thereby to solve problems.

During our experiments we have found out that a non hierarchical information flow is a powerful tool in building coherent situational pictures. A situational picture is a simplified representation of the perceived reality. By allowing everyone, regardless of rank and level, to contribute with their respective knowledge, a more detailed and correct picture can be achieved. A situational picture built on a shared combat information object database creates a foundation for more effective communication, more effective co-operation and a better understanding of the broader picture.
Access to the combat information object database is open to all participants in an operation. The database will be fed with objects with the aim of maintaining a clear representation of reality. The objects can then be combined to provide individual or common situational awareness. The intention is not to create **the** common situation picture, but to offer units at all levels[11] access to what is called a **Shared Combat Information Object Database.**
A Shared Combat Information Object Database is a prerequisite for unleashing the full power of non hierarchic information flow and distributed dynamic decision-making, enabling true

[11] All levels implies the chain from OHQ to soldier.

application of the Manoeuverist approach with autonomous units operating with proper freedom of action.

Hierarchical, organisational and administrative boundaries should not limit the sharing of information.

The most important conclusion about "*Non Hierarchic Information Flow"* is that:

- The ability and permission to make assessments on all hierarchical levels and beyond organisational boundaries could strengthen mission command and reduce organisational vulnerability.

*Decision-making*

Because situations change continuously, all decisions must be made in the face of uncertainty. While it is natural to seek additional information to reduce that uncertainty, it usually comes at the expense of time. Since decision making is a time-competitive process, commanders need to find a *balance between uncertainty and time.* While decision making is often theoretically viewed as an analytical process of comparing options against some set of criteria, it can also be viewed as intuitive, whereby an experienced decision maker recognizes the key elements of a particular problem and arrives at the proper decision. While the two approaches to decision making are conceptually distinct, they are rarely mutually exclusive in practice.

Since war is a conflict between opposing wills, decisions cannot be made in a vacuum. They must be made in a light of the enemy's anticipated reactions and counter reactions, recognizing that while we are trying to impose our will on the enemy, he is trying to do the same to us. A military decision is not merely a mathematical computation. *Decision making requires both situational awareness to recognize the essence of a given problem and the creative ability to devise a practical solution.*

Military decision-making thus requires professional skills. This also means the insight into, and understanding of, the decisions that need to be made, and their implications. To support the commander in decision-making, we need to embed control mechanisms to search for new ways to succeed, as well as to correct discovered flaws. In the IDC2 these mechanisms is the development of *expected decision events.* The construct of such a mechanism often need war games and simulations to understand what information that is necessary for the upcoming decision event.

The $IDC^2$ decision-making model allows the commander too intuitively, based on experience, generate one potential course of action to be reviewed collaboratively by dialogue and war gaming. In order to act in a changing environment, decisions need to be made in a dynamic and sequential way.

Dynamic decision-making requires[12]:

- a sequence of decisions,
- interdependent decisions,

[12] Brehmer, B. 1990, *Dynamiskt och fördelat beslutsfattande*, Försvarsmedia (In Swedish)

- decisions made in near real time.

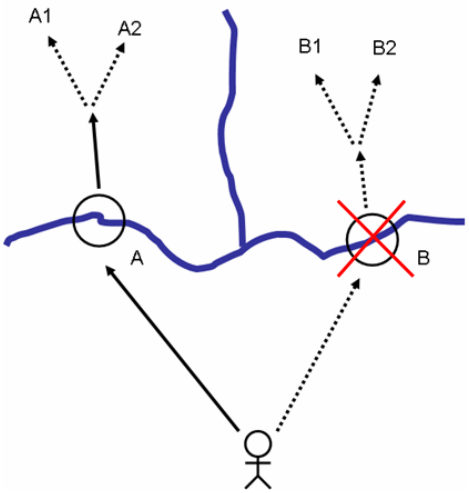


**Figure 5 Dynamic decision making**

The fact that it takes a sequence of decisions and that the decisions are interdependent means – 'what you are doing now will have an impact on your ability to act in the future'. It creates both limitations and opportunities. One example of this is; if you make a decision to cross A instead of B, it will limit your future possibility to make the decision between B1 and B2. However, it will give you the possibility to choose between A1 and A2.

