

NETWORK CENTRIC WARFARE: A PERSPECTIVE AND ITS STATUS IN SOUTH ASIAN MILITARIES

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INTRODUCTION

War is a product of its age. The tools and tactics of how we fight have always evolved along with technology. We are poised to continue this trend. Warfare in the Information Age will inevitably embody the characteristics that distinguish this age from previous ones. These characteristics affect the capabilities that are brought to battle as well as the nature of the environment in which conflicts occur.

Last decade of 20th century saw a major change in the way we communicated, IT (Information Technology), which spearheaded the Information Revolution, made it possible to communicate faster, easier and over large spectrum. This virtual world also impacted the Militaries and the IT related RMA revolutionised the way war was planned, organized, executed and managed. These developments further moved on during the first decade of 21st century. Today it is not possible to even imagine undertaking, peace time small scale, operations without solid backing by the IT support services. Yes, NCW, (Network Centric Warfare) is the future of any Operations whether it is War or OOTW (Operations Other Than War). Developments in technologies have brought revolutionary changes in the conduct of warfare. With the worldwide expansion of IT, the military warfare is now digitized particularly in the command, control and decision making. The challenges of military commanders are as complex and demanding as ever. Speed and flexibility of response are of increasing importance and the range of activity, security forces are expected to undertake is ever expanding. At the same time the range of technology available to support the commanders is also increasing. All commanders desire to connect each individual soldier on the frontline with the command area on a real time basis. It is in this context that armed forces need to be networked not only at higher levels but also in the battle field. To support operation of this kind, the new dimension of warfare, NCW, has evolved.

Technology has introduced radical changes in the composition and structure of the modern day battlefield and has had a profound impact on the nature and conduct of modern warfare. A look at the sophisticated gadgetry and the automated battle space today gives us the feeling of going through the pages of a

space fiction novel or the “Star Wars” scenario of the yester years. Thus, it would not be wrong to say that contemporary technology has been the key contributor towards the ongoing Revolution in Military Affairs and the main force driving the dynamics of modern warfare. This new dimension of warfare has given rise to various theories and concepts of war fighting aimed at exploiting the capabilities of the contemporary sophisticated technology. NCW is one such Concept which aims to establish the centrality of technology driven networks as compared to the erstwhile weapon platforms. This has found universal applicability and acceptance and is equally relevant in the South Asian context.

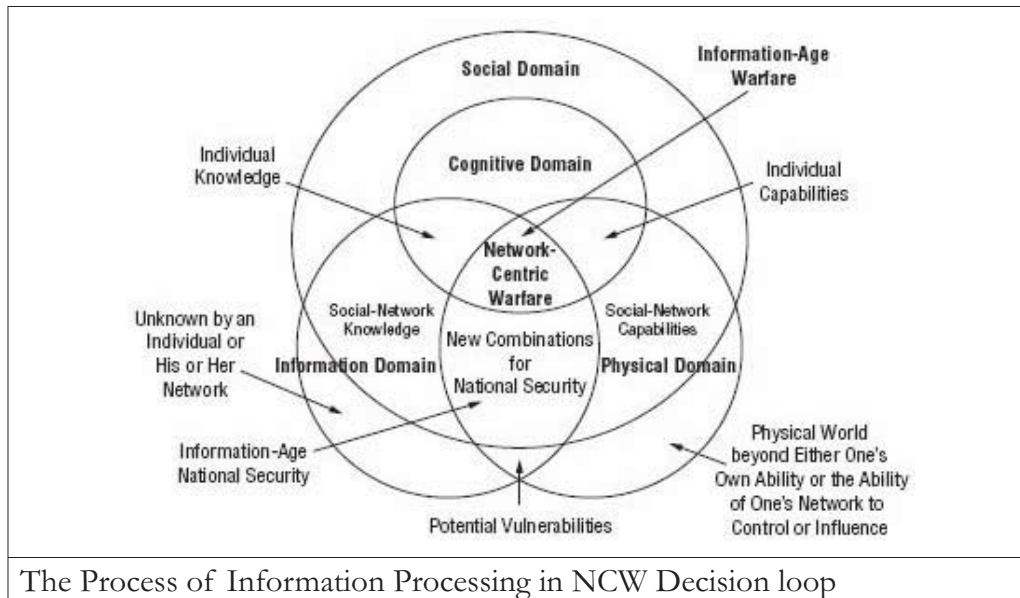
NCW is a concept which derives its strength from seamless flow and exploitation of information by geographically dispersed entities and their ability to produce massed effects at the points of decision to create a definitive war winning edge for a fully or even partially networked force. However, as we introduce more sophisticated equipment and lethal weapon systems into the battlefield milieu and evolve new doctrines and strategies to deal with the NCW phenomenon, we should not lose sight of the fact that technology alone is no guarantee to success – it has to be backed up with equally adaptive and responsive leadership, force structures and procedures. Therefore, the full potential of the transformation will only be realised once it is wholesome and complete.

