

The New Dimension in War - Virtual Warfare

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The future discussed in this chapter is one when the technological information revolution reaches maturity and its applications are available to all. This process is not purely technical. Tomorrow's wars will have to adapt themselves to act in a different cultural, economic and political environment. War has always been multi-dimensional, but it focused on direct confrontation with an enemy within a defined contact area. The information age fundamentally changes temporal and spatial concepts that were prevalent in the past.

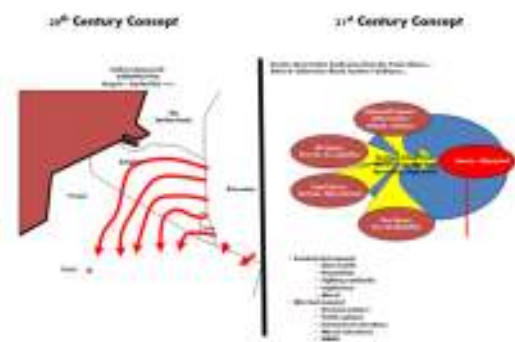


Figure 1 Different wars

The relative role of those involved in warfare has changed, the distant has become close, the influenced have become the influencers and a new balance has reached. The information age is creating new situations, starting with a new virtual dimension – information

warfare – and ending with tactical and operational technological capabilities of weapon system in a wide range of functions.

The virtual dimension stands alone and includes two components: the first involves providing support and assistance to the forces via networking as net-centric warfare, including communications systems for elements involved in the combat space, such as weapon system intelligence, fire, logistics and alike, headquarters and commanders and data processing and management. This component is an integral part of ground forces operations.

The second involves cyber systems and electronic warfare of various kinds. This warfare directed against enemy systems and commanders with the aim of gaining superiority at operational and strategic levels. However, it is an independent, stand-alone battlefield, like the air force and the navy. It may provide support of and integration with ground forces, whether for attack or defense; missions including patrols, security, tactical intelligence, deception or security are not foreign to this dimension.

Warfare in the virtual dimension might take place without any physical fighting and might be non-destructive, for instance, Chinese combat doctrine preaches how the weak defeat the strong by means of information warfare (Thomas, 2003). It provides an additional dimension to war that may be integrated into battles on land, sea and air from the lowest tactical to the highest strategic level, all with the aim of achieving superiority. Nowadays we are only at the dawn of these developments, so the virtual dimension is not yet perceived as having an independent existence, but is rather utilized by various specialized organizations or integrated into existing ones. In future, continued technological developments and their integration on all levels will cause it to be recognized as a separate dimension, as was the case with the air arm and the space program.

Adding the virtual warfare dimension can sustain continuous fighting, without human physical limitations of fatigue or anxiety. It has no geographical or topographical boundaries. At periods when direct contact by maneuvers or firing ceases, fighting continues in the virtual sphere anywhere it is required. This form of warfare is already being directed against national and economic infrastructures, as has been seen in Chinese and North Korean cyber-attacks on industry (Thomas, 2003), and this is just the beginning.

Multi-dimensional warfare that combines physical and virtual dimensions acting in harmony and synergy under one supreme commander creates multi-capabilities and demands continuous fighting. This in turn demands a suitable deployment of forces and resources, command and control. Deploying troops in a decentralized manner enables concentration or dispersion as needed, accelerated advances or changes of direction limited only by the commander's will and the quality of the organization (and the enemy of course). The link between the two dimensions is man, who dictates the quality of performance; this type of battle plan enables the commander to realize his highest abilities and those of his men, with mission command as the most suitable format.

Typically, technological innovations precede human cognitive development, so their integration involves a lengthy process of trial and error, success and failure in tailoring these new capabilities to human needs. We are at the beginning of a period that had its beginnings in the 1960s and has been rapidly developing ever since. We still have a long way to go, but clearly the past is long gone and we must look to the future.

A Hologram of the Fighting Arena

Technological advances create available data anywhere and at any time and for almost every need, both for decision making and operating technological systems. The opening conditions have changed, with more participants having direct and indirect influence, some of them uninvolved in the actual fighting but having an impact on outcomes.

The fighting arena has also changed, combining or blending a physical, geographical environment with a military and civilian population, all enveloped by a virtual

dimension supplying data, management systems, command networks, virtual power centers, public opinion and the international and local communities. Command and control systems accessed through open and closed networks, thus fundamentally altering and making redundant past hierarchical relations. In the past, these systems based on information hierarchies. As Francis Bacon stated long ago (1597), "Information is power".

In a linear system, collected data was sent to the higher level for analysis and sent on to "clients" at the higher level. Technology has created "looker-shooter" closed-circle systems based on equipment, a small step in the right direction. The information era with net-centric warfare enables any user to pull necessary information without depending on a higher level's will or efficiency. The internet has shown us the way to realize this situation.

Of course, a surfeit of information can create "data fog" concealing what is important. This demands the integration of information management systems whose function is to categorize and verify data according to topic and specific mission; this lies within the responsibility of the high command, not as a means of control, but as a source of correct streaming of vital information.

According to the mission command approach, the information management system creates professional or operational center of powers adapted to the need of the mission or users and linked by a network-centric systems. It assembles or dismantles these centers ad hoc according to the mission's needs. The net "boundaries" are a means of flood control or security, but they are dynamic and decentralized and provide support for every fighting force, whether tactical or systemic.

Flattening the hierarchy of available information significantly changes the meaning of time and exploitation, while changes in the space dimension exert local influences from distant geographical spaces, broadening command areas and hierarchies to efficient network spaces for various near and remote power authorities. All of these create a new way of looking at strategic, operational and tactical hierarchical arrangements.

Hierarchy loses its sector significance in favor of content. The hierarchy is mission oriented, which is fixed, the order of battle is agile. A blending of capabilities and direct communication occurs at the point where hierarchy is no longer necessary; only two levels needed one apportioning missions and resources and the other performing them. Other intermediate "layers" slow the flow of operations and information – in this respect, “less is better”.

The mission command approach enables the construction of ad hoc fighting formations adapted to need and mission, which sometimes are lengthy and operational and at others short and tactical. Network systems enable this flexibility, with the physical organization of units and formations as either a limiting or a motivating factor.

The Fighting Arena in the Information Age

The fighting arena is the outcome of military leaders’ cognitive grasp of objectives and ambitions and their armies’ force structure and technological capabilities. The present chapter will not deal with the cognitive dimension, but with one aspect of the technological one, namely, command and control in the technological information age and their influence. The “virtual environment” existed in the past mainly as a battle of

the wits among generals on one hand and as matters of morale and motivation on the other

Nowadays the information age “moves continents” and brings the heart of the battle into the urban environment, which has existed for thousands of years in varying degrees of importance according to historical period. In the broadest sense, the urban environment was always a decisive factor when it was physically involved in warfare. However, in the information era, cities have become targets due to being critical information center of power-wielding, strategic virtual (and physical) warfare.