To conduct dynamic decision-making, we must embed functions to continually search for *new ways* to succeed, as well as functions to *correct discovered flaws*.

Dynamic decision making, together with integrated command and control, can discover weak signals and make the military organization able to react to them.

*Effects-based and Systems thinking*

Effects-based thinking considers situations as a whole, rather than just in terms of '*the enemy*', or activities, or issues. Moreover, it optimizes the use of the military instrument of power, in relation to other instruments and influences. In doing so, it treats and considers the environment as a complex, unpredictable and adaptive system.

This stresses the need for enhanced *understanding* and *knowledge* of the operational environment and its actors, including interdependencies as well as both the symptoms and the root causes of conflict. Moreover, the importance of being able to monitor and manage the *perceptions* of the actions and its impact in-theatre, especially regarding the military instrument.

Systems thinking establish a developed systems perspective, whereby own units, enemy units and neutral units or organisations are viewed as complex and inter-dependent systems.

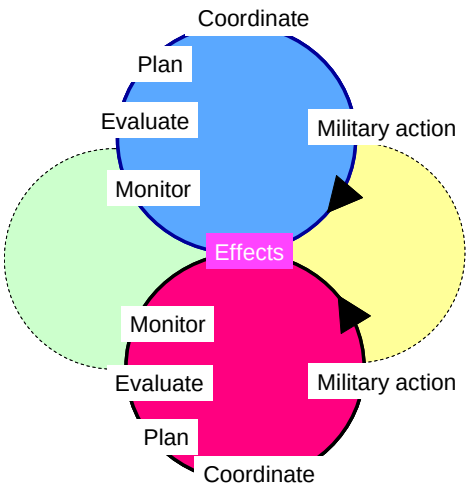


**Figure 6 Systems thinking of effects within the system**

Systems thinking should distance us from the viewpoint, whereby, our military activities exert influence *upon* a system. Rather, we should view our activities as having effect *within* a system, an effect that may also depend upon the influence of other parties[13].

This part of the concept has evolved in concordance with the ongoing international development of Effects-Based Approach to Operations (EBAO) and we will not elaborate further in this paper about effects- and systems thinking but we believe that it will contribute to an efficient command and control.

*Flexible organization*

The network facilitates new ways of organising resources more effectively, thereby help reaching the specified objectives.
A distributed, assembled-on-demand, temporary command unit is an example that illustrates the concept of virtual organisations for integrated network based C2. Such units can conduct C2, but may also act as subject matter experts.
The network may also be utilised for Reach Back, involving gathering of information from military and civil actors, outside the area of operation.

[13] Brehmer, B. 2006, Seminar at FHS

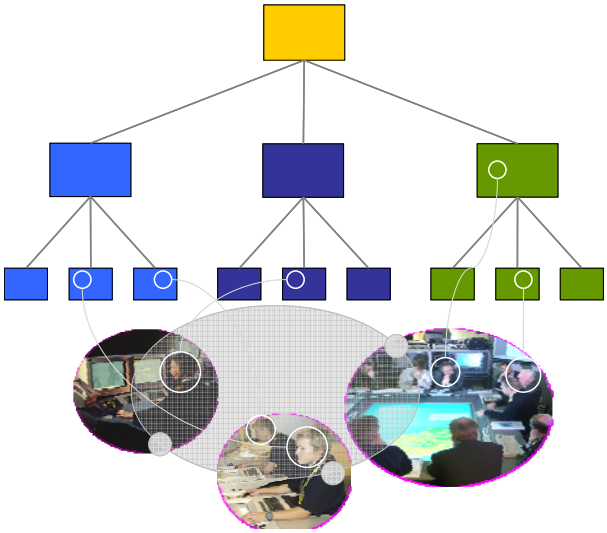

**Figure 7 A distributed, assembled-on-demands, temporary command unit**

During our experiments we have tried distributed, assembled-on-demand, temporary command units and found this organization form very efficient when they are coordinating activities during a shorter time and the actors within the organization knows each other. This organization form demands training and interpersonal trust.