NCW is a logical by product of the information age. It is the new military doctrine or theory of war pioneered by the United States Department of Defense. United Kingdom used Network Enabled Capability (NEC) for similar doctrine. In Sweden, this was translated as Network Based Defense. It can be broadly described as deriving power from the rapid and robust networking of well-informed, geographically dispersed war fighters. At the most fundamental level networking aims to accelerate engagement cycles and operational tempo at all levels of a war fighting system. In a very simple term NCW can be explained as a means of quick flow of information that assist in making a faster decision to execute a mission. A high speed network permits error free transmission in a fraction of the time required for voice transmission, and permits transfer of a wide range of data formats.

In modern warfare none of the battles can be successfully fought by single service in isolation. The planning and conduct of campaigns and major operations will involve all the services to take part as a cohesive single entity. There is a need to integrate the planning and prosecution of operations during war. NCW is an emerging solution to do this in a better way. It needs lots of infrastructural development to fulfill its requirement. In the developed countries, NCW is based

on sensors, satellite and modern communication equipment. Many countries in South Asia, eg. India, Pakistan and China have introduced NCW to enhance overall military capabilities. Present economical, COTS (Commercially off the Shelf) Information Technology (IT) systems and communication equipment are able to make this technology accessible to the Militaries of this region.

The Fog of war has always been a great constraint to commanders in decision making. This phenomenon has existed throughout the evolution of warfare. Many military philosophers have suggested numerous ways to ease the fog of war, thus helping commanders to take the most appropriate decision at the appropriate time. Great military thinkers, such as Sun Tzu and Carl von Clausewitz, brought to light the requirement of taking bold decision in winning any war. Many mechanisms have been introduced since then and evaluated, tested; some were negated and some have rolled on through the history of warfare. It is felt that the most appropriate mechanism to be adopted till date is the Decision Making Process (DMP). DMP is a dynamic and logical way of solving problems of military significance. It is considered the single most established and proven analytical process.

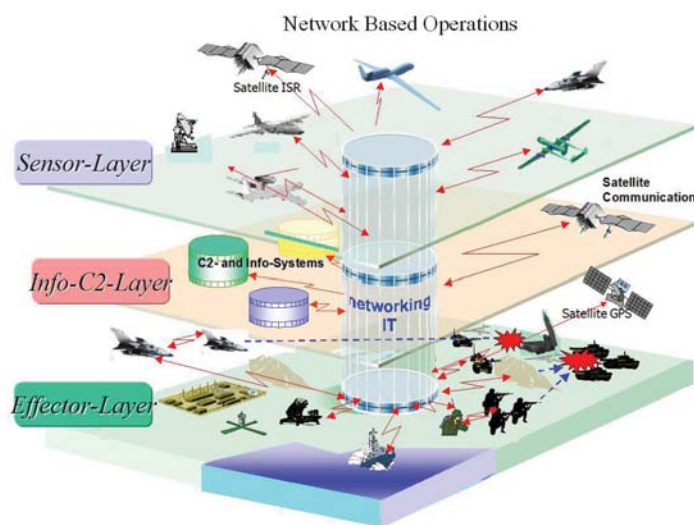


Still, the DMP is a time consuming affair and needs accurate inputs for the resulting decisions to be of some value. As military decisions are time bound in their relevance, the time factor becomes one of the most important factors affecting such decisions. Superior technology is a significant advantage that can change the total outcome of a battle, as war always demands the use of

the most sophisticated technological skills. Advances in telecommunication technology have contributed to the swift transmission of information. Network Centric Warfare (NCW) is the best term developed to date to describe the way to organize to fight in today's Information Age. Introduction of satellite technology and subsequently the Remote Sensing (RS) phenomenon has swiftly taken the battlefield into precision accuracy.