Urbanization has made cities the significant part, while the periphery mainly exists to service the metropolis and has lost much of its importance. The city has become the cultural, economic and political core of the country housing more than half the population worldwide. The information war directed at a number of centers of power that are all located in cities. In most instances, the military may found outside the cities, preferring to fight in open areas; from the strategic point of view, the army is no more than an obstacle protecting the center of power. This is not new, but in the information, age warfare can bypass the army on its way to centers of power. That calls for new forms of warfare, virtual battles being among them, but the physical "face-to-face" battle will need to adjust as well.

The virtual sphere has added to the tactical and operational fighting arena a range of virtual activities as integral part of physical warfare. It has added new types of objectives to the struggle for physical and virtual supremacy, while expanding the fighting arena and its activities range. The battlefield has always been subject to “external” influences, but in the information age external forces are no longer at a distance, but are adjacent to or even penetrate the battlefield and directly impact

possible actions and their consequences, cyber and electro-optical warfare being prime examples of this. Thus not only has ground fighting become even more complex and concentrated than in the past, but it has also grown in volume, width, depth and height. Weapon systems have rendered complex armed struggles even more complex. This demands an attempt to simplify it and one way to do this is to improve command and control systems as part of the new information age.

In our times, cities have become too big to swallow unless one aims at flattening a city altogether (Grozny, Aleppo, and Mosul to name a few), fighting in cities leaves two open spaces: the air and information dimensions. Both can create superiority, but in order to achieve control over a city, one need "boots on the ground". This calls for multi-dimensional net-centric warfare, something the needs to be developed afresh. Important components of these new developments will be command and control methods and systems.

A situation is developing in which new thinking is necessary, no longer adapting past successes to present conditions, but being open to a future where the unexpected and unknown are the central focus and ways of behavior will need to adapt to future capabilities. Mission command can lead to a new era characterized by effective multi-dimensional, mission-focused warfare free of hierarchical restrictions and bureaucracy that subordinates organizational solutions to battle doctrine.

Past, Present and Future

Command and control have been an integral part of warfare ever since struggles involving two or more fighters. Armies have dealt with these elements from time immemorial up to the present day. In the present chapter, we will attempt to predict a future, while making a number of assumptions. Dependence on the past can be

relevant for processes moving forward to the future, but at a certain point when a significant change occurs, a large proportion of experience can act as a millstone around one's neck. While considering processes, it is occasionally important to reconsider fundamental principles that are the basis of past solutions. In the information era, technological innovations generate cognitive and physical capabilities that can only fully exploited when they freed from the bonds of the past and form the basis for new structures.

For the sake of the present argument, we will assume the following:

- There are enough indications of how the information age will influence operational management: the internet and social media, global systems and their like indicate these directions.
- The virtual arena will governed by its own dynamic from which systems and resources will be activated to integrate or damage infrastructures and mobile systems; mobile smartphones, television, satellite communication, cyber systems and their like are constantly improving.
- The integration of information-based innovations into technological structures will continue: robotics, sensors and command and control systems are already at various stages of use and development.
- Technological systems have limited capacities, as they perform only what they programmed to do. They are (meanwhile) incapable of thinking independently, drawing conclusions and improvising. This means that in order to derive the maximum benefit from them, systems with different capabilities must combined and some of their capabilities integrated with other technical systems, whether for operating weapon system or planning strategies.

Organization Adapted to Capabilities

The structure and organization of armies today based on experience adapted to predicted threats and technological abilities. Over the past years various slogans and solutions for increased functioning efficiency have gained and lost popularity, among them “air-land battles,” “full-spectrum operations,” “a revolution in military affairs” and “multi-dimensional warfare,” each era and its own pet phrases. In the information age, military employment needs to be organized on a mission command foundation due to its dimensions and it should be activated by net-centric concepts. These will generate combined multi-dimensional operational capabilities exploiting a combination of information-based resources, tailored to the needs of a mission.

Modularity and versatility will be the guiding principles at every level and the combination of these building blocks will make up combat formations supporting mission command warfare. The doctrine will be formulated enabling agility in concentrating effort, economic employment of means and forces by net-centric warfare, and concentrated task forces on the unit and formation level based on exploiting successes, initiative, flexibility and lethal power. Command and control, requires building an information system, flattening hierarchies and adhering to mission command as a leading concept.

The influence of the Information Revolution on Warfare

With the information revolution, local and international weak points have become widely accessible, enabling quasi-military organizations to exert their influence on the general populace and affect all areas of private and public life, the economy and security systems. Thus, a non-lethal public warfare sector has developed parallel to the lethal battlefield and war is no longer limited to physical battles.

The goals of such a war are not limited to the struggle for material resources or a country's identity, but expand to include social issues such as imposing religion, culture or ideology; the idea is to attack from within, utilizing local forces. A situation has created in which the gap between military victory on the battlefield and achieving war objectives is constantly widening.

As the information revolution gained ground toward the end of the last century, this type of warfare has gradually become prevalent. Amazing technological advances have changed the balance of power within and between countries and rivals. New forces have emerged, old ones have downgraded and the global village has made its mark on all areas of our lives. Nevertheless, armies and battle doctrines have remained among the most conservative sectors of human society. Although they undergo development and become a focus of interest in wartime, in peacetime from a national point of view they recede into the background and lag behind other domains in technological development.

Technological Developments' Influence on Military Doctrine

When studying military history we encounter countless examples of new technologies that influenced military doctrine. An example would be taming the horse, inventing the saddle, the reign and the short bow that brought the Mongols to the gates of Vienna. The invention of the wheel that enabled the development of the chariot; and the invention of gunpowder that resulted in the production of small arms and heavy artillery which expand the battlefield and changed the balance of forces within it. The internal combustion engine brought about massive advances, including ships and submarines, trains and planes, tanks and guided missiles, increasing the battlefield to far distances over continents and oceans. Every development met with a counter-

development and the competition between weapon system and counter-weapon system has always played a part in war. The information era battlefield is not mature yet but when it comes in addition to the influences within the battlefield, it will expand the war to every aspect of our lives – military and non-military as well.

The first signs appeared when we witnessed a shift from symmetrical warfare between regular armies to asymmetrical fighting between regular armies and terrorist organizations. Vast armies have found themselves helpless opposite an invisible enemy and wars that in the past ended with decisive military victory have remained unresolved, leaving armies to seek new solutions. Armies have found themselves searching for limited solutions that would “restore the situation to normal”.

Volumes have written to justify this situation, with “asymmetry” being offered as an excuse for failure. Actually, in any war we attempt to create asymmetry, in our favor, so what has changed? The term “hybrid war” has been suggested, but it explains nothing; what has happened is that the enemy by quick adaptation to information-era developments has find ways of outwitting us by avoiding the heavy battle, moving directly "over our heads" to civilian centers of power. The search for solutions has raised the classical linear concept of “the more the better.” This is a mistake, as the enemy has prepared itself precisely to counteract this approach by acting according to non-linear concepts, aiming at virtual victories in public opinion and social support.

