CANADIAN FORCES COLLEGE / COLLÈGE DES FORCES CANADIENNES
JCSP 35 / PCEMI 35

EXERCISE/EXERCICE NEW HORIZONS

NETWORK CENTRIC WARFARE : THE WAY AHEAD FOR INDIA

By /par Major Saurabh Joshi

NETWORK CENTRIC WARFARE : THE WAY AHEAD FOR INDIA

> "The implementation of NCW is first of all about human behaviour as opposed to technology. The key is to see how do forces behave, perform, and organize themselves when they are networked"
>
> -----United States Department of Defense[1]

The Revolution in Military Affairs (RMA) has been a catch phrase since the turn of the 21st century. Technology, a prime mover for the RMA, has made significant changes in warfare since the Napoleonic and industrial age. Network centric warfare (NCW) has emerged to be a key concept within the RMA as it influences the strategic, operational and tactical levels of warfare by significantly improving the combat potential of the forces. Originally developed by the US Navy, to facilitate its expeditionary role, the term NCW is now dominating the entire US military transformation including command and control (C2) frameworks.[2]

The US led coalition forces in Gulf War; Operation IRAQI FREEDOM (OIF) and Afghanistan have achieved ground breaking success in linking technologies on the battlefield through NCW.[3] Highly networked coalition forces achieved complete supremacy over their counterparts within a few days of both conflicts. But, soon afterwards, the post-conflict situations in Iraq and Afghanistan have raised questions over the enduring efficiency of NCW. Some possible drawbacks, initially spelled out by the early proponents of NCW as potential problems are now manifesting themselves. The use of unconventional and asymmetric tactics by insurgents, have also further highlighted significant challenges to the use and implementation of NCW. Over-reliance on information and technology, at the cost of neglecting the human

---

[1] United States Department of Defence, Office of Force Transformation, *The Implementation of Network Centric Warfare* (Washington, DC: Office of the Secretary of Defence,2005), 3.

[2] Allan English, *Beware of Putting the Cart Before the Horse: Network Enabled Operations as a Canadian Approach to Transformation* (Toronto : DRDC Report, 2005), 1.

[3] John Luddy, "The Challenge and Promise of NCW", Lexington University, executive summary (February 2005); available from www.lexingtoninstitute.org/docs/521.pdf ; internet; accessed on 21 February 09.

dimension in C2 and transformation of forces, have been cited as some of the major reasons for the ineffectiveness of NCW.[4]

Traditionally seen as a regional power, India, is now emerging as a major power on the global scene. Indian Armed Forces (IAF) have attempted to adopt the American NCW concept in order to transform itself into a world class military. The IAF has built up a significant networking capability, albeit without complete integration, across its three services, viz, Army, Navy and the Air force. India's geo-strategic location, its emerging economy, and a unique regional role, makes its forces significantly different from the expeditionary role played by the only super-power in the world. The land-centric IAF face hybrid challenges of limited conventional conflicts (with a nuclear backdrop) as well as irregular and asymmetric threats characterized by terrorism, insurgency, sectarian violence, piracy, etc. This wide spectrum of challenges demand not just the adoption of superior technology and information techniques but also superior C2, leadership and a human-centric approach. While most developed nations have embraced the concept of NCW to modernize their militaries, they have adapted it to their own requirements and capabilities. The IAF too needs to view and develop NCW, through its own lens and national needs. The challenges and criticalities, typical to the IAF have to be addressed in the development of an Indian NCW concept rather than slavishly following the American model.

Thesis Statement

There is no doubt that the IAF should seek a robust NCW capability, in order to become a credible military and to achieve interoperability with the modern armies of the world. This paper will argue that the IAF needs to create a strategic NCW programme with a NCW task force, to adopt a balanced approach in achieving NCW, through the balanced development of the critical human dimension.

This paper will first briefly examine NCW as a concept and then illustrate some of the key capabilities it provides. The paper will then focus on some of the peculiar challenges it

[4] English, *Beware of Putting*… ,abstract.

presents that warrant extensive and comprehensive development of the human dimension of NCW.

After examining the current Indian NCW capability, the paper will then highlight some of the existing gray areas which require further investigation by the NCW task force. The paper will conclude by suggesting a strategic approach to be developed by the NCW task force, in order to best leverage the NCW advantages within an Indian context.

WHAT IS NCW?

Before embarking upon the evaluation of NCW, a common understanding of NCW is first required. There exist many versions of the US coined NCW concept. The UK describes it as Network- Enabled Capabilities (NEC) with a 'command-centric' approach rather than a network-centric approach. The Australian military focuses more on the 'human' dimension of NCW. Canada describes it as Network-Enabled Operations (NEOps), which are network enabled but human-centric.[5] One of the earliest descriptions of NCW was given by three of its first proponents- David Alberts, John Gratska and Fredrick Stein:

> NCW is about human and organizational behavior. NCW is based on adopting a new way of thinking—network-centric thinking—and applying it to military operations. NCW focuses on the combat power that can be generated from the effective linking or networking of the war fighting enterprise. It is characterized by the ability of geographically dispersed forces (consisting of entities) to create a high level of shared battle space awareness that can be exploited via self-synchronization and other network-centric operations to achieve commanders' intent.[6]

In essence, NCW was initially seen as a new mindset to be applied to operations by leaders to enhance C2. NCW has its roots in the success of networked business which sought to integrate subunits in a corporate organization to generate better business solutions for customer

---

[5] *Ibid*.,7.

[6] David S. Alberts, John J. Garstka, and Frederick P. Stein, *Network Centric Warfare: Developing and Leveraging Information Superiority,* Second Edition (Revised) (Washington, DC : CCRP Publications Series, 1999),88.

care, supply and demands, decision making and collaboration.[7] Networking was seen to increase the overall efficiency of the corporations through shared awareness. The advocates of NCW saw such enabling capabilities as ideally suited to a complex battlefield wherein highly dispersed, yet networked, forces could generate information superiority[8] through shared awareness and self synchronization.[9]

NCW in military operations essentially aims at integrating the sensors, weapon platforms (shooters), and the C2 (ie the decision makers). This integration occurs via a secure network to provide a common operating picture (COP)[10] and situational awareness to the commanders.[11] NCW is based on the Metcalf Law principle that states that the increase in combat power of a force is directly proportional to the networking of weapons, sensors and C2 elements.[12] But, NCW is not just about technology and networks. It also focuses on information flows and interaction between different battle space entities.[13] Significant changes in behaviours,

---

[7] Paul T Mitchell, *Network Centric Warfare and Coalition Operations : The New Military Operating System* (New York: Routledge,2009),31.