But the prime question is “What are the options open for Militaries of South Asian region to adopt the concept of NCW?” In view of obtaining suitable answer, this paper has emphasized on the exploration of the existing status of NCW capabilities of regional Armed Forces. While doing so at first, endeavor will be made to introduce the concept of NCW briefly and the prospect of NCW in the Militaries of South Asia will be analyzed. At the end, the paper has put forward few recommendations on NCW in Armed Forces perspective. The research was conducted as an ‘Exploratory Study’, which examined NCW- as a new phenomenon from Armed Forces perspective. The research is the outcome of consulting a number of secondary sources of information and personal knowledge and experience on the subject.

EVOLUTION OF NCW AS A MILITARY CAPABILITY



The Revolution in Military Affairs (RMA) moves by ideas of military thinkers and on the wheels of Technology, Doctrine and Organisation, however, the main support structure, which gives it the predominant strength, is undoubtedly the technology. The changing concepts of warfare are driven by the available

technology of the times. While sophisticated weapons and sensors have greatly enhanced combat potential and efficiency, developments in Information and Communication Technology (ICT) have enabled greater connectivity and information sharing among widely spread force components. The concept of networking in business enterprises has found an equivalent in warfare and what is now referred to as 'Network Centric Warfare (NCW). NCW rests on the premise that the power of a force grows proportionate to the extent of networking among the weapons, sensors and the command and control (C2) elements, quite akin to Metcalfs Law, which is applicable to any network. NCW not only enhances situational awareness, but drastically reduces the time for decision-making at higher levels of command.

In view of the changing battlefield environment, modern warfare is characterized by rapid mobility, efficient command and control apparatus and joint man-ship. Threat from weapons of mass destruction and precision guided weapons makes it imperative to have an increased stress on surveillance. Information and electronic warfare, transfer and exchange of digitized maps and terrain features are also of equal importance. The operational and conceptual base line for effective conduct of integrated operations in the future battlefield milieu, therefore, will demand enhanced situational awareness at all levels and the capability to react on information faster than the enemy. Rapid processing and transfer of information would be an absolute requirement to synchronise direct and indirect fires i.e. effective control of weapon systems; both strategic and tactical. The key component of the future battlefield milieu will be an accurate or near accurate battlefield visualization by commanders at all levels, from the lowest to the highest. Digital communication and info technology will enable commanders to visualize the operations, analyze and formulate the potential courses of action, develop and communicate their intent, and monitor the operations to ensure conformance.

Communication is all pervasive and is a decisive factor in planning and executing any military operation. These are absolutely essential to exercise effective command and control and to support both the force multipliers and IT applications. Communication by themselves, are a potent force multiplier and perhaps least expensive. The rapid technological convergence between communication, computers and the media due to digitization, has added a new dimension both to the exploitation of communication technology and management of facilities. *"Communications have to be network centric, special multimedia applications and provide global connectivity and numerous value added services".* This will bring in the much needed

synergy between various resources at the disposal of a commander and facilitate their optimum and timely application/exploitation.

Network Centric Warfare is the product of convergence of computers and communications. NCW is information superiority enabled, concept of operations, that generates enhanced combat power by networking the sensors, shooters, decision makers and soldiers in the field. Thereby we translate the information superiority and assurance into the combat power. The concept of NCW is premised on three hypotheses:

- (a) Information sharing promotes shared awareness across the networked force,
- (b) Shared awareness improves collaboration and synchronization,
- (c) Improved synchronization yields greater mission effectiveness, due to:
 - (i) A Greater Speed of Command
 - (ii) Resource Sharing
 - (iii) Increased Lethality, Survivability and Responsiveness.

Networking of sensors, shooters and decision makers will thus be able to generate increased combat power by better synchronized effects in the battle space, achieving greater speed of command and by increasing lethality and responsiveness. Structurally, the network centric warfare involves an operational architecture with three critical elements:

- (a) Network Grid for Sensors (Sensor Grid)
- (b) Network Grid for Shooters (Engagement Grid)
- (c) Command and Control Grid (C2 Grid)

Defining NCW

A US Department of Defense release in 2005, entitled ‘The Implementation of Network- Centric Warfare’, defined NCW as “the combination of emerging tactics, techniques and procedures that a fully or even partially networked force can employ to create a decisive war-fighting advantage.” The document highlighted three characteristics:

- (a) NCW is first of all about human behavior as opposed to information technology. The focus is on the verb ‘to network’ rather than on the noun ‘network’, which is just an enabler;

- (b) NCW is a concept that, at the highest level, constitutes the military's response to the information age;
- (c) NCW is an emerging theory of war because it identifies new sources of power (information sharing, information access, speed), how those sources relate to each other, how they are brought to bear to achieve the desired outcome, and how they link to political objectives.