Developing New Equations

The gradual developments of the information era have initiated new forms of military thought and introduced a new dimension: virtual warfare. The physical dimension has always been present in war in the form of maneuvering and fire power, as has counter-fire There has always been competition between fire and counter-fire fighting

for supremacy according to the concrete situation at hand, whether offense or defense. In the course of World War I, airpower added to the equation and quickly air space became part of the battlefield, but it took about 25 years for it to become a warfare dimension in its own right. However, the debate regarding supremacy was limited to the physical dimension; at the end of the 20th century, the information age has appeared, slowly removing this limitation.

The “asymmetry” argument leads to the conclusion that a quantitative balance of power does not win small wars. At times, in the struggle between equals, numbers can determine outcomes, but when the forces are asymmetrical, the perspective changes. A striking example would be the IDF’s confrontations with Hezbollah in Lebanon in 2006 and or against Hamas in the Gaza Strip over the past decade, where Israel’s overwhelming numerical advantage did not prevent both sides from claiming victory. This is non-linear warfare, where every gain creates a new beginning, creating a political warfare climate conducive to realizing the same political objectives in service of which the battles started in the first place.

If we hark back to definitions from previous wars – end states and centers of gravity – we will see that the first represents the desired outcome of a certain operation and the second the source of physical and spiritual power required to achieve it. No matter how these defined in the literature regarding Army A or Army B, they are no longer relevant. End states are no more than opening conditions for the next phase and centers of gravity divided up into a number of sub-centers that when combined can provide the necessary power to achieve missions. They are not necessarily geographically connected, but linked by networks acting in synergy and should more accurately be renamed “dynamic power centers”. This stems from the insight that the environment is dynamic and in constant flux, while the balance of power and

influence is ceaselessly shifting and changing direction, along with other components that have bearing on the situation.

When every conclusion becomes a new beginning, the balance of power equation might well shift at the opening of each new phase. For instance, if we completed Phase A by fire, it is possible that Phase B will be achieved by maneuver, as the situation demands. Thus, our activities must adapt regarding emphasis, resources and forces according to real-time conditions on the battlefield. In general terms there is nothing new in this, but changes in time, space and information require a new look at the meaning and doctrine of how we should act in the new era. In such a situation, command, control and battlefield management systems take on new importance. Rigid hierarchical systems would have difficulty functioning in such a flexible, rapidly changing and multi-dimensional battlefield; what we need is a dynamic, flexible system that can accommodate modular, non-linear warfare and a doctrine and forces structure providing us with supremacy over the enemy by gaining the initiative. This will have far-reaching implications both for officer training and for military doctrine.

According to this approach, mission command and control systems constructed to realize the mission through a wide, open perspective of power build-up and flexible battle management. Staff work and decision-making processes suited to flexible, conscious and rapid action needed. A distinction must be made between hierarchical command centering on command and mission command concentrating on control and management over networks. The control and management systems need to provide the commander (the hierarchical system) a vehicle to execute mission command-style operations. Both forms have their own rules and processes and must be linked, by interfacing.

Multi-Dimensional Inter-System Maneuvering

Maneuvering is a doctrinal blanket term covering insights, force organization and operations doctrine. Its central principle is that by initiative, aggression and stratagems it is possible to improve forces' effectiveness and the physical power by means of human wisdom, rather than by exhausting battles and firepower and attrition. A striking historical example of battle maneuvering would be the World War II German blitzkrieg as a reaction to the trench warfare of World War I.

In the information era, when networks replace the decisive field and the focus shifts from people to systems, especially when fighting takes place in complex urban areas, maneuvering requires a new meaning. Maneuvering and other means – whether lethal or non-lethal – must bring the war to the enemy, not only physically, but virtually as well. The enemy's centers of power, which are the maneuvering objectives, constitute a multi-dimensional space. They include the enemy's command, control and management systems, public opinion and image, morale and motivation of fighters and civilians and the involvement of the international community. Maneuvers conducted multi-dimensionally as well – on the ground and from the air – in an integrated effort of physical and virtual power and movement (including IW, cyber, remote-control means, etc.).

Maneuvers directed against systems, attacking them by many means from many directions in a non-linear attack, some of them conducted with traditional fire and movements, but as a whole with much more.

The common picture of linear battle is one force aligned opposite another in order to conduct an "organized" campaign. Multi-dimensional maneuvering breaks down this order. Fighting becomes fluid and agile, especially when directed against an enemy

that is not a regular army. The fighting arena spans 360 degrees and encompasses the virtual sphere as well. This demands new ways of thinking and the development of appropriate tools, other than those meant to support linear troop movements. It should base on agile but effective systems and calls for commanders capable of functioning on a fluid, fast changing battlefield and multi-dimensional maneuvering. All of these can achieve amazing results, but only if appropriate command and control systems are put into place. Thus mission command, which was exceptional in the past, appears to be the main direction of the future.

Continuous Fighting in a Non-Linear Environment

In order to function in a non-linear environment, it is first necessary to define it and for our purpose we will list a number of principles that will be elaborated upon later:

- “Non-linear” means constant change having no end state, but rather a chain of opening conditions in a limited period. This is actually a flow of events that are artificially “frozen at a given point” (place or time) according to a need.
- In order to function in such an environment, timing and structure are adapted to the mission at hand.
- The degree of change and its changing direction or power influenced by the power and nature of the participants in the operation and their opponents.
- Power of participation is a general, complex definition made up of numerous contributory factors that generate effective power.
- Effective power defined according to what is deemed relevant and not necessarily by the power of the participants, since in different circumstances and for particular needs the same participant will have varying degrees of effective power.

- The more long-term designated operations are or the larger the number of participants, the more difficult it is to predict developments and plan accordingly.
- Influence is the major result of an operation and judged by power (type and mean) and movement (location, timing, continuity) and may be measured or assessed by positive or negative values.
- When an operation planned in an environment that is in perpetual motion, the battle plan must integrate these influences and control their development in order to achieve the desired result.
- Functioning in a constantly changing environment net-centrally supported, thus it combines forces and elements with cross-hierarchical boundaries. Thus it is necessary to be able to map relevant strengths in the field of action, including nodes or junctions; activators – any agency bringing about activation; and power – the factors influencing the process that are relevant for our purposes.
- By means of mapping an activation system will be created that will enable command and control over processes and allow agile decision making that improves the chances of achieving desirable results.
- According to the non-linear approach, such a plan of action will consist of a succession of small, flexible activities directed toward a unified goal and capable of changing direction at all levels.
- The general master plan defines interim goals, initially directs mapping and later supervises direction of effort.