[8] Information superiority as defined in Joint Publication 3-13, is the ability to collect, process and disseminate an uninterrupted flow of information while exploiting and/or denying an adversary's ability to do the same. Achieving information superiority increases the speed of command preempting adversary options, creates new options, and improves the effectiveness of selected options. This promises to bring operations to a successful conclusion more rapidly at a lower cost. Alberts,Garstka,et al, Network…,54.

[9] *Ibid*.,54. self synchronization enables lower-level decision makers to be guided only by their training, understanding of the commmander's intent, and their awareness of the situation in relevant portions of the battlespace. They can take actions without formal orders and directions from seniors. Alberts, David S., Garstka, John J., Hayes, Richard E. and Signori, David A. *Understanding Information Age Warfare* (Washington, DC: CCRP Publications Series, August 2001), 219.

[10] COP means a singular representation of Operational Information, based on common data and information shared by more than one command that can be tailored by users. Note: The representation shows both temporal and spatial relationships, and the assessed confidence value of the information. It facilitates collaborative planning, self-synchronization, and assists all echelons to achieve situational awareness. Dept. of National Defence, *Canadian Forces Operations* (Ottawa, ON: Dept. of National Defence, 2005), 21-6.

[11] Australian Department of Defence, "NCW Roadmap", (Canberra, ACT: Defence Publishing Service, Dept of Defence, 2005), 4.

[12] Shitanshu Mishra, "Network Centric Warfare in the context of Operation Iraqi Freedom", *Strategic Analysis* , Vol 27, No 4, Oct- Dec 2003, Institute for Defence Studies and Analysis, available from *www.idsa.in/publications/strategic-analysis/2003/oct/Shitanshu.pdf ;* internet; accessed on 10 Jan 09.

[13] Alberts,Garstka,et al, *Network*…, 93.

organizations and doctrines must also occur in order to exploit the technology into combat power and apply it to best advantage.[14] While NCW covers a wide spectrum of merging strategies, tactics, techniques and procedures (TTPs), even small, networked forces can apply NCW to achieve a decisive war fighting advantage. "The key to implementation of NCW lies with human behaviour as opposed to technology: how forces "behave, perform, and organize themselves when they are networked."[15]Thus, the human dimension is the main synergestic factor in the development and implementation of NCW.

> Clay Wilson in a CRS report to the US Congress listed several C2 objectives of NCW:
>
> (1) Self-synchronization, or doing what needs to be done without traditional orders; (2) Improved understanding of higher command's intent; (3) Improved understanding of the operational situation at all levels of command; and, (4) Increased ability to tap into the collective knowledge of all U.S. (and coalition) forces to reduce the "fog and friction"[16] commonly referred to in descriptions of fighting".[17]

Dr. Paul Mitchell, a Canadian analyst, characterizes the NCW framework as consisting of four domains: the physical, the information, the cognitive, and the social domains (see Figure 1).[18] The 'physical' domain includes all the seamlessly connected weapon platforms, maneuver and strike elements and spans all environments where forces might conduct military operations. The 'information' domain includes all the sensors which enable information to be created and shared. These sensors provide raw footage, display and/or impressions to create an overall picture of the battle space. It is where C2 of military forces is exercised and the commander's intent is conveyed.[19] The third is the 'cognitive' domain which resides in the 'mind' of the

---

[14] Clay Wilson, CRS Report RL32411; *Network Centric Operations: Background And Oversight Issues For Congress*, Report Prepared for the U.S. Congress, 15 Mar 2007, 6.

[15] United States Department of Defence, Office of Force transformation, *The Implementation of Network Centric Warfare*, Washington, DC, 2005, 3.

[16] Fog describes the uncertainty in a battlefield. Whereas, friction describes difficulty of translating Commander's intent into battlefield actions.

[17] Wilson, *Network Centric Operations…*, 2.

[18] Mitchell, *Network Centric Operations*…, 37.

[19] Office of Force Transformation, *The Implementation of*…, 20.

warfighter.[20] It includes all the intangibles of command, leadership, training, morale, etc. It is in this domain that all the information is converted into knowledge and understanding.

The latest addition to the framework is the fourth domain - the 'social' domain. It mediates the evaluations, judgments, and decisions developed in the cognitive domain. This important domain is where humans interact, exchange information and make decisions. Although it is distinct, it overlaps with the information and cognitive domain as shown below.[21]

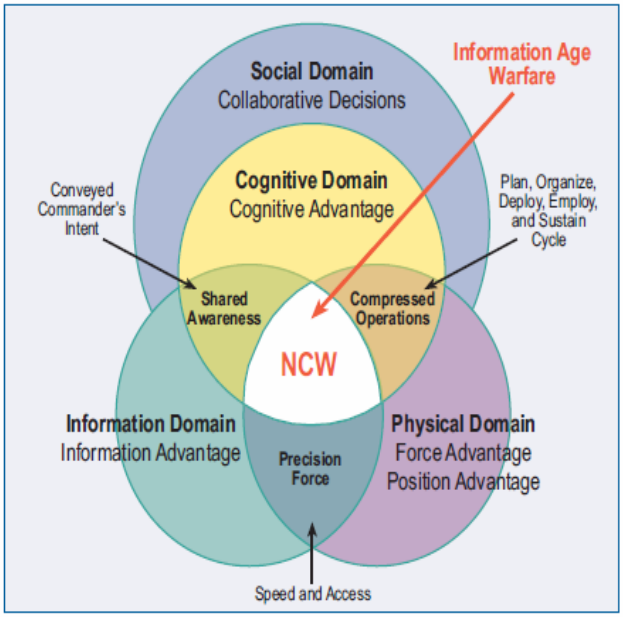

Figure 1- NCW Domains.

Source: Office of Force Transformation, *The Implementation of NCW*,20

The information and cognitive domain clearly overlap to create shared awareness. The physical and cognitive domain overlap facilitates faster planning, deployment and employment i.e. compressed operations. The information and physical domain overlap to form a highly mobile and precise force. At the centre or nexus facilitating this entire activity is the NCW.[22] For the purpose of the thesis, the main focus will be on the cognitive and social domain. After

[20] Ibid.