NCW is an information superiority-enabled concept of operations that generates increased combat power by networking sensors, decision makers, and shooters. It focuses on the tactical and operational level of warfare, but they impact all levels of military activity from the tactical to the strategic. At operation level it provides commanders with the capability to generate precise warfighting effects. In brief, NCW is not narrowly about technology, but broadly about an emerging military response to the Information Age. It is the emerging theory of war for information age. NCW is often associated with advanced command and control systems, information technology and superiority and computer networking. This is achieved by providing a mechanism to rapidly gather and distribute targeting information, and rapidly issue directives.

The term network-centric warfare provides a useful shorthand for describing a broad class of approach to military operations that are enabled by networking of the force. "Networking the Force" entails much more than providing connectivity among force components. It involves the development of distributed collaboration processes designed to ensure that all pertinent available information is shared and that all appropriate assets can be brought to bear by the enemy by employing dominant manoeuvre, precision engagement, full-dimensional protection, and focused logistics. Network Centric Warfare takes place simultaneously in various Domains of the existing war fighting environment. These domains are as given below:

- (a) **Physical Domain.** Physical domain is the traditional domain of warfare. It is the domain where physical platforms and the communication networks that physically connect them reside. All elements of the force are robustly networked achieving secure and seamless connectivity. The elements of this domain are the easiest to measure, and the important metrics for measuring combat power in this domain are lethality and survivability.
- (b) **Information Domain.** This is the domain where information is created, manipulated, shared and resides. It is the domain that facilitates the communication of information among war fighters. It is the domain

where command and control of modern military forces is communicated, where commander's intent is conveyed. This domain must be protected and defended to enable a force to generate combat power in the face of offensive actions taken by an adversary.

- (c) **Cognitive Domain.** Cognitive domain is the domain of the mind of the warfighter and the support populous. This is the domain of intangibles: leadership, morale, unit cohesion, level of training and experience, situation awareness, and public opinion. The attributes of this domain are extremely difficult to measure, and each sub-domain (each individual mind) is unique.

The Technological Dimension. The technology supporting NCW is inherently complex. A basic prerequisite for an NCW capability is the digitization of combat platforms. A fighter plane, tank or warship with a digital weapon system can be seamlessly integrated in an NCW environment by providing digital wireless connections to other platforms. Without the digital weapon system, and its internal computers, NCW is not implementable. Key issues of the technological dimension are:

- (a) Security of Transmission.
- (b) Robustness of Transmission.
- (c) Transmission Capacity.
- (d) Message and Signal Routing.

Benefits of NCW

The concept of NCW offers many benefits as opposed to the traditional platform centric approach of warfare. The situational awareness answers the questions which hovers in mind during the battle- '*where am I?*', '*Where is my friend?*' and '*where my enemy is?*'. With these answers, commanders can shape the battle space and control the various missions effectively. The benefits are:

- (a) Force Multiplier.
- (b) Faster and easier Integrated Mission Planning.
- (c) Synchronization of All Available Fire Support Elements in Battle Field.
- (d) Integrated Intelligence Network.
- (e) Archiving of Track Record.

Disadvantages of NCW

While undertaking NW operations there are some aspects that we need to keep track of. Yes the technology provides a big force multiplier effect it also has some attributes that we need to factor while undertaking the operations in an NCW scenario. Some of these are enumerated below:

- (a) The entry fee is reasonably higher.
- (b) Software and hardware are susceptible to cyber attack.
- (c) Secrecy may be compromised as open architecture and commercial interface standards of networking and software are used.
- (d) Wireless networking technology uses known electromagnetic spectrum. As such, disruption and eavesdropping of data are likely to be frequent.