- Specific plans directed toward action and constructed as short, controlled processes that can be combined, divided, and mutually supportive or performed in synergy according to need.
- Such a plan includes physical components, including active forces and the required interfaced systems like command and control to achieve its goals.
- Such an approach demands organizing mission-command net-centric warfare principles, both in forces structure, staff work and command and control procedures. Its effectiveness depends on combined staff teams and integrated command and control systems providing relevant information to those requiring it, wherever they might be and when it is needed.

All of the above is mission oriented, so analysis and management must base on actual and expected results, not on resource investment.

Decision Making in a Continual Fighting Environment

The involvement of an additional virtual warfare element expands and increases the boundaries and duration of armed conflicts. Combat it might remain unchanged, but warfare as a whole will change. Information warfare has no geographical boundaries or human fatigue restrictions, and it can integrate at any fighting level with multiple targets and goals. By introducing information warfare as an integral part in warfare as a whole we will break through the "restrictions" of time, space and human capabilities, making war continual. Another major influence of the information era is that once we enter the information dimension, our standard control measures are unsuitable; a new fighting dimension creates multiple new options that when use by various actors take fighting out of our control and render it non-linear.

According to non-linear theory, at the end of the non-linear spectrum lies chaos, so we must gain control we want to avoid chaos and win the war. It thus becomes clear that in order to gain the upper hand, we must adjust our decision-making doctrine and practice to suit a non-linear environment.

If we understand that our control of the non-linear environment is limited, we have two ways of dealing with it – one is force-centered control – as we acted before the information age. The other is to construct a system suitable for rapid, unexpected changes that allows leeway for immediate effective adaptations, as it the case in the Mission command concept discussed here.

Since we can only partially control non-linear developments, the concept we must follow is planning a non-linear campaign while acting in a linear format: small linear segments steps, enabling changes according to the (non-linear) results of our linear actions, then plan the next (linear) move. This calls for organization suitable to dynamic and constant changes without losing superiority or control and a suitable command and control doctrine.

This means that we will determine a plan with many limited goals, each reached by a force operating according to mission command. We will climb from one small goal to the next on the road to the mission's objective. We are capable of changing and adapting along the way – the campaign is flexible, so we can concentrate efforts or disperse them at will, on condition that we direct field commanders to carry out their mission alone according to the higher command's intentions.

The dimensions (volume, distance and complexity) of the goal will determine the extent of the linear step that can safely completed. Good planning will always consider continuity, including the next step or possible changes in course of action.

Such a planning concept is universal, so that every operation and on any level will conduct its planning and forces dispersion based on the same concept, namely, mission command and mission-oriented flexible forces deployment.

Building an Integrated Multi-Layered System That is Both Centralized and Decentralized

A framework for planning and action is required that is directed at war objectives and enables maximum operational flexibility without losing its general direction.

Regarding the operational system, centralization may be found in an operational framework linking a network of milestones that serve as road signs and net-centric resources accessible to end users requiring data and support. Decentralization may be found in applying coordinated mission command objectives to and from the milestones.

Regarding staff work, centralization is found in the unity of command, one commander runs the operations, and decentralization is found in distributing authority to sub-commanders, each responsible for his mission under the higher level. Thus, a complete system created which centralized from the outside and decentralized from within. Forces and staff headquarters must adapt to functioning efficiently and economically within this format.

Coping with a Dynamic Environment

We are gradually realizing that the two-dimensional linear world that we have become accustomed to and in which it is comfortable to live, and in which we have formulated our battle doctrine is not the whole truth. There is another reality no matter how hard we try that is difficult for us to grasp.

It appears that parallel to our familiar flat world, there is a multi-dimensional non-linear world influencing our world.

The information age has opened a window the other worlds outside our "standard" physical world, enabling us to reach dimensions that we could not access before, so we need to learn to live with this and develop suitable vehicles to "maneuver" between these new horizons and our traditional world.

From the time of Isaac Newton, we have harnessed reality to mathematical, linear principles that enabled us to develop technology and live in a world that was comfortable for us. In the military sphere at various periods, armies formulated principles based on ease of control and adapted to the resources at their disposal, from Sun Tzu's reliance on cognitive leadership to European armies based on geometric formations.

Today's world is making the transition to reliance on digital information and the technological developments stemming from it. What was sufficient in the Napoleonic Era and the wars that followed is no longer enough. Reality is becoming more complex; as better tools are developed, it is possible to observe and analyze many more aspects that influence our functioning and achievements. At the same time, we are becoming aware of a diminishing ability to describe and influence with current tools. The world opening before us today is far more complex and if we acknowledge its existence and our limits, we will need to create new vehicles to cope with it and operate in the new reality.

Even if we do not yet understand it fully, the digital world provides us with tools to open the door and step in. The digital world is multi-dimensional, unlimited and infinite and accords time and space an entirely new meaning. Our traditional

perceptions of weight, distance and volume are replaced by concepts involving time, resolution and, availability. This world does not eliminate the physical one in which we live, but enriches it immeasurably, creating new perspectives.

Organizing Command and Control on the Non-Linear Battlefield

This chapter does not deal with the operational side of warfare, so we will focus on information as the heart of any command and control system. The physical structure of an information center is irrelevant; it might be a single computer terminal or comprise a large number of computers and personnel. Its purpose is to gather information, process and apply it, making it available for its own purposes and those of additional users. Information centers exist at every level connected by networking systems.

Since command on the tactical level operations is hierarchical, a different type of interface is necessary between information systems and physical components. In the information age, the volume of information at the commander's disposal is much greater than he can handle, so technical solutions are necessary that receive, process and distribute greater amounts of information. However, not only volume has changed; access to supportive center of powers and hubs of information have undergone a "population explosion". In addition to traditional "pure" information sources, net-centric warfare connects other means of support on the net as well, thus the amount of information is enormous. A professional, mission-oriented cellular structure is required, a crucial means of allowing the commander to enable fully his unit to operate efficiently. We had in the past, and still possess, radio networks dedicated to connecting units and services, but they are restricted in range and volume, whereas computerized networking can connect an unlimited number of

information providers and cellular organizations can engineer who can do what, when and about what.

Based on such cellular networking, a staff can offer the commander much more relevant and timely information than the present system is able to do. Moreover, it creates the ability to separate the control from the command function and let the staff become an operational arm in the commander's service, thus releasing him to carry out his main function: to command.

Mission control can come to the aid of this complex interface. As an organizational framework, this approach constructed of autonomous centers that make decisions and manage operations in their fields of expertise and authority for achieving their defined objectives. These centers are supported by others (each with its own field of expertise, whether firepower, intelligence, logistics, etc.) that are integrated into the mission's cellular networking system to achieve objectives.

The element uniting all these centers is an information system needed to accomplish the mission. Such a battle management system interfaces hierarchical command (the tactical unit) with supportive center of powers that are not necessarily under the sway of a hierarchical system, but with information and capabilities that temporarily assigned to it. This exists today to a certain degree, but when it is possible to integrate powers based on up-to-date information, a fighting formation will reinforced by truly multi-dimensional support.