[21] Ibid.

[22] Phillip G. Pattee," Network-Centric Operations : A Need for Adaptation and Efficiency," *Air & Space Power Journal* - Spring 2008 available from ;internet accessed on 21 Mar 09.

having overviewed the concept of NCW, I will now evaluate and analyze some of the major advantages gained from it.

ADVANTAGES

NCW, when properly achieved and applied, can result in significant increases to the combat potential of forces at all levels of warfare. It can enable self synchronization and situational awareness (SA)[23] that allows junior commanders and individual soldiers at the tactical level to operate independently and autonomously. They can make decisions based on shared information, and/or through knowledge of their commander's intent.[24] Improved information sharing with higher and lower echelons, and enhanced understanding of the situation, enables operational and tactical commanders to get ahead of the enemy OODA[25] loop and take faster decisions. It also helps commanders to bring appropriate assets to bear at the right time and place during combat operations.[26] Information superiority thus results in faster decision making, pre-emption and increases overall tempo[27] of the combat operations.[28]

NCW also enables networked forces to be smaller and dispersed thus reducing the 'battlespace' footprint and concentrating on effects rather than massed force.[29] Small, lean and

---

[23] The term *situational awareness* describes the awareness of a situation that exists in part or all of the battlespace at a particular point in time. Alberts, David S., Garstka, John J., Hayes, Richard E. and Signori, David A. *Understanding Information AgeWarfare* (Washington, DC: CCRP Publications Series, August 2001), 120.

[24] Ibid., 9.

[25] Observe, Orient, Decide, Act—a cycle used by Colonel John R. Boyd, U.S. Air Force, to characterize fighter engagements and since then applied to the decision-making process in general. Major Trussel, Canadian Approach to NCW: Data Links and Multi Sensor Fusion, Journal on-line available from www.*ps.cfc.forces.gc.ca/papers/csc/csc30/exnh/truswell.doc*;internet;accessed on 20 feb 09.

[26] Wilson, *Network Centric Operations…*, 2.

[27] Tempo is the rate or rhythm of activity relative to the opposition. A faster relative tempo will allow one side to seize the initiative and dictate the conduct of operations. Tempo incorporates the capacity of a force to transition from one operational posture to another. By varying tempo or rhythm of operations a commander can impose threats to which an opponent's decision cycle is increasingly unable to react, and thus to which his responses are increasingly inappropriate. Dept. of National Defence, *Canadian Forces Operations* (Ottawa, ON: Dept. of National Defence, 2005),3-1.

[28] Ibid.,51.

highly mobile forces can achieve decisive results due to information superiority. NCW also allows superior application of combat power through precision targeting, enhanced control of operations, minimum collateral damage and better interoperability.

Knowledge of exact location of friendly forces also minimalizes fratricide, a common occurrence in complex and chaotic war-fighting. For example, legacy methods of sharing information by pilots over audio links can now be overcome by pilots flying data-link equipped aircraft. This enables key information from the onboard sensors to be shared instantaneously with other platforms and enabling a COP.

In sum, NCW capability leads to faster responsiveness, concentration of force, and economy of effort at the strategic and operational levels. It also leads to better survivability and lethality at the tactical levels. The use of 'swarm tactics'[30]adopted by the US forces during OIF for example reflect the new ways of enabled war fighting at the tactical levels.

The real-time "sensor-to-shooter" link, with secure communications allows soldiers to do a quick on-site analysis of the situation and take immediate decisions thereby getting inside the enemy OODA cycle rather than await decisions from far-away commanders. It also increases the ISR capability and overall reach of sensors. It helps in conducting joint operations at the lowest organizational levels by eliminating structural boundaries.[31] The senior commanders may actually be able to guide the tactical commanders in critical situations as they will have better

---

[29] Alberts,Garstka,et al, *Network…*, 90.

[30] Swarm tactics--- networking allows soldiers to keep track of each other when they are out of one another's sight, forces could move forward in Iraq spread out in smaller independent units, avoiding the need to maintain a tight formation. Using "swarm tactics," unit movements are conducted quickly, without securing the rear. All units know each other's location. If one unit gets into trouble, other independent units nearby can quickly come to their aid, "swarming" to attack the enemy from all directions at once. Benefits may include the following: (1) fewer troops and less equipment are needed, so waging war is less expensive; (2) it is harder for an enemy to effectively attack a widely dispersed formation; (3) combat units can cover much more ground, because they do not have to maintain a formation or slow down for lagging vehicles; (4) knowing the location of all friendly units reduces fratricide during combat operations; and (5) swarming allows an attack to be directed straight into the heart of an enemy command structure, undermining support by operating from the inside, rather than battling only on the periphery. Wilson, *Network Centric Operations…*, 7.

[31] Office of Force Transformation, *The Implementation of…*, 10.

information. They may also help avoid negative strategic impacts due to their increased SA and the ability to avoid collateral damage. Thus, NCW enhances operational command for better tactical effects. In essence, NCW attempts to clear away the 'fog of war' in the battlespace.

CHALLENGES

Technology and information saw the US achieve success during the initial stages of OIF and in Afghanistan. However, the post-conflict operations emphasized the criticality of the human dimension in the social and cognitive domains. Allan English and others believe that "NCW exaggerates certain fashionable technological features of ideas about war fighting" and that "the sun may already be setting on NCW as 'post-hostilities' campaigns in Afghanistan and Iraq challenge some of its basic tenets."[32]

Well into its second decade, the technology permitting NCW still remains in a nascent stage and has definite physical limitations. This section will address some of the challenges facing the human dimension in the further development and implementation of NCW. These challenges include the uniqueness of land warfare, threats of irregular warfare and some real impacts on C2. The hybrid requirements of fighting conventional and irregular warfare make these challenges characteristic of the IAF.