NETWORK-CENTRIC WARFARE IN MILITARIES OF SOUTH ASIA



The militaries of the Asia-Pacific region continue to invest heavily in strategic communications systems. According to Gordon Arthur (Hong Kong Based Defence writer), this all points to one thing – they are getting serious about enhancing their Network-Centric Warfare (NCW) capabilities. Because NCW encompasses many intangibles that are difficult to gauge, much of the assessment of NCW capability will focus on new hardware being employed. In theory, such acquisitions should reflect more deep-seated NCW changes occurring within militaries. Let us now look at the Militaries of South Asia with respect to the

capability in NCW environment. While analysing this we will concentrate on four of the major Militaries of the region, namely China, Pakistan, Bangladesh and India. Other smaller nations though do possess Military capabilities but have not progressed much in the field of NCW.

NCW in China's Defence Forces

The People's Republic of China (PRC) may be a global power economically but its military lacks force projection beyond the Asia Pacific region. Its traditional military hardware is one to three generations behind the US and Russia. In light of these deficiencies it is probable that cyber warfare will provide China with an asymmetric advantage to deter aggression from stronger military powers as they catch up in traditional military capabilities. In the last two decades the PLA has tried to transform itself from a land based power, to a smaller, mobile, high tech power that is capable of reaching beyond its borders (China's National Defense in 2006). China is seeking to modernize this force. The size of China's traditional force will shrink, as fewer numbers are needed when new technology is introduced (Cordesman and Kleiber 2006; Corpus 2006; Moore 2000).

China's 2006 white paper on national defence places an emphasis on the informationization of the military. "Informationization" (xinxihua) means improving the PLA's ability to use the latest technologies in command, intelligence, training, and weapon systems. New automatic command systems linked by fibre-optic internet, satellite and new high-frequency digital radio systems, allow for more efficient joint-service planning and command, while also enabling a reduction in layers of command. The PLA's move towards information technology can be seen with the use of new space-based surveillance and intelligence gathering systems, ASATs, anti-radar, infrared decoys, and false target generators. PLA soldiers are using decision simulators, a low-light automatic tracking system for helicopters, and a battlefield artillery/mortar fuse jamming system derived from Russian technology. "Priority is given to R&D of new and high-tech weaponry and equipment, and endeavors to achieve breakthroughs in a number of key technologies and leapfrogging technological progress, thus speeding up weaponry and equipment modernization" (China's National Defense 2006). Informationization includes increased education of soldiers in cyber warfare and NCW, a reorganization of military branches and command system, and integrating joint operations. The PLA is improving the information network for military training, and has built more virtual laboratories, digital libraries and

digital campuses to provide distance learning and online teaching and training. University courses have emerged for cyber attack and defence, a study of hacker methods, computer virus design and application, and network security protocols (Annual Report to Congress 2008).

Chinese military doctrine places an emphasis on asymmetric attack. Cyber warfare epitomizes this, a low cost means of levelling the playing field. Though there is no official published paper on the latest NCW capability of the Chinese armed forces. But the white papers on Defence Preparedness do indicate large amount of emphasis being put towards digitisation of the data processing and integrating of its armed forces.

NCW in Pakistan's Armed Forces

Since 2010 the MoD of Pakistan has laid great emphasis on developing the NCW capabilities in her Armed Forces. It has laid emphasis on using NCW as a basis for strategic planning decisions. The PAF is the lead service in this aspect. Its old system of SILLACS is getting upgraded for better flow of information and also getting integrated with other two services. JF-17 operation, new batch of F-16, inclusion of Saab 2000 erieye, and ZDK 03 AWACS aircrafts are all part of steps taken by Pakistan Air Force, to meet the NCW and Electronic Warfare requirements.

More emphasis by all three services on EW and secure integrated communication is a step towards enhancing the NCW capability in the Armed Forces of Pakistan. The civil communication infrastructure is being utilized along with dedicated network of the armed forces towards enhancing NCW infrastructure and capability.

NCW in Bangladesh Armed Forces

The concept of NCW is not very familiar in Bangladesh Armed Forces. But they are definitely towards enhancing this capability in a phased manner, keeping in mind the resources and technology availability. However, the research analyses that the potentialities of present system automation, fiber optics link plan of BAF, recent initiative of ICT (Information and Communication Technology) directorate and above all, plan of own satellite launching project of BTRC (Bangladesh Telecommunication Regulatory Commission) are very much

promising to achieve NCW capability. Integration of all the surveillance sensors of BAF, Bangladesh Navy (BN) and Bangladesh Army (BA) are being looked at as the first step of sensor integration.