*Co-operation*

Operations are increasingly affected by, and thus need to take into account, social, political, cultural, economic, environmental and humanitarian conditions and the fact that different types of units and resources – civil and military – will need to co-operate in a network, nationally as well as multinational. The number of civil actors will presumably increase.

**Co-operation with civilian actors is a natural part of all phases of an operation.**

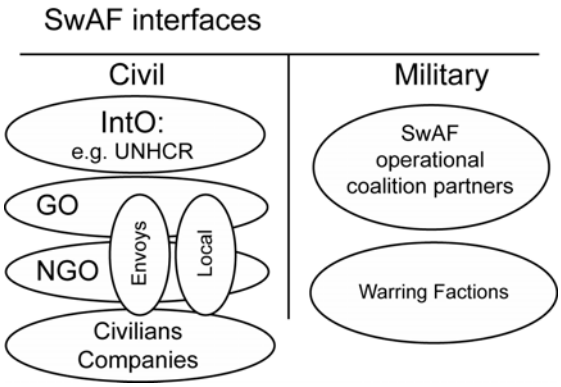


**Figure 8 Cooperation**

During our experiments we have found out that there is a clear relationship between social presence and interpersonal trust. We must develop a system for trustworthy co-operation and beside physical presence we can use video and audio connection between networked partners and it is also possible to simultaneously write and sketch on a common workspace to achieve the important interpersonal trust during cooperation. Technical solutions can never totally

replace the physical and social presence. This part of the IDC$^2$ concept must be further developed during the next years.

*The commander's role*

The capabilities offered through the network will affect the commander's way of exerting leadership. The primary use of the network is to share information and to support understanding.
The commander's role will evolve, but will always rely on solid professional knowledge and experience.
The IDC$^2$ concept emphasises the requirement that everybody in a unit, contributes to – and is responsible for – accomplishing the task. Each individual is expected, according to their means, to contribute with intelligent and creative actions, building the effects required to reach the desired end state.
In order to achieve this it is vital that all levels have an early and more profound understanding of what is to be achieved.

**The C2 model**

The C2 model in the IDC$^2$ concept describes which functions that define C2, and it constitutes a stable description for the further development of specific C2 methods.

*The Effects Perspective* involves placing emphasis upon the definition of desired conditions/ objectives and effects, simultaneously avoiding undesired effects. This implies proper decision-making, regarding operations over time, and understanding the 'whole' as well as the higher-level context.

The *Activity Perspective*, on the other hand, involves placing emphasis upon the best possible conduct of operations. This implies reaching objectives and 'ordered' effects, as well as meeting resource constraints and observing efficiency in battle.

Overall, the IDC$^2$ concept consists of four elements, the C2 Method Components.

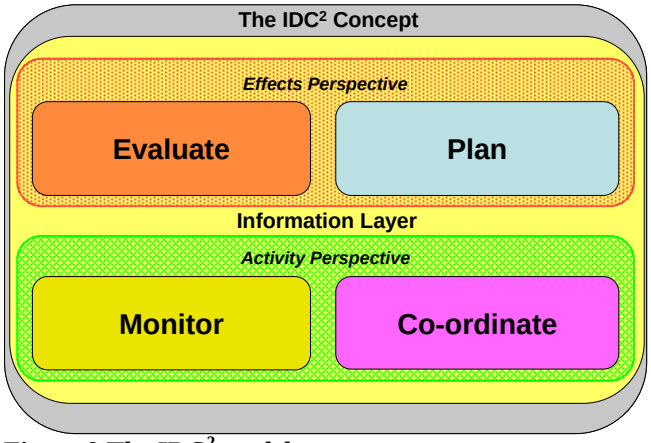


**Figure 9 The IDC$^2$ model**

To **Plan** business by means of conditions/objectives, including the desired effects and plans how the execution shall accomplish this.

To **Co-ordinate** and support the execution in a way that allows seizing of fleeting opportunities and solves frictions and complications that may arise.
To **Monitor** execution and other factors which are important for the mission in order to discover new opportunities or limitations.
To **Evaluate** whether activities actually fulfils the desired conditions/objectives and whether tasked effects are produced. Our action patterns may also need to be improved.

Each of these four elements, in turn, consists of four sub elements.