Uniqueness of Land Warfare

One of the major challenges facing NCW has been its successful implementation on the land spectrum of warfare. The Navy and Air Force have been comparatively successful in adapting to net-centric ways of warfare given their roles, functions, and weapon platforms. It is easier to know both own and enemy locations of all ships, submarines, aircrafts etc in the sea and in the air. Thus, accurate SA can be achieved easily in the Air Force and Navy as they are platform "oriented". By contrast, SA is very difficult to achieve on land. The land environment remains highly complex due to the operating terrain and highly dispersed forces. The presence of civilian population and insurgents merged within them, adds a high degree of difficulty in

[32] Allan English, *Networked Operations and Transformation: Context and Canadian Contribution* (Montreal : McGill-Queen's University Press,2007), 5.

accurately predicting own and enemy dispositions. Moreover, the land battle is also a fight of wills, between the soldiers in a combat. Luck too plays a major role in the outcome of small subunit actions. The soldier on the ground with his finger on the trigger thus has decisions to make at every step. The captain of the vessel or an aircraft does that for the entire crew with adequate guidance, influence, information and communications from his superiors. The foot soldier has to rely on his own training, and intuition for most decisions. All these human intangibles are difficult to factor in the domains of NCW. Hence, the development of human dimension, within the cognitive and social domains, remains most critical in the application of land based NCW.

Another problematic area for land warfare is precise target identification. Identification of valid targets poses difficulties in the land context. It is further exacerbated by asymmetric warfare and the presence of irregular threats. The soldier in contact is perhaps the best person to identify targets in a complex environment and to make decisions to engage it. Hence, the human element in the decision matrix assumes importance. The tendency to rely on sensors and shooters to decide within the fog of war may be a definite recipe for disaster. Two physically displaced sensors may or may not pickup and identify the same target and find it difficult to achieve correct SA of the enemy. The man on the ground with his skills and contact with the enemy cannot be just pushed to the side. His judgment remains invaluable.

The aspects of legitimacy, legality and minimum collateral damage further highlight the necessity of man behind the machine. Intelligence assessment of information obtained by the sensors and then acting on it may be better conducted with a human brain rather than a software programme. Thus, success of NCW on land is heavily dependent on the human dimension which characterizes the social and cognitive domains.

Irregular Warfare

Perhaps harnessing intelligence, to gain SA over an elusive enemy poses the greatest challenges to the most sophisticated sensors. NCW, from its conception, was heavily focused against conventional militaries using conventional forces, weapons and similar TTPs. But, recent conflicts clearly show an alarming increase of non-state actors, insurgents and terrorists

that defy any definitions of "conventional". Today's adversary has better knowledge of the terrain, culture and social tapestry of the region. He typically operates from within the civilian populace and uses unconventional tactics. He seldom appears on the SA screen of his predators. He does not play by any rules and commonly resorts to kidnapping, hostage-taking, arson and sabotage. He is equally tech-savvy and is capable of waging cyber warfare. He can attack networks or use the same 'network' to gain information or sow information.[33] As Allan English argues, information dominance is not easy to achieve over an adversary who is capable of deceiving and disrupting your information gathering through use of the same technology that one's forces are using.[34]

Finally, it is 'Human' intelligence that proves to be more accurate as high-tech sensors fail to establish a pattern and differentiate the insurgents from the population. Another key aspect of essential task in irregular warfare is gaining the support of the local populace. This can only be done by winning their "hearts and minds" through a comprehensive approach of development, diplomacy and defense. The focus of an asymmetric conflict can be said to be in the mind of a man.[35] The requirement for minimum collateral damage in an irregular warfare also negates the need for a preponderance of highly lethal and technologically superior platforms. All these factors underline the importance of the human dimension in any successful application of NCW to irregular warfare. As American analyst John Luddy, recently has recently noted-

> NCW may improve what technology already does, but it cannot do things technology cannot -- such as occupy ground, protect patrolling troops from exploding mines and improvised explosive devices, or give skittish locals the feeling of security they need to come out and vote.[36]

The problems of complexity of the environment, difficulty in achieving SA, target identification, discussed earlier, also remain common while fighting a irregular warfare

---

[33] Edward Allen Smith, *Effects Based Operations : Applying NCW to Peace, Crisis and War*, DoD CCRP, Washington, DC, 2003, 72.

[34] English, *Networked Operations*…, 99.

[35] Edward Allen Smith, *Effects Based Operations*…,xxxvi.

[36] Luddy, *The Challenge*…,Introduction.

campaign. Simply put, there is no substitute for "boots on ground" in asymmetric or irregular warfare. One must clearly understand the importance of comprehending the human aspects of irregular warfare and ensure that this knowledge is assimilated and merged with the application of NCW to address the latter's limitations and shortfalls. The results of rampant irregular warfare fought the world over, warns of dire consequences of relying merely on technology and disregarding the human dimension in NCW.

Impacts on Command and Control

While NCW helps achieve information superiority, it may degrade or impair command decisions, essentially a critical human dimension within the cognitive and social domains. If leadership is not trained, nurtured and developed in tandem with the other domains of NCW, the C2 dimension will spell death for NCW. There is a risk of commanders waiting and relying heavily on that 'last' critical piece of information before taking a decision.[37] Commander's analysis of the enemy, or 'reading' the enemy's design of battle based on their own experience, may get degraded and may actually delay decisions. Information dependence can constrain the creative, analytical process required for a true operational planning process.

Commanders must remember, according to Australian Defence doctrine, "while the concept of transparency is seductive, it is almost certainly unachievable".[38] According to Milan Vego, commanders can become micro-managers, drawn down to the tactical level rather than remaining at the operational and strategic through an over- reliance on technology.[39] Commanders would end up in becoming micro-managers. 'Zero-mistake' syndromes and enormous powers would force operational commanders to force control over tactical actions.[40]

---

[37] Australian Defence Force Doctrine Publication-D.3.1, *Enabling Future Warfighting : Network Centric Warfare*, Edition 1, (Canberra, ACT: Defence Publishing Service, Dept of Defence, 2005), 3-3.

[38] Ibid.

[39] Milan Vego, *Net-Centric is Not Decisive*, United States Naval Institute Proceedings 129, (January 2003), 56.

[40] Erik J. Dahl, *Network Centric Warfare and the Death of the Operational Art.* U.S. Naval War College, Newport, RI, (November 2001), 9.