National data backbone of Bangladesh which is available to 41 district head quarters through telephone cables is being utilized to connect the military bases across the country. At service level BAF has digital MW communication between all bases and radar stations. Under project 'Falcon Eye', all BAF bases are also connected with the BA and BN sharing the same communication infrastructure.

NCW in Indian Armed Forces

NCW has recently been introduced as a war fighting concept in the Indian Armed Forces and various projects, procurements and doctrinal innovations are being undertaken to ensure that they are not found stranded at the wrong end of the revolution. However, almost all these initiatives pertain primarily to operations in the conventional spectrum. While building NCW capabilities for conventional operations, due priority is also being extended to meet the challenges of NCW in sub-conventional operations.

The existing communication networks in Army are based on ASCON Phase 1 and II, Army Intranet, AREN, Satellite and other zonal access networks. The proposed networks are, ASCON Phase III and IV, A WAN, a No of satellite networks and upgraded zonal access networks. The Air Force information dissemination system is known as IACCS. This is a network of radar and communication links for providing surveillance to various air defence elements, and assists in the command and control of deployed resources. For logistics, the Air Force has evolved Integrated Material Management On-line system (IMMOLS). For its administrative communication requirement it has a dedicated AFNET (Air Force Net Work). This system can be exploited for add-ons like e-mail, fax and video-conferencing. In The Indian Navy networking is through Local Area Networks (LANs) within the establishments, Metropolitan Area Networks (MANs) within the metropolises and Wide Area Networks (WANs) providing connectivity over the continental landmass of India, including island territories. Navy Enterprise Wide Network, LINK II project, development of encryption algorithms for multiple use, Computer Aided Decision Support systems (EMCCA, SADL, development and integration of IBW systems etc. are efforts in this direction.

As a part of national level *C4e* system, the Army has already made some headway in evolving its operational information system with the acronym ASTROIDS. Earlier the tactical command, control, communication systems (Tactical C3I) and its sub compo nets have been developed independently without adequate emphasis or inter-services integration and at times even without intra-service integration. In the realm of inter-Services integration, the most essential components of Tactical C3I systems amenable to joint development are Air Defence Control and Reporting System (ADC & RS), Air Space Control System (ASCS), joint Electronic Warfare (EW) and integration of sensors of all kinds at various levels. All these systems when properly enmeshed together would enable a joint commander to achieve real time battlefield transparency. All these systems would be spokes connected to a Decision Support System (DSS), providing inputs enabling the commander to reduce elements of fog, friction and uncertainty in the digitized battlefield.

RECOMMENDATIONS

Network-centric operations will deliver to the three armed services of any country a very powerful dynamism in terms RMA and act as a big Force Multiplier. At the strategic level, the critical element is a detailed understanding of the appropriate competitive space-all elements of battle space and battle time. Operationally, the close linkage among actors in business ecosystems is mirrored in the military by the linkages and interactions among units and the operating environment. Tactically, speed is critical. At the structural level, network-centric warfare requires an operational architecture with three critical elements: sensor grids and transaction (or engagement) grids hosted by a high-quality information back plane. They are supported by value adding command-and-control processes, many of which must be automated to get required speed.

Network-centric warfare enables a shift from attrition-style warfare to a much faster and more effective war fighting style characterised by the new concepts of speed of command and self-synchronization.

For the Militaries to enhance their NCW capability the force planners will have to look at certain changes and objectives to be achieved. These are as enumerated below:

- (a) A robustly networked information structure system to support information sharing and collaboration.

- (b) An appropriate technology base and an improved understanding of related issues.
- (c) Adoption of COTS approach by customization of commercial technologies.
- (d) Integrated development of informatisation and weaponisation.
- (e) Dominance of space and EM spectrum.
- (f) Educating and training people in the service on NCW.
- (g) Development of Core Group to monitor the progress of NCW and suggest timely changes to be abreast in the field of ICT.