These capabilities have existed in the past, but changes in relevant time dimensions, informational requirements and scope have led to improved command, control and management systems face-to-face but this demands thinking "outside the box".

An organizational distinction between command, control (responsibility and authority) and staff work (preparation, supervision, management) reduces pressure on the commander and frees him to concentrate on the mission; simultaneously, it maximizes the range of services that the staff and headquarters can and must provide to this end. Mission command imposes a greater burden on the higher echelons and supportive headquarters, while lightening the load on the commander's shoulders and providing him with what is necessary, including the freedom to make decisions.

According to this approach, the accepted separation of strategic, operation and tactical, loses much of its relevancy. If the system develops a reliable, supportive net-centric system that is accessible to all (based on information and an authority control plan), it will be possible to manage a campaign on two levels only, the tactical – contact level and the strategic-campaign level that comprises the commander's intentions and apportioning of resources.

Changing Priorities in Staff Work

Staff work relies on two technical frameworks:

- Information management systems dealing with collection, processing and distribution; integrating mechanized systems, information management teams and content experts;
- Time and means management systems dealing with planning and coordinating processes of resource allocation based on the current plan, integrating and preparing the next battle plan for the commander.

Successful professional management of these two supportive systems is a prerequisite for effective continuous fighting management. Staff work must be flexible and staff

headquarters organized according to mission command principles, Mission-oriented staff teams can centralize and decentralize according to need, and networking information systems enable the transmission of necessary data and its products at any time or place. The headquarters is one on the nodes on the mission's net-centric system.

Technological capabilities enable information to retrieve from remote dedicated centers that are available as information sub-networks to all users.

The Approach to Command in Net-Centric Warfare

The approach presented here rests on the assumption that in net-centric warfare, the architecture of the network system must support mission command from the outset as the central model for command and control and battle management. According to this approach, command and control are not limited to the ingenuity and expertise of a local commander, but rather the entire system is adapted to support mission-command- style battle management. "Information pulling" rather than higher echelons supplying information as in a hierarchal system, thus enabling "clients" to follow the mission control concept, support command and control. This means that the entire system will change based on a variety of resources and information teams.

The architecture of a system that can support mission command based on an operational control format (JP6) that is fundamentally rigid and rarely changes, around which a dynamic infrastructure built of computerized information management functioning in a tactical control (JP1) format.¹ Nevertheless, implementation lags behind since we are slow at making a cognitive leap forward.

To the purpose it is necessary to determine the components that can transform today has standardized hierarchical command and control systems into mission-command-centered systems. This involves two operational dimensions: a hierarchal chain of command and net-centric support.

In the information era, managing and commanding fighting takes on a new form. Potential and optional courses of action created for "the next step," thus easing the efficiency of activating forces and resources for continuous fighting. Structures of this type enable maximum utilization and economy of forces and means, lessening overload on headquarters, exploiting time and space and improving versatility.

When the command and control system enables each commander direct access to information and when they have direct contact with center of powers regarding combat support and combat support services, the time span necessary for activation and coordination will considerably shortened. The commander's ability to take the initiative increases and he can make decisions with minimal dependence on hierarchies.

The hub of the system is the hierarchical command and control system, as a unified command and objective are sacred values of battle management. It should kept thin and effective, the net-centric part should be wide and flat and control over the flow of information should done by access control.

The new technological advances enable the commander to utilize management capabilities that are not necessarily in his geographical area or under his command, two parameters are necessary in order to integrate systems: effective range and precision. This holds true for both information and combat materials. The framework in which that data center functions is irrelevant; commanders can reach them at any

time and get the information they are looking for from a non-hierarchical network.

The space dimension expands.

Net-centric warfare also brings about significant changes in the time dimension. Data concerning intelligence or activating supportive resources is constant available, meaning that combat can be continuous, so time becomes a weapon system.

According to the theory (OODA) developed by Boyd (2007) based on his experiences as a pilot, pre-empting the enemy by means of efficient exploitation of time becomes a central component in warfare.

When analyzing a situation, commanders tend to analyze quantities based on a hierarchical approach. Conversely, network-based activity and mission command grounded in enhancing power ratios, involving the force's actual performance at the point of contact with the enemy at a particular time. These power ratios are constantly in flux, without necessarily determined by statistics regarding forces and resources appearing on staff charts. In order to use this as a force multiplier, headquarters and staff must be adapted to function in net-centric warfare formats and officers must be trained for multi-tasking coordinated by a unified command.

The implications of the information era and mission command for battle doctrine include data availability, increased availability of data-dependent resources (weapon systems, logistics) and breaking down bureaucratic and hierarchical barriers to networking communication. All of these enhance the planning of command and management capabilities and enable a cognitive breakthrough into a non-linear world that previously concealed from view.

The Commander and the Staff

In the information era, the commander is required to increase his capabilities, as compared to those required by a hierarchical-linear format. More resources given to him, he expected to plan and execute his mission his way. By employing net-centric warfare, more staff support given to commanders by way of information availability. The commander will have a wide array of supportive data and resources at his disposal. Resource usage depends on him – instead of waiting for data to send to him, it will now be available to him from the beginning and it can be retrieved at his convenience. Staff work must adapt to a changing hierarchy and a speeded-up tempo and commander and staff must adapt to these new capabilities. Headquarters will undergo fundamental changes; it will no longer function solely as the commander's assistant, but as a fighting unit in its own right, activating resources that are at times not under direct control.

The staff will continue to aid and support the commander with far more resources, not necessarily through geographical proximity or direct contact. This will speed up action, require different (better) qualifications for staff officers, different decision-making procedures and highly-qualified commanders. Too many variables in the system place us inside the non-linear spectrum, thus we should take one step at a time; assignments and mission work should be broken down into cells of a size that the staff officer can handle in terms of pressure; the network should be arranged to function according to mission-based net-centric cells.

Command and Control as a Weapon System

In the information era, command and control systems change from supportive tools to weapon systems. As the fighting tempo speeds up and the potential number of parties

involved in the fighting increases, battle management becomes a central component in deciding outcomes.

Face-to-face fighting is a direct result of a plan and its execution and must create local superiority in time and space. Linear warfare organized based on a plan with clear end-state objectives, by either main and secondary efforts or variations of them with a preliminary set of forces. In non-linear warfare, the road to end-states convoluted, with a number of small steps at each phase. The transition from one phase to another is not predictable in advance, but the result of the previous one based on success and situation development. Forces deployed to perform dynamic, flexible fighting. Thus, the command and control system will have to cope with dynamic events on the battlefield, set the pace, develop local and temporary supremacies and ensure that the way to the final objective is as short as possible.