This over-centralisation of C2 could take initiative away from the juniors, jeopardizing the concept of mission command[41] and forcing subordinate commanders to always look up to seniors for directions. Thomas Barnett aptly summarizes this potential syndrome when he states –

> I am concerned that the push for speed of command and self-synchronization will drive all participants to an over-reliance on the COP as a shared reality that is neither shared nor real. The COP cannot really be shared in the sense that ownership will remain a top-down affair. What is scary about NCW's ambition is the strain it may put on commanders at various levels to integrate the commander's intent from all other commanders and not just up the chain of command. NCW promises to flatten hierarchies, but the grave nature of military operations may push too many commanders into becoming control freaks, fed by an almost unlimited data flow. In the end, the quest for sharing may prove more disintegrating than integrating.[42]

A corollary to the above syndrome is that subordinates may be drawn into second guessing their senior commander's intent due to their own upward's access to the higher level picture. This could lead to erroneous initiatives.

Information superiority has also been criticized for lending itself to information-overload. Huge amounts of data and info requiring processing can arrive and individuals or software may not have the capacity or time to analyze it in a timely fashion. This may lead to "paralysis" due to a lack of analysis. Once again, the necessity of stressing development of the human dimension within the domains of NCW comes to the fore. Only serious training, along with a

---

[41] Mission command allows faster, more relevant decision-making in complex, volatile environments, but also relies more heavily on individual judgement and tactical exertion. It is based on the clear expression of the senior commander's intent and the granting of freedom to subordinates to act creatively within that intent. In order for mission command to be successfully employed, the junior leader must have a detailed understanding not only of the immediate tactical commander's intent, but also of the broader operational and strategic situation. The subordinate is then expected to apply tactical judgement in achieving the commander's intent, regardless of changing situations. Junior leaders are also expected to seek opportunities to pursue their commander's intent without waiting for formal orders. Department of Defence. *The Fundamentals of Land Warfare*. Puckapunyal, Australia: Land Warfare and Development Centre, 2008, 50.

[42] Thomas Barnett, "The Seven Deadly Sins of Network-Centric Warfare," United States Naval Institute. Proceedings, Annapolis, Jan 1999. Journal on-line; available from https://acc.dau.mil/GetAttachment.aspx?id=37559&pname=file&lang=en-US&aid=9064;internet; accessed on 5 Mar 09.

clear articulation of information requirements and a comprehensive strategy or doctrine, can ensure the alleviation of the problems cited above.

According to Barnett, another gray area in the cognitive and social domain of NCW is that sharing SA does not necessarily result in understanding that shared appreciation of the situation. Correct appreciation and response to a situation only comes through extensive training, education, and experience. The technological component of war can never fully account for the dynamic interaction of human beings and "war will remain predominantly an art, infused with human will, creativity, and judgement."[43]

Human skills also play an important role in the cognitive domain. In spite of all the technology and information superiority achieved by an armed force, ultimately it is the man behind the machine that delivers the goods. The recent example of US and Allied forces bloodless victories over Iraqi forces can be directly attributed to the inferior skills and training of the Iraqi forces. According to Allan English, better skills and training, even with inferior technology, could have resulted in coalition forces sustaining many more casualties. The technologically superior Allied forces on the other hand, with inferior skills and poorer training, could have fared catastrophically in the campaign.[44]

Over-reliance on information and technology can also give rise to major concerns relating to C2. Some of these are the impacts they have on creativity and intuition. Commander's personalities, emotions and competencies clearly influence decision making. John Luddy rightly asserts:

> Key aspects of leadership and the "art of war," such as intelligence, training, and command initiative, can be assisted by a network, but they cannot be replaced by one. Likewise, while network-centric operations are sustained by information and data, they have not reduced combat leadership to a process of quantitative azcalculations. In short,

[43] Ibid., 100,104.

[44] English, *Networked Operations*…, 96.

> as a technology-based process, networking can neither replace, nor succeed without, many other less tangible, human aspects of waging war.[45]

All the challenges discussed above have a common theme running throughout. Success or failure is dependent on the human dimension aspects of NCW and how it is intellectually addressed and applied, not the technology!

DEVELOPING THE INDIAN NCW CAPABILITY

This section will examine the current Indian NCW capability and identify certain gray areas that require clear definition and focus. By examining the contrasting requirements of the IAF, this section will identify the need for a balanced approach to achieve NCW and recommend options to be considered by the NCW task force at the strategic level.

Current Capability

The IAF have made significant progress in developing a NCW capability. All three services have their own information networks connecting their respective assets into functional systems. However, they are still not joint and remain isolated within their own components. They have also achieved different levels of capability. The Navy is at the forefront in service NCW capability, while the Air Force and Army lag behind, the latter still dependant on manual feeding of data and information between existing systems.

The NCW capability of the Indian Army is based on the Army Static Switched Communication Network (ASCON) and Army Wide Area Network (AWAN) and Army Radio Engineered Network (AREN)[46] architecture.[47] The Army has developed the Command Information and Decision Support System (CIDSS), Artillery Combat Command and Control

---

[45] Luddy, *The Challenge*…Introduction.

[46] AREN is a tactical area radio communications system which provides Indian ground forces with a secure, computerised area grid communication network.

[47] "Indian Army Refines Network Centric Warfare Skills," article-online; available from http://news.indiamart.com/news-analysis/indian-army-refines--18095.html; internet; accessed on 21 Feb 09.

System (ACCCS) and Battlefield Surveillance System (BSS) which are network centric.[48] All systems achieve integration of the sensor, shooter and the decision makers, but most are only integrated up to the divisional level. The lower tactical echelons are designated to utilize SATHI[49] and FINSAS,[50] systems which help achieve a COP. The development of all these projects is glacial and future inter-services integration is a long way off.[51]

The Indian Air Force has based its network-centric capability onto a fibre optic network called the Air Force Network (AFNET). On this will ride the Integrated Air Command and Control Systems (IACCS).[52] The $4.2 million development of an operational data link (ODL) is a major step in achieving a NCW capability for the Air Force.[53] The ODL will integrate all aircraft, AWACS, radars ad UAVs with the C2 structure. It will have both data and voice networking capability.

The Navy is the most advanced service in achieving NCW capability. It has developed Navy Enterprise Wide Network (NEWN), Integrated Logistics Management System (ILMS),

---

[48] " C4I2SR in the Indian Context : Challenges and Responses," article-online;available from www.landwarfare**india**.org/index.php?action=details&m_id=180 - 60k ; internet;accessed on 15 Mar 09.