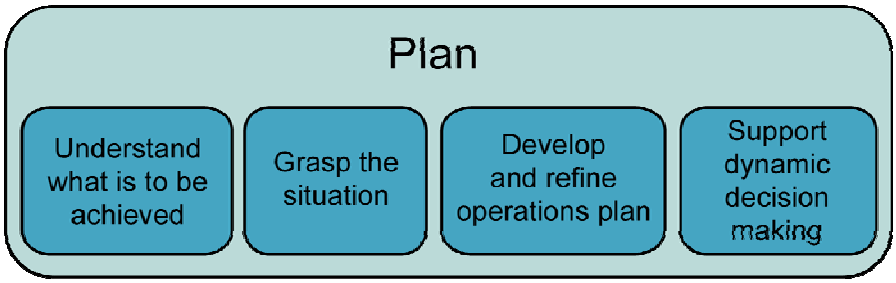


**Figure 10 Sub elements in the plan component**

The goal with the plan component is to describe the desired effects in an end state and create a credible execution plan and decision points that describe how the actions should take place to achieve desired effects. To strive towards a common understanding about what the unit should accomplish is an important goal with the plan component. We use integrated planning with dialogue about the end state, the operation plan and during the war gaming. In the IDC$^2$ method approach we describe how integrated planning can be executed. The method approach for the plan component emanate from Planning Under Time Presure (PUT)[14] which is a planning model developed by Peter Thunholm. The IDC$^2$ plan component is similar to PUT except that IDC$^2$ describes how multi-level integrated tactical mission planning should be conducted with dialogues. The dialogues can be executed both within the military hierarchy and as a non hierarchical net-based collaboration.

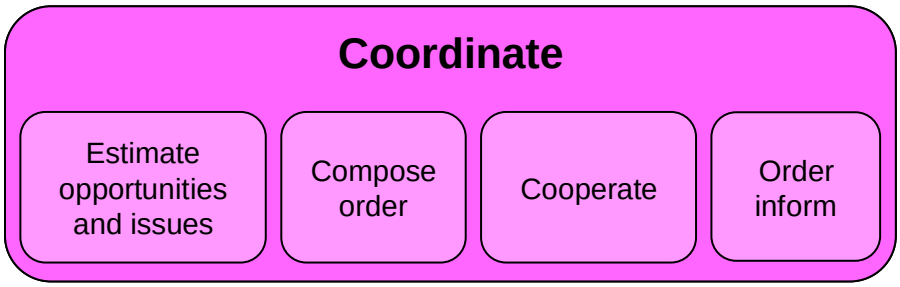


**Figure 11 Sub elements in the coordinate component**

The goal with the coordinate component is to formulate and communicate missions that give the receiver motivation, freedom and support to his actions. The coordinate component use the credible plan and the decision points as foundation for writing orders, finding new

[14] Thunholm, P. (2003a) Military Decision Making and Planning: Towards a New Prescriptive Model. Doctoral dissertation at Stockholm University. Edsbruk: Akademitryck

opportunities and solving frictions and complications that may arise to reach the desired effects. To estimate opportunities, dialogue can be executed both within the military hierarchy and as a non hierarchical net-based collaboration.

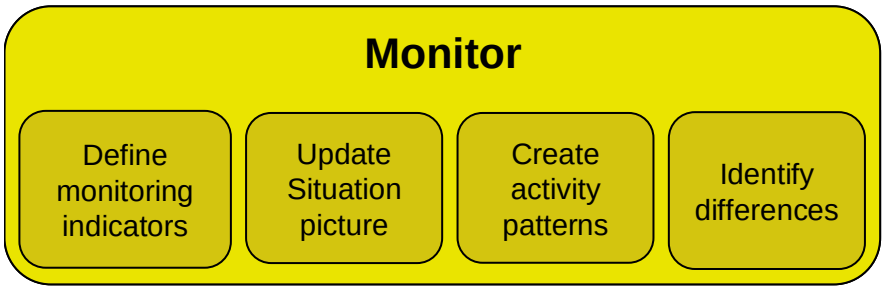


**Figure 12 Sub elements in the monitor component**

The goal with the monitor component is to support the other components in this C2 model with tactical situation descriptions and relevant discrepancies from expected outcome during the operation. The monitor component uses non hierarchic information and dialogue to produce a coherent situation picture up to date in all time.