The command and control system must support rapid, continuous fighting according to the abilities and needs of the operational forces, and it reinforced by capabilities and support of "every capable mean" that is within effective range or holds effective data. When information is available and accessible, and when there are technological solutions for every relevant range and target, two problems remain, the first is an organizational structure and deployment enabling the dynamic and efficient activation of forces and the second is a command and control system with capabilities and skills for initiating multi-dimensional operations. Mission command makes this possible.

Applying these systems to the new battlefield opens up new possibilities for practicing the art of war, taking us away from numerical calculations based on human limitations toward new insights. Mission command based on these insights and will bring the art of war into the information age of the twenty-first century.

This demands quality commanders who, in addition to their basic skills and expertise in deploying resources, will be more than just military leaders. They will need to be “artists of war” capable of initiating, inventing, taking risks and controlling events.

Mission Control, the Commander and the Headquarters

There are three major phases in data processing: facts that become information that in turn becomes knowledge. This is a never-ending process, since every piece of information contains more than basic facts, while knowledge always reveals something new. It is non-linear process from the outset, as information flows in constant motion and has value insofar as a person or a program derives new insights from it.

Information management systems were always present in the military to support optimal decision-making, constituting the major force promoting staff work and providing the basis for its functions. In the information era and according to the precepts of mission command, they have an additional goal: to generate information that is at the disposal of commanders at different levels for decision-making purposes. In the past (and still today), such databases were for the exclusive use of the local commander, but in the new era they have broken through barriers; databases are available to anybody, subject to security clearance. The system is no longer available to subordinates according to the judgment of their superiors, but shared by commanders and junior officers at all levels according to professional needs.

Prior to the digital era, staff control centers constructed around data, but they flowed in one professional, authoritative direction. Communication channels connected between similar bodies: operations to operations, firepower-to-firepower, logistics, and maintenance. These complexes collected relevant data in cells (operational,

medical, artillery, engineering, logistics, etc.). The information was then processed and distributed to professional bodies for processing and completion and it then transferred to a combined management center and from there to those commanding the battle. One disadvantage of this system was that it did not consider “foreign” influences; they were only included in the equation later on in the process.

Conversely, digital systems function according to topical categories rather than professional or authoritative ones. Any interested party might access accumulated data derived from various sources. Such a system enables control of data flow, its processing and transmission to any part of the system. Promoting data according to topic makes it possible to shorten processing time and manpower, and especially to improve data processing and distribution among consumers. Of course, every professional or command network maintains a hierarchy ensuring reliability and quality, but information is readily available to all network participants.

Partnership with the Digital World

Digital systems for managing and processing information based on computers at various technical levels, but computers cannot think for themselves. Computerized command and control system and management systems aimed at assisting commanders with planning, command, supervision and control of fighting. In the three-part process that was described above (data-information-knowledge), the mechanized component plays a major part in the first stage of collecting and storing data; it plays a smaller part in the second stage that involves processing facts into information, although it will still support sound planning procedures. However, with the transition from information to knowledge, human insights will be dominant, with digital technologies playing a supportive role. In other words, the computer managed

by means of previously determined protocols and operated by expert analysts who process data according to the needs of commanders. Winning the battle will always ultimately rely on the commander cognitive skills.

Information management serves staff work and planning, as well as the command and control system, each with its own requirements, but in harmony. The structure of staff headquarters and decision-making processes must ensure that this harmony maintained at all times.

The solution lies in decentralizing functions at headquarters in the form of data centers from which the necessary information derived. The commander deals with planning and commanding the battle and the staff partially supports him and partially administers a data center with a wide range of information, This already exists today, but scope and work methods are different. Networked communication makes it possible to concentrate and process information in professional centers and leave it to the staff to assemble process and distribute what is necessary for the mission. Thus, the staff takes on a new task, namely, data management.

Data Management Systems

Every data management system focuses on two spheres, firstly collection and processing that is done in specialized centers, secondly support for decision-making that done at command, and control centers. Between the two, there are information-networking channels. If we succeed in creating computerized systems that intensify processing capabilities to the level of artificial intelligence and the organizational structure upgraded to accommodate these capabilities, we will be able to concentrate human effort on activities that machines cannot perform and reach new levels of quality and better exploit the resources at our disposal.

As a surfeit of information can create severe difficulties in utilizing information and ensuring that it is available to those looking for it, data management systems must be efficient and reliable. The technological solution for such problems may be found by minimizing the scope of a single professional network center and managing mission- or issue-dedicated networks, which operate according to mission command as well. This means networks that assemble and disassemble according to need, so that the higher level can support lower-level operations.

Two types of networks are necessary for this: information networks for supporting immediate needs like command, control, intelligence and fire and supporting networks for operating resources for forces logistics and deployment, monitoring, medium- and long-term pre-planning. In order to promote staff work, there must be full communication between these two networks. Mission command enables the commander to tailor specific connections between the two systems; although the second supporting system is not under his command, he can authorize access to it according to his operational planning.

Data management as the basis for mission command in control centers

All information takes on a different meaning according to consumers' purposes. For instance, information regarding enemy deployment serves intelligence to estimate enemy activity, artillery to plot targets and operations to plan maneuvers and fire power. How effective information is depends on end users and the degree to which they receive it in a form that serves their needs in the period necessary to make decisions.

We will describe these two elements – information centers and information available to the decision makers who require it:

- Information centers - the system that receives, stores, processes and distributes information:
 - Large amounts of information constantly arrive from a variety of sources.
 - Information categorized according to relevance, purpose and urgency for potential end users.
 - There may be users who require all or part of the same info.
 - Processed information takes on new meaning in a never-ending process.
 - The usefulness of information changes according to the use made of it.
- Command and control centers:
 - Many users require information in order to reach decisions.
 - Users require the information in a format that supports their decisions.
 - Processing and presenting information is multi-directional. Each individual piece of processed information is likely to create the need for additional information.
 - Processing and presenting information non-linear and is subject to constantly changing influences, implications and intensities.

Since different users need information that processed in different ways, the manner in which it presented is a critical factor in determining its value. Thus, the system must be flexible, simultaneously available to a number of consumers and user-friendly.

Staff work must focus on preparing information, presenting it and managing operations with the support of digital systems that improve their output and shorten the time required to produce it. These capabilities do not alter anything concerning the

commander's insights and decision-making; his responsibilities remain very hierarchical.

Points of reference

Information is the driving force behind operational management.

- The quality of information and its availability play a major part in successfully achieving an operation's objectives.
- The digital system contains huge amounts of information from countless sources, which diverge from the boundaries of the former professional-hierarchical context.
- Digital information systems afford supervision, management and dissemination of information that cross-hierarchical boundaries and afford operational forces and decision-makers direct access.
- Military operations have a single commander, while unity of objective and command are a cornerstone of warfare; the decentralization of information must not threaten this principle.