[49] The Beta Battle Computer, now named SATHI, is a hand held battle computer made for infantry sub units of the Indian Army under Project Beta, a pioneering project by Indian Army and Encore Software Ltd. SATHI, which stands for Situational Awareness and Tactical Handheld Information, provides 'Situation Awareness' and 'Communications' to a sub unit (infantry company and below) during operations in the battlefield. It is truly a battle computer, which acts as a force multiplier during engagements with the enemy and not merely a fancy PDA. It significantly improves co-ordination within the team and command and control by immediate and higher commanders thereby enabling swift surgical operations.

[50] F-INSAS has been taken up to equip Indian infantry with the latest weaponry, communication network and instant access to information on the battlefield.This program is similar to the future soldier programs of other nations. F-INSAS includes a fully networked all-terrain, all-weather personal-equipment platform, enhanced firepower and mobility for the digitalised battlefield of the future. The weight carried by soldiers will be reduced by at least 50%.

[51] Lt Gen V K Kapoor , "RMA and India's Transformation", article-online, available from www.idsa.in/publications/JDS/2.2/article8.pdf; internet; accessed on 23 Mar 09.

[52] "India Developing Network Centric Warfare Capability," available from http://www.expressindia.com/latest-news/India-developing-network-centric-warfare-capability/349591/; internet; accessed on 20 Apr 09.

[53] "India Declines Offer Of Free Data Link From Israel," available from http://www.defensenews.com/story.php?i=3899538; internet; accessed on 05 Apr 09.

Desktop to Desktop Messaging system and Maritime Domain Awareness (MDA) system. NEWN connects all its shore units with a high-speed optical-fibre backbone. ILMS provides on-line logistics support to all these shore units and its ships in harbour. The messaging system provides desktop to desktop messaging among users at all levels, from ships and establishments to Command and Naval Headquarters. MDA using wireless networks provides automatic exchange of radar and other sensor data, among units of a force at sea.

What IAF Lacks

Although, the IAF have a significant UAV capability within its three services, there exists no integration to leverage a wide array of Intelligence, Surveillance and Reconnaissance (ISR) capability. The Army UAVs are integrated within the BSS. However the Air Force and Navy operated UAVs have their own service integration and thus do not yield a wider coverage as well as a COP at the strategic level. Integrated planning, development and acquisition for all three service NCW systems including UAVs is still non-existent with very little strategic oversight for interoperability or jointness.[54]

Data networking within the three services needs to be integrated to obtain a better strategic and operational COP. Incorporation of Internet Protocol-based communications networks (IIPC) is also required.[55] Also, uniformity in data in order to be utilized by all sensors and weapon platforms is lacking in the IAF. Except for the recently created Headquarters Integrated Defence Staff, at the National level, the IAF have very limited joint and interoperable organizations at the operational and tactical level. This seriously hampers transfer of information, communications, execution of operations and ultimately fighting jointly.[56] NCW can only flourish when there exists a common, robust, secure and interoperable communication

[54] Kapoor, *RMA and India's…*, 141.

[55] Ibid.

[56] Kapoor, *RMA and India's…*, 134.

network shared amongst the three services. To date, each of the services have created insular networks within their own domains and with limited potential interfaces.[57]

Indian space research and exploration capabilities which have heralded India as a major player in the world should also be mentioned. The numerous satellites launched by India are for dual use (ie for both military and civilian usage.) However, there still remains a need to develop hardware and software to integrate satellites with military aircrafts and weapons platforms to make them NCW compatible.[58] There is also a requirement of connectivity to ensure speedy distribution of information to the troops on ground.[59] In sum, there are numerous problems of interconnectivity between existing systems that require a balanced strategic level approach to ensure a robust and well coordinated NCW capability for the IAF.

Need for a Balanced Approach

The impact of globalization has been felt by the IAF. 'Security' no longer means protection form traditional and conventional military threats. Security is not restricted to the military domain but spins various political, social, economic and religious domains as well. Along with its traditional adversaries, India faces daunting challenges from global terrorism, weapons of mass destruction and regional instability, and therefore must leverage the myriad forms of technology it has at its disposal. The key catalyst in all this will emanate from the human dimension.

On the one hand, the conventional threats facing India, call for a force on force, conventional solution. Conventional conflicts, however, will remain localized and limited in their geography and extent and achieving a robust NCW capability with a focus on information and technology will certainly help the IAF to gain all the advantages discussed in the paper. NCW will also help the IAF to become a highly mobile, precise, lethal and a lean force.

---

[57] Mishra, "*Network Centric Warfare*…, 558.

[58] Lon Rains,"India Exchanging Network Centric Warfare Concepts with STRATCOM," available from http://www.space.com/spacenews/archive06/indiaspace_1016.html; internet; accessed on 10 Apr 09.

[59] Ibid.

Advantages of NCW like SA, self-synchronization, enhanced decision making and the capability to conduct operations faster will give India a cutting edge over her conventional adversaries. NCW will also facilitate application of the latest concepts of cold start[60], and heavy breakthrough. Thus, achieving NCW remains a pre-requisite to achieve supremacy over the conventional conflicts.

A corollary to the conventional operations is the ability to participate in the coalition operations such as UN missions all over the globe. These missions range from peace enforcement to peace keeping. Hence, the forces need to remain flexible to deliver every type of action. This calls for flexibility in C2 as well as leadership and soldiering writ large.[61]

On the other hand, IAF's extensive involvement in the Counter Insurgency (CI) operations has kept it stymied by the critical challenges already discussed in the paper. These challenges may have an adverse impact on the IAF which are heavily weighed by human-centered networks and human decision making. The IAF have also realized that challenges of IW have to be met with a holistic approach and not a net-centric approach. The IAF effectively employs a whole of government approach in the insurgency-torn areas of Kashmir and North Eastern parts of the country. This approach recognizes that networks extend beyond the mere use of technology into the realm of social networks.[62]

The competing requirements of conventional wars and irregular warfare thus necessitate a balanced approach for future development of IAF's NCW capability. Technology must be used as an enabler and not as driver for transformation of forces. To this end, as the IAF surges ahead with the technology component of NCW, the IAF must exercise caution and sagely develop and adapt its core human dimension within the cognitive and social dimensions. Any failure to

---

[60] Indian Army announced a new offensive doctrine in 2004 intended to allow it to mobilize quickly and undertake limited retaliatory attacks on its neighbor, without crossing Pakistan's nuclear threshold. This Cold Start doctrine marks a break with the fundamentally defensive military doctrines that India has employed since gaining independence in 1947. Requiring combined arms operating jointly with the Indian Air Force, Cold Start represents a significant advance in India's conventional military capabilities.