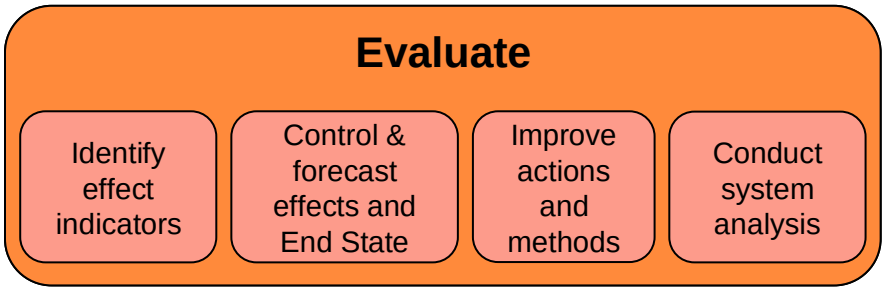


**Figure 13 Sub elements in the evaluate component**

The goal with the evaluate component is to evaluate and prognosticate effects (both desired and undesired effects) from relevant actors actions and other incidents along with drawing conclusions about possibilities and risks to the ongoing operation. The evaluation and the system analysis should be done integrated with other relevant actors. The dialogues can be executed both within the military hierarchy and as a non hierarchical net-based collaboration.

Efficient information management is necessary in order for the information layer to provide the required structures and mechanisms for rapid storage, access and processing of information.

Another way to illustrate the functions of the $IDC^2$ concept is in the form of an outer and an inner loop:

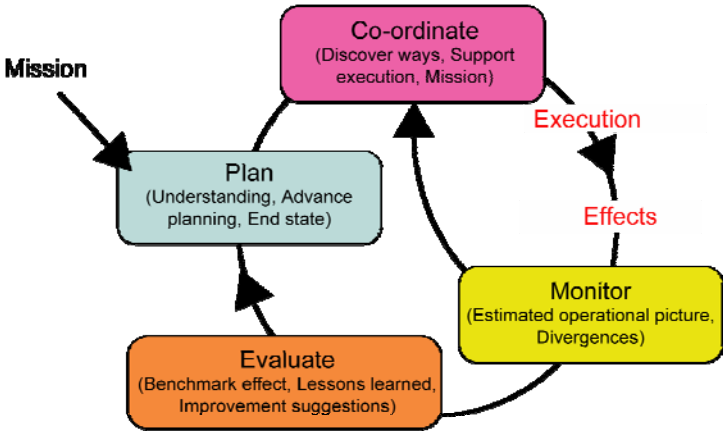


**Figure 14 IDC$^2$ as an outer and inner loop**

When you look at the IDC2 model as both a single and double loop C2 system you can easily se the similarities with a learning process. The inner loop gives the C2 system possibilities to react on upcoming opportunities and risks. The outer loop gives the C2 system possibilities to look ahead and evaluate if the desired effects will be achieved.

The IDC$^2$ document[15] also presents one approach or suggestion for a specific C2 method, where every function actually is broken down to the level of individual work steps but this is not described in this paper.

## The development process

The C2 concept Integrated Dynamic Command and Control (IDC$^2$), has been developed within the framework of Sweden's Networked Based Defence (NBD) concept (LedsystM 2004 – 2006).

Integrated planning was developed in cooperation with Peter Thunholm from the National Swedish Defence College (FHS) and tested during the fall experiment in 2004 after that we developed the other components in IDC$^2$. During these years we held several workshops and seminars with participators from all branches in the Swedish Armed Forces and scientists from FHS and the Swedish Defence Research Agency (FOI).

The IDC$^2$ concept was tested both in the spring and the fall experiments of 2005 and in the spring experiment of 2006. During these experiments we have had command levels from FHQ down to single soldiers in all branches. The experiments were mainly executed at the Swedish Joint CD&E Centre in Enköping but parts of the experiments were executed as field experiments with units from all branches. During the experiments we had support from the Swedish Defence Material Administration (FMV) and people from the defence industry. All experiments were evaluated by scientist from FOI.