CONCLUSION

“Societies That Want to Live in Peace, Should be Always Prepared for War”

Kautiyya

Network Centric Warfare (NCW) is the best term developed to date to describe the way we will organize and fight in the Information Age. It is also called “a fundamental shift from Platform-Centric Warfare to Integrated Systems Centric Warfare.” NCW is an information superiority-enabled concept of operations that generates increased combat power by *networking sensors, decision makers, and shooters* to achieve shared awareness, increased speed of command, higher tempo of operations, greater lethality, increased survivability, and a degree of self synchronization. In essence, NCW translates information superiority into combat power by effectively linking knowledgeable entities in the battle space.

To reach its full potential, Network Centric Warfare must be deeply rooted in operational art. As such, it is not possible to simply apply new technologies to the current platforms, organizations, and doctrine of warfare. There is ample historical precedence for the co-evolution of organization, doctrine and technology in the war fighting ecosystem. For example, performance advantages at the platform level have often led to the emergence of new doctrine, tactics, techniques, or procedures. During World War II, Army Air Corps commanders increased the survivability and lethality of daylight bombing operations by co-evolving tactics to exploit the improved range and endurance capabilities of the P-51 and the improved capabilities of the Norden Bombsight to conduct daylight precision bombing with fighter protection for the otherwise more vulnerable bombers.

Till date several national, theatre and access networks have been established, some of them are still unconnected with each other. But the future shall bring about the convergence and interconnection of all such networks on a common fabric. The IT workforce (civil and military) has been pioneer in the field of computers, communication and convergence and has got infrastructure, vision and will to achieve today's platform centric forces to Network Centric Forces and is leading the way on behalf of defence forces to achieve the same. The all-pervasive influence of information technology also creates overlap between strategic, operational and tactical levels of warfare and conflict. A perfected inter-Services communication network and an integrated C4e system would logically promote joint operational, joint doctrine, joint planning, joint intelligence, joint staffing and procedures. The RMA and the nature of war dictate to us that our armed forces fight as an integrated force. The new tools of IT would help the defence forces to fuse together in reinforcing and complementing each other. A streamlined Inter-Service Network, C4e system supported by ISR and precision platforms would enable defence forces to truly become Network Centric Forces of the twenty first century.

NCW is an emerging theory of war in the Information Age. It is also a concept that, at the highest level, constitutes the military's response to the Information Age. It is the high-tech defence concept for the future, based on open but highly secured internet-type network architecture. It is characterized by the ability of geographically dispersed forces to attain a high level of shared battle space awareness that is exploited to achieve strategic, operational and tactical objectives. This linking of people, platforms, weapons, sensors and decision aids into a single network creates a seamless, joint and coalition warfighting force.

The concept of NCW is relatively new to the Armed Forces of South Asia. Present system of flow of information is inadequate for NCW and is complex and lengthy. A minimum level of information technology infrastructure is very essential to start evolving NCW processes. Most of the Armed Forces of this region do have modern telecommunication facilities, as well as national communication sector is also modernizing very fast. Integration both the national and armed forces resources, a robust network can be established which will enable the armed forces to enhance and build towards NCW capability.

NCW is a buzzword for the 21st century's military thinkers. This is an emerging theory of war in this digital age. Today, internet pages and recent defence publications are now flooded to promote this concept. The temperature of

today's stupendous development in ICT sector is felt through the evolution of the real time shared battle space picture. Driven by the prescription of Boyd's OODA loop, now military commanders pursue for information dominance to achieve the operational effectiveness in war.

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Air Commodore Surat Singh was commissioned in the Indian Air Force (LAF) on 06 Dec 1986 as a fighter pilot. He has close to 3000 Hrs of fighter flying on Mig-21, Mig-29 and Su 30 aircrafts. During his service career he has held the appointments of Flight Commander and Commanding Officer of a Mig 29 Sqn. He has also been an instructor in the tactics school of the LAF. Besides commanding the Fighter Sqn, he also commanded a Radar Station, The prestigious Tactics School of the LAF. He has been an Inspector for Flying Operations of the LAF for three years. Before joining NDC he was commanding the premier Su 30 fighter base of LAF at Pune.

He is a graduate of Australian Command and Staff Course, Canberra. During the course he did his Masters in Management and Defence Studies from University of Canberra. He also holds an M. Sc degree from University of Madras in Mil Studies. He has been commended twice by the Air Officer Commanding in Chief, and has been awarded three medals for distinguished service by the President of India. A keen sportsperson, he plays Squash, Volleyball and Golf. He is married to Mrs Nisha Singh, a home maker, and is blessed with a daughter and son.