[61] Ibid., 137.

[62] English, *Beware of Putting*…, 66.

develop the human dimension concurrently will adversely affect the NCW domains framework and render it incapable of creating the desired advantages identified in this paper. The result of unbalanced development in the NCW domains has been demonstrated in Figure 2 below.

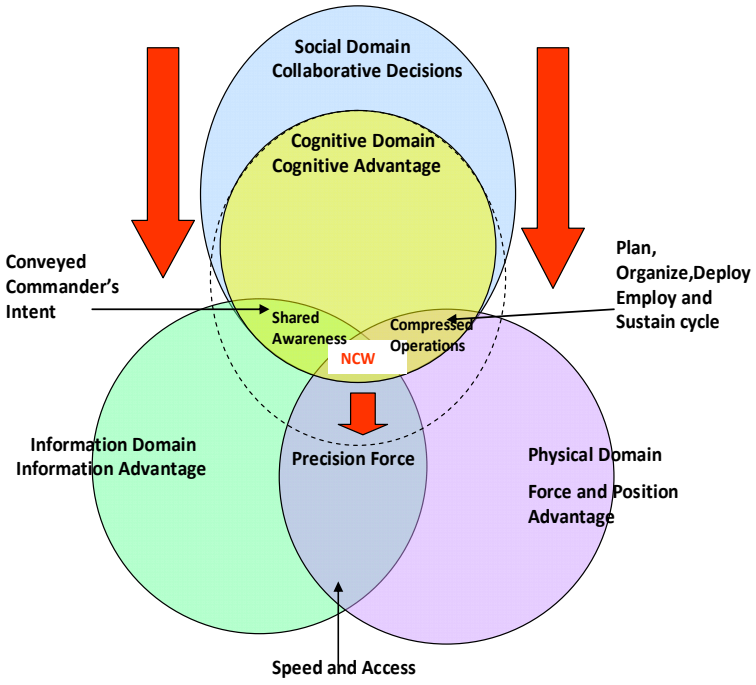

Figure 2- Unbalanced Domains = Minimal NCW Capability.

Source: Office of Force Transformation, *The Implementation of NCW*,20

Figure 2 clearly shows that stressing technology and information will certainly lead to a capability for a precise and lethal force in the information and physical domains at the base of the model. However, unless due emphasis and importance are placed on the cognitive domain within the larger social domain, the operations will remain slower and C2 inhibited by minimal shared awareness and an ability to plan and organize. Overall, there will be a minimal NCW capability achieved unless one expands the social and cognitive domains downwards with

emphasis on developing the human dimension within them so as to achieve a greater and more efficient NCW capability.

What the IAF Should Do

As recommended by Commodore Prem Chand, in 2005, India needs to create a focused strategic NCW programme. This programme should be championed by a strategic level task force (NCWTF)[63] to include experts from the military, government and industry along with and Defence Research and Development Organization (DRDO) officials. This NCWTF would conduct a lateral review at the joint services level as well as at the national level. After doing an analysis of existing capabilities in the services, government and industrial sectors, they would be in a position to address issues of funding, procurement and research and development. Indigenous experimentation, validation and development of equipment would also be addressed. Besides examining the technologies and organizations required for achieving the optimal NCW best suited for India, the NCWTF would also articulate doctrines, priorities, and budget allocations.

Technological development would no longer be a driver but would be harnessed as an enabler by the human domain. Thus, NCW doctrine would be established at the strategic level and would force all services to craft changes in TTPs, planning, organizational roles and responsibilities to meet strategic aims and objectives. They would direct required actions to achieve synergy within all arms and services and validate them through training and exercises. The NCW programme will have to adopt a comprehensive strategic approach, encompassing dimensions other than technology.

[63] Prem Chand, " Network Centric Warfare : Some Fundamentals, available from www.aerospaceindia.org/Journals/Spring%202005/**Network**-**Centric**%20**Warfare**%20-%20**Some**%20**Fundamentals**.pdf; internet; accessed on 23 Mar 09.

Figure 3 shows the approach adopted by the US DoD for achieving NCW capability. [64] As shown in the figure below, technological development at the core is carefully balanced by doctrine, organization and training on one side and leadership, personal and facilities development on the other.

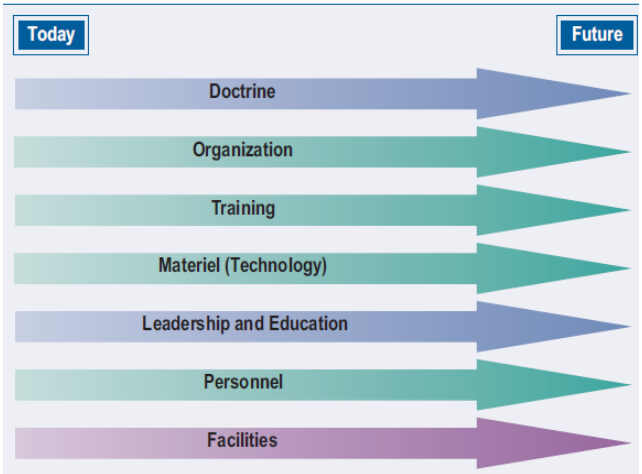

Figure 3 – NCW Approch : Co- evolution of Functional Areas

Source: Office of Force Transformation, *The Implementation of NCW*, 43.

Hence, the IAF also have to adopt a balanced approach with technological development being only a 'part' of the broader spectrum. Addressing aspects of leadership, personnel, training and doctrine will certainly develop the critical human dimension in the social and cognitive domains. Reinforcing the essential needs to enhance the IAF's NCW capability are recent comments by Lt Gen V K Kapoor to the effect that-

> …The change and transformation in Indian armed forces will require fundamental attitudinal change on the part of the military to accept and absorb the changes and to educate the political leadership so that they become stakeholders along with the military in the transformation process.[65]

[64] Office of Force Transformation, *The Implementation of*…, 43.