From the beginning it was supposed to be a C2 concept for the Swedish national defence only but early 2005 we got new directions according to the ongoing transformation. So now the

[15] Josefsson, Ledningskoncept för Integrerad Dynamisk, Ledning IDC$^2$ 2007. 2007-08-27. Försvarsmakten.

concept is developed for both defending Swedish territory and when Swedish units are participating in international operation with coalition partners from other countries.

**Strengths and weaknesses with the IDC2 concept**

The $IDC^2$ concepts most important strength is that it is a C2 concept that considers humans cognitive and social requirements. The IDC2 concept emphasize the synergy of the collective intellectual capacity and thereby an increased holistic understanding within the whole organization which is important in future military operations. The net is used for dialogue and non hierarchic information flow to increase the understanding.

A second big strength is that this C2 concept emphasizes Mission Command which still remains a central pillar of the SwAF Approach to Operations.

A third big strength is that this C2 concept is flexible. It doesn't prescribe exactly what you are allowed to do and what you are forbidden to do when you execute command and control.

The $IDC^2$ concepts most significant weakness is that is has only been tested with the planning procedures within NATO (GOP) and the other components (coordination, monitoring and evaluation) interoperability has not been tested. We believe that the conceptual context easily can be interoperable but the model must perhaps be further developed.

Another weakness that we have seen during our experiments is that dialogues take time and there is a risk that commanders participate in so many dialogues that their leadership will be suffering. We believe that we can minimise this risk by education and training.

A third weakness that we have seen during our experiments is that so many participants are invited to the dialogues that some of them do not feel comfortable and it becomes more like a conference. We have noticed that you must plan these dialogues properly and you should not invite too many participants. If there is time, many actors can listen to other's dialogues but there should not be too many participants.

A fourth weakness is that some commanders feel that they can lose control if there subordinates are invited to think with them instead of just taking orders. We believe that this mindset is old-fashioned and that if commanders invite their subordinates to dialogue the interpersonal trust will increase and if there is a situation where there is not time to have a dialogue the subordinates will better understand direct orders if they know how their commander thinks.

The $IDC^2$ concept is an alterative way to utilise net-based collaboration, not only to speed up the communication but to give the whole organization a better holistic understanding and thereby be able to operate in an uncertain and dangerous environment.

**Adapting the IDC2 concept to the Swedish Armed Forces**

In august 2007 the chief of the Swedish army decided that the $IDC^2$ concept is to be adopted by the Swedish army during 2008 and then evaluated. The Swedish army has written a field

manual for the battalion level and they are just now writing a field manual for the brigade level.

Every teacher in leadership and tactics within the army are going to be educated and trained in the $IDC^2$ concept.

The Swedish navy and air force can use the conceptual context in $IDC^2$ but are just now not ready to implement the C2 model because they are training their units in the NATO processes to become more interoperable.

**Conclusions**

The $IDC^2$ concept contributes to the SwAF's ongoing transformation from a defence force against invasion to a mobile, flexible operational defence which can both defend Sweden and take part in international operations.

$IDC^2$ regards the military organisation as a complex and social knowledge system based on interpersonal communication.

Integrated planning will lead to a deepened understanding of the desired outcome and to mutual commitment to the required actions that will realize that outcome.

Integrated C2 (including situation assessment) will lead to a mutual understanding and an enhanced collective awareness.

Integrated assessment including also the lowest hierarchical levels:

- will reflect the local situation,
- will allow room for attention at higher levels of command, and
- will constitute relevant local and subjective assessments, even though they do not represent an absolute truth.

Distributed dynamic decision making allows decision makers to lead in situations that are continuously changing.

Hierarchical, organisational and administrative boundaries should not normally limit information sharing.

The ability and permission to make assessments on all hierarchical levels could strengthen mission command and reduce organisational vulnerability.

Networking allows temporary convergence around an unforeseen challenge. Hence networking can be seen as a corporal response to uncertainty.

In order to provide agility to the war fighter $IDC^2$ emphasise integration and strive for increased collaboration and cooperation.

The $IDC^2$ concept will be an important part within the ongoing transformation of the SwAF towards the NBD concept.

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