Basic Assumptions

- There is more than one reality and creating, managing the one that is relevant to a particular mission and setting depends on the quality of information, and its management according to planning and deploying forces suited to that mission.
- A commander activating his forces by means of sub-commanders according to a hierarchical command system manages military operations.

- The command center has the ability to manage information allows it exercise command and control over all the forces under its command and constituting a mission center of gravity in commanding operations,
- While the commander manages fighting on a hierarchical axis, headquarters functions as a multi-dimensional network equipped to manage information, supervise activities and control their execution.

Repercussions

- Although the role of headquarters in supporting the commander has not changed, it has acquired new capabilities; new needs have developed on the battlefield enabling and demanding headquarters to broaden its interests and activities beyond previous limits.
- The influence of a headquarters fulfilling all its responsibilities transforms it into a weapon system and force multiplier.
- A combined and coordinated effort of a hierarchical command (the commander and his assistance staff) and a network command and control system (headquarters) is likely to result in more efficient capabilities exploitation of the forces' and enhance effective battle management.
- Making the distinction between the two tasks of command and control demands organizational adjustments and work processes that will bring about full realization of capabilities, while every organization is suited to its specific tasks and role:
 - The commander and the command team – operational management
 - The control center – planning, supervision, control and activating efforts and resources as part of the commander's operational plan.

Technology and Mission Control

In theory, weapon systems developed according to operational needs, but in fact, military industries develop according to the technologies at their disposal then market them to the army, which follows their lead. Arms development stems from a problem requiring a solution. Warfare in a mission command format demands the characterization and development of war resources suited to its fighting principles which industry cannot develop.

According to battle doctrine, the professional field of military technological is relatively narrow regarding each individual weapon and as expertise increases; this trend is even more evident. However, the battlefield made up of forces woven together into a multi-dimensional whole. Thus the mutual influence of each resource on others is just as important, or more so, than its individual capabilities.

As the army starts thinking in terms of a multi-dimensional battle environment and net-centric warfare, it must also consider multi-dimensional technological solutions and net-centric technologies. The information era allows this to happen. The new era makes it possible to activate weapon systems toward a common goal by any organization and from any geographical location, especially when they developed on an interface combining their capabilities in one management and command framework.

It thus becomes obvious that alongside the specific capabilities of each system, operational requirements demand placing emphasis on interfaces containing supplementary support systems that are not dependent on manufacturers' original, unique technologies.

The influential factors shift

The two major factors influencing warfare are time and space and how they are utilized; this constitutes the core of all military activity. Neither time nor space is passive or dependent on force majeure; they are at the disposal of the commander and he is responsible for creating temporal and spatial superiority by wisely utilizing environmental conditions and the resources and forces at his disposal. A large number of modern technological developments directed at improving temporal and spatial management.

Time - The ability to maximize our strengths and pre-empt the enemy by exploiting our capabilities is a key factor in achieving decisive superiority. This is true at the lowest tactical level; "looker-shooter" is a good example when one is dealing with disappearing targets, as well as on the operational level. In the Six-Day War, the IDF achieved a decisive advantage on the ground by quickly and effectively deploying forces, bringing victory on the Egyptian front regardless of the size and quality of the forces in the field. Conversely, the hesitation and slow pace displayed by the IDF in the Second Lebanon War and in the Gaza Strip in subsequent years resulted in a stalemate, despite the relative size of the forces, even when they were clearly in Israel's favor. These examples demonstrate that time is a non-lethal weapon that when wisely managed and exploited can be a decisive factor in battle. The time element is under the commander's control and with the assistance of information systems; the temporal gap between receiving data and utilizing it is constantly narrowing.

Space – Warfare waged against an enemy deployed in four dimensions: land, air, sea and information. The four are not static; in the information era, the battlefield is likely to be urban and a significant proportion of the battle area will be located deep in

enemy territory.ⁱⁱ In most cases, there will be no clear front line and fighting will be multi-dimensional with a 360-degree range.

The fighting area is plotted out at the planning stage, when it is determined where and how we choose to maneuver and fire and from where we can decisively influence the development of the operation, whether by occupying territory or by gaining control over enemy activity. The selected battle arena is not necessarily static and fixed, but might be flexible, mobile and dispersed over a large area.ⁱⁱⁱ The result of careful strategic planning is likely to determine the outcome of the battle before it begins.

According to non-linear battle principles, the battlefield's importance changes according to the situation on the ground, while planning involves a large number of small steps and dynamic battle management.

Information Warfare and Multi-Dimensional Battles

The information – or virtual – sphere has developed slowly from the invention of the radio and other media use for control to digital information systems. They have become a battle space in themselves when every device gives rise to a counter-device,

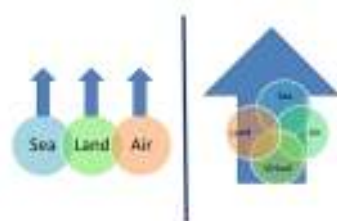


Figure 2 Unified battle

cyber technology being a striking example of this. The information environment has become equally dominant on land, in the air and at sea. It exist as a stand-alone battle environment (IW) but at the same time is active parallel to the others, completing and enhancing them by adding another dimension altogether.

Information integrated into every aspect of warfare. It has many branches, a prominent one being cyber warfare, but this is not unique and not always the most significant. Electronic and electro-magnetic warfare participate in the information war, either on their own, combined with other elements, or as backup for land, sea and air battles.

Information is a vital element of all weapon systems used by the army, in the form of information-based automatic or autonomous systems: data automatically programmed in advance or data that processed in real time by autonomous systems. The involvement of humans at various levels in these systems constitutes the cooperation between man and machine and fighting systems.

The significance of the information era is not restricted to the appearance of a new weapon system or fighting arena, but also to changes in attitude toward organizing and managing battle arenas and warfare in general. Networking gives us net-centric warfare that opens up new opportunities for organizing warfare based on operational characteristics and availability of information, as well as interfacing as a vital element in organizing forces, to the point where digital networks may considered non-lethal weapon systems.

Organizational hierarchies that constructed due to difficulties in sharing and controlling information are no longer necessary. It is possible to include and combine forces and resources based on shared information and activate them when spatially distant from one another, while still working in harmony under one commander and toward one objective.

The Integrated Battle as a Condition for Mission Control

The concepts of integrated battles, cooperation and combined efforts must all be examined afresh in the information era. These are multi-dimensional integrated battles, which need integrated combat forces, regardless of origin or heritage. When weapon systems based on interfaced technologies, the battlefield becomes unified. Battlefield organization must be mission-oriented and managed according to mission command due to its being complex rather than resource-centered.

As far as possible, technological resources must be developed toward cooperation. Although all technical devices provide limited solutions, their combined performance on the battlefield is a higher priority than their individual capabilities.

The starting point of battle planning is the commander's intentions and the allotment of resources for the mission. From that point on, managing and controlling the battle is in the hands of sub-commanders with assigned missions and ad hoc battle teams responsible for deployment, exploiting advantages and completing missions.