[65] Kapoor, *RMA and India's*…, 144.

Thus the development of a NCW strategy dictates that the IAF must understand technology is not a panacea, nor is it a substitute for good leadership. While India will certainly benefit from the war fighting capabilities that NCW brings to the fight, it must be done through a careful balance between technology (physical and information domains) and the critical human dimension that encompasses all aspects of C2, good leadership and a whole of government approach (cognitive and social domains).

CONCLUSION

NCW is the key enabler for the future joint war fighting capabilities of militaries all over the world. It has already revolutionalized the battlefield by its ability to provide precision engagements, shared SA, and enhanced C2. However, it has many vulnerabilities and challenges that still remain to be overcome, with the threat of insurgents and low-intensity conflicts remaining the biggest challenge. These challenges in Iraq and Afghanistan have forced the US, the pioneers of NCW, to shun its technological dependency and adopt a more holistic, human-centric approach. The criticality of human dimension has also influenced other modern militaries to re-define their approach towards building NCW capability.

Following the US, the IAF has acquired reasonable NCW capability, independently, within its three services for achieving a conventional superiority in the region. However, while doing so the thrust has been on technology and not on a balanced and complementary development of other aspects including the human dimension as discussed in the paper. India faces unique challenges both internally and externally in a very unstable region. The IAF has to respond to a wide range of conflicts from conventional, nuclear on one end to suicide bombers on the other. Hence, it is imperative that the IAF define and develop their own NCW capability and not slavishly follow the US.

The IAF needs to seriously review and develop NCW through its own lens of competing requirements. The IAF needs a strategic NCW programme, with a task force to develop, refine and coordinate a joint NCW roadmap. In this roadmap, development of human dimension within the cognitive and social domains must remain the underlying theme. The NCWTF should have

the ‘vested authority’ to facilitate rapid integration from the top down in tune with modern technology, make timely changes in order to ensure relevance, provide leadership and doctrinal inputs needed to transform current conventional thinking. The task force would also act as oversight body to validate NCW capability through training and exercises. Such a top-down approach will enable the IAF to propel from a network enabled/capable component force to a seamless, integrated, joint information-age force, read to meet all challenges of the 21st century.

BIBLIOGRAPHY

Alberts, David S., Garstka, John J. and Stein, Frederick P. *Network Centric Warfare: Developing and Leveraging Information Superiority*, Second Edition (Revised). Washington, DC: CCRP Publications Series, 1999.

Alberts, David S., Garstka, John J., Hayes, Richard E., Signori, David A. *Understanding Information Age Warfare*. Library of Congress Cataloging-in-Publication Data, September 2001,ISBN 1-893723-04-6. [http://www.ece.stevens-tech.edu/research/securesys/battlefield/ccrpReports/UndInfoAgeWar.pdf]

Australia. Department of Defence, "NCW Roadmap", Canberra, ACT: Defence Publishing Service, Dept of Defence, 2005.

Australia. Defence Force Doctrine Publication-D.3.1, *Enabling Future Warfighting : Network Centric Warfare*, Edition 1, Canberra, ACT: Defence Publishing Service, Dept of Defence, 2005.

Australia. Department of Defence. *The Fundamentals of Land Warfare*. Puckapunyal, Australia: Land Warfare and Development Centre, 2008.

Barnett, Thomas P. M. "The Seven Deadly Sins of Network-Centric Warfare," United States Naval Institute. Proceedings, Annapolis, Jan 1999. Journal on-line; available from https://acc.dau.mil/GetAttachment.aspx?id=37559&pname=file&lang=en-US&aid=9064.

Blaker, James R. The Legacy of Arthur Cebrowski and Network Centric Warfare, London, Praeger Security International, 2007.

Canada. Dept. of National Defence, *Canadian Forces Operations*. Ottawa, ON: Dept. of National Defence, 2005.

Dahl,Commander Erik J. "Network Centric Warfare and the Death of Operational Art." *Defense Studies* 2, no.1 (Spring 2002): 1-24.

Department of Defence (2000) *Joint Vision 2020* www.dtic.mil/jointvision/jv2020a.pdf and www.dtic.mil/jointvision/jv2020b.pdf.

Department of Defence Report to Congress (2001) *Network Centric Warfare 27 July 2001* www.dodccrp.org/NCW/NCW_report/report/ncw_main.pdf.

DRDC Toronto Contract Report. Vol. CR 2005-212. Toronto: Defence R&D Canada – Toronto, 2005.

English, Allan D., Carol McCann, Richard Howard Gimblett, Howard G. Coombs, Canada. Dept. of National Defence, Defence R&D Canada, and KMG Associates. *Beware of Putting the Cart before the Horse : Network Enabled Operations as a Canadian Approach to Transformation*, Toronto : DRDC Report, 2005.

English Allan. *Networked Operations and Transformation : Context and Canadian Contribution*, Montreal : McGill-Queen's University Press, 2007.

Luddy, John. "The Challenge and Promise of NCW", executive summary, Lexington University, February 2005, available from *www.lexingtoninstitute.org/docs/521.pdf* ;internet; accessed on 21 February 09.

Mishra, Shitanshu. "Network Centric Warfare in the context of Operation Iraqi Freedom", *Strategic Analysis* , Vol 27, No 4, Oct- Dec 2003, Institute for Defence Studies and Analysis, available from *www.idsa.in/publications/strategic-analysis/2003/oct/Shitanshu.pdf*

Mitchell, Paul. *Network Centric Warfare and Coalition Operations : The New Military Operating System* , New York: Routledge,2009.

Pattee, Phillip G.” Network-Centric Operations : A Need for Adaptation and Efficiency,” *Air & Space Power Journal* - Spring 2008.

Smith, Edward R. *Effects Based Operations: Applying Network Centric Warfare in Peace, Crisis and War* ,Washington, DC: Dept. of Defense-CCRP, 2003.

United States. Office of Force Transformation, ed., *The Implementation of Network Centric Warfare,* Washington, D.C.: Force Transformation, Office of the Secretary of Defense, 2005.

Vego, Milan. *Net-Centric is Not Decisive,* United States Naval Institute Proceedings 129, January 2003.

Wilson, Clay. *CRS Report RL32411 Network Centric Operations: Background And Oversight Issues For Congress.* Report Prepared for the U.S. Congress. March 15, 2007.