Deployment ranges are no longer limited, but now lie in the ability to combine and share information. Task forces are efficient as long as their activities are performed in a relevant period^{iv} and their output impacts the mission at the time and place required. The commander can make a major contribution to activating his forces by the wise exploitation of time and space. Taking the initiative and controlling the forces' concentration and dispersion enable him to confound the enemy's capabilities and gain supremacy.

In the information era, the concrete battle area expands far beyond face-to-face fighting. Systems influencing tactical fighting (and higher) are likely to be found outside the range of the weapon systems in the hands of the fighting force, but might have an impact through direct or indirect involvement in a short time span or even

immediately. The ground battle not only overlaps with low-altitude air space, but also with an invisible information environment.

According to the mission command format, battle organization is ideally based on decentralized reserves of forces and resources, maximum utilization of all capabilities, ad hoc battle teams that can easily change direction and effort, flexibility of deployment and decisive superiority in contact, which may be graphically described as “fighting from the depth to the depth”.

Repercussions for Battle Doctrine

Battle doctrine combines functional and operational principles. The human element comes to expression through insight and leadership that maximize capabilities in developing circumstances and dynamic environmental conditions. The level of excellence attained depends on the quality of battle organization and the availability of resources for commanders to activate.

Mission control - In the information era enables the commander to receive and pass on much more data than was possible at the beginning of the present century.

Efficient data management and mission command and professional network activity open up a wider range of choices before the commander than ever before. More information aids the commander in making decisions with much less dependence on the higher echelons and affords him tools to function in a true mission command framework.

The shorter time span necessary for making decisions and carrying them out also renders adherence to mission command principles the preferred command style. A

flexible approach to fighting and integrated support systems will improve the commander's ability to realize these principles to the fullest.

Flexibility – This means the ability to combine and organize teams, decentralize and centralize forces and resources unrelated to physical location or origin, enabling the commander to change his mind and deploy and concentrate forces and resources without jeopardizing fighting power.

His wide range of choices and ability to carry them out generate greater functional flexibility. Mutual interfaces, a common language, unity of mission and command will provide any fighting organization with the necessary flexibility to perform its missions.

Initiative – When the commander supported and strengthened by means that are not under his direct control, he can operate “outside the box,” knowing that the system will provide the necessary additional resources for his initiatives. When he sees the possibility of achieving local or even temporary superiority, an energetic commander can exercise initiative, exploit circumstances, solve problems and lead the battle according to his own individual style.

Deception – The information age creates endless opportunities for deception, trickery, pretext, and other surreptitious means of gaining supremacy.

Influences on the Organizational Framework

The information era has broad implications for the organizational framework. It leads to a shift in the power and importance of various components.

Numerous and varied solutions exist today that are far more unique than in the past due to being based on expert technological systems. These systems are limited to the

applications for which they were developed. While there is vast improvement in their performance, the ability to combine them is significantly limited. Pre-programmed machines now perform what human beings formerly instinctively carried out and people must adapt themselves to this situation. It is impossible to convince a computer to make changes, if it not programmed in advance to function as it does. Thus, simplicity is necessary when activating a wide range of resources. Battle management must base on four fundamental principles: a common language, simplicity, a clear, understandable functional approach and ongoing organizational flexibility. This will enable the following:

- Freedom of action in conditions of troop saturation and complex areas
- Flexible deployment at any width and depth that is necessary, while reserving the ability to concentrate decisive effort at the selected time and place
- Economical use of forces through modular structures and shared interfaces
- Flexible fighting formation structure according to immediate ongoing and changing needs on the battlefield
- Continuous action with the necessary decisive power
- Organizing units/formations for battle

The information era enhances the ability to organize teams and resources at lower levels. More flexible combat organizations are required that maintain the ability to concentrate large, powerful forces when necessary for decisive action.

There remains the need to concentrate effort on strategic objectives and to concentrate forces and means. However, an enlarged battle area and decentralized fighting, together with the concept of battles “from depth to depth”, demand a different mindset

to deal with the problem of how to exploit strengths and excellence to gain supremacy and decisive victory.

Large maneuvering bodies are necessary for in-depth resolution of fighting, but “large” refers to the power exerted on the enemy, not on concentrated organized numbers. The information era has brought about the integration of autonomous and automatic systems into warfare, enabling us to deploy the best possible synergetic combinations of resources and a wide range of activities that do not detract, but even improve quality and flexibility of performance.

While maintaining maximum precision of warheads, the greater effectiveness of intelligence and firing capabilities lessens the need for large concentrations of forces and resources in advance as the solution to every difficulty on the battlefield.

Available weapon systems may be widely decentralized, but still readily available to the commander for activation.

Fighting is a combination of face-to-face fighting and supportive resources for a particular mission. The combined mission command battle takes place simultaneously at every range and location in which it is possible to combine data and weapon systems in a united mission under one commander.

Continuous fighting constitutes one way of exerting pressure on the enemy, disrupting the rationale behind its deployment and thwarting its ability to respond. Continuous fighting achieved by mobility and transportation of means and forces. Deploying a range of resources and forces from depth to depth enables continuous fighting without the need to concentrate large forces on the battle line. The battle for supremacy in continuous fighting is one of the crucial elements of any military attack. Employs the

information virtual battle space as integral part of the campaign supports the battle continuation and the enemy systems disruption.

Organization based on these concepts is valid for every fighting level according to conditions and actual needs.

The Significance of the Above

- Combined battles and mission control require a simple, basic organization, a clear, structured battle order, a common language and technological interfacing among resources and systems.
- Integrating warfare into the information sphere and from it to other fighting arenas is the key to maximum exploitation of information technology and synergy among all the forces and resources active in a mission.
- A mission command networked fighting organization will replace former hierarchical corps-centered frameworks based on limited resources.
- Improved tools for data management, new staff procedures and control systems based on information-era capabilities all needed in order to support a “net centric warfare organizational framework.
- Commander training must accommodate changing conditions; new ways of control must developed along with mobility and transportation of forces and resources for multi-dimensional depth-to-depth fighting.
- Databases needed that provide optimal solutions for every level, a kind of super-network that encompasses professional and command and control networks. These systems must be flexible and subject to change ad hoc, adding and removing users, sorting and distribution information according to the needs of the mission.

- Data management has become a crucial element in modern warfare.

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- i. Tactical control provides sufficient authority for controlling and directing the application of force or tactical use of combat support within the assigned mission or task (JP1).
 - ii. “Depth” means the distance from our lines and it is not fixed, but determined at all times by our ability to act in it. The greater the range of weapons, intelligence and command and control, the broader will be the proportion of face-to-face fighting and deep zones.
 - iii. There might be a number of systemically controlled, but geographically and spatially scattered, fighting areas.
 - iv. Relevant time is that in which a necessary activity carried out within the framework of a mission.