2004 Command and Control Research and Technology Symposium
The Power of Information Age Concepts and Technologies

Harnessing the Power of Network Centric Operations: the role of ideas, norms and values

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Introduction

Military transformation is the act of creating and harnessing a Revolution in Military Affairs. In the Canadian context, transformation is defined as "a departmental process of strategic re-orientation in response to anticipated or tangible change to the security environment, designed to shape our nation's armed forces to ensure their continued effectiveness and relevance." In this regard, transformation is focused on: 1) orienting us towards emerging and future missions, 2) changing the way we operate in order to leverage information and technologies; and, 3) changing our business practices to take advantage of the information age. That said, while we often associate transformation with the technological aspects of change, too frequently we forget about a core component – the cultural aspects.

How does this gap relate to Command and Control? As pointed out by Alberts and Hayes, Command and Control (C2) encompasses the four domains of warfare: 1) physical; 2) information; 3) cognitive; and 4) social. Whereas the first two domains relate to objective elements (the physical domain consists of C2 sensors, systems, platforms and facilities and the information domain consists of information that is collected, posted, pulled, displayed processed and stored) the later two domains are socially constructed. (The cognitive domain involves the perceptions and understanding of what information means and the social domain consists of the mental models and value systems that underlie our thinking.) Critical for understanding the sociological aspects of C2 is the fact that the social and cognitive domains overlap since our mental models, preconceptions, biases and values serve to influence how information is interpreted, understood and acted upon.

Given the importance of the cognitive domain in military operations, I will argue that the future of network centric operations (NCO)[1] and transformation will rely just as much on cultural adaptation as it will on technology. While new technology will continue to be adopted, the success of network-centric operations will depend not only on how individual nations use technology, but also on how the allies employ it. Given this assertion and in order to stimulate discussion within the parameters of the symposium's objectives, my paper suggests that if we are to overcome the difficulties that increasingly complex multinational operations entail in the informational age, we must not only address questions about the optimal way to achieve technical interoperability when thinking about network centric operations, we must also understand the role that ideas, norms, and values play in the process. The following paper will attempt to identify these challenges by looking at some of the conceptual, technical and culture barriers of NCW that need to be overcome. This paper draws largely from current literature on NCW and

[1] While the use of NCO has recently emerged as a preferred term to NCW in the USA, in other countries such as the UK, Canada and Australia, there is debate over what alternative term to use. Therefore, for the sake of clarity, the terms NCO , NCW and NCOW are used interchangeably herein.

the outcomes of a recent multinational workshop on NCW that was held at Valcartier, Quebec in February 2004.[2]

Setting the Context

As stated above military transformation is the act of creating and harnessing a Revolution in Military Affairs. Network Centric Warfare (NCW) and Effects Based Operations [3] are essential concepts behind military transformation (Smith 2003). Together they address the future mission space (what the military will be called upon to do), environment (the conditions, constraints, and values that govern military operations), concepts (how the military functions), and the business side of the defence departments (acquisition, logistics and support). EBO is about the first two of these four dimensions while NCW addresses the last two. Hence, NCW and EBO form a synergistic treatment of military transformation. They deal with the why, what, how, and support of military transformation. That said, this paper will focus upon the challenges of Network Centric Warfare while keeping in mind that NCW is a means to an end – that of achieving Effects Based Operations.

What is Network Centric Warfare?

> ***Network-Centric Warfare*** **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 battlespace.**
>
> **(Alberts, et al 1999)**

The operational benefits that are expected to result from NCW are precision in applying force, rapidity of effect, force multiplier effect, improved force protection, and improved combat effectiveness. The NCW benefits chain can be stated to be that better networks lead to better information sharing, that in turn leads to better shared understanding, and subsequently to better decision making, to result in better effects (Febrache 2004). NCW is resulting in very significant changes to operational concepts, current equipment programs, reform of the acquisition process, and indeed is challenging conventional ways of thinking. NCW is enabling integration, including that of the support function. It provides an environment which allows integrated project teams and industry to set

[2] The Technical Cooperation Program *NAMRAD Principals Action Group on Network Centric Warfare*. *Final Report*. 23 February 2004.

[3] Edward A. Smith defines Effects Based Operations as, "Effects-based operations are coordinated sets of actions directed as shaping the behavior of friends, foes, and neutrals in peace, crisis, and war" (2003)

themselves in context, identify integration issues early on, jointly work to resolve concerns, use and build on reference architecture, recognise opportunities for global optimisation.

Promises of the Information Age

The beginning of the Executive Summary of the March 2001 NCW Report to Congress: states that, "Network Centric Warfare is no less than the embodiment of an Information Age transformation of the DoD (DoD 2001). NCW involves a new way of thinking about how we accomplish our missions, how we organize and interrelate, and how we acquire and field the systems that support us. NCW moves the Department to the next level of Jointness as envisaged in Joint Vision 2020. This monumental task is expected to span a quarter century or more. It will involve ways of operating that have yet to be conceived, and will employ some technologies yet to be invented. NCW has the potential to increase warfighting capabilities by orders of magnitude as it represents a powerful set of warfighting concepts and associated military capabilities that will allow warfighters to take full advantage of all available information and bring all available assets to bear in a rapid and flexible manner, just-in-time. The main tenets of NCW are that 1) a robustly networked force improves information sharing; 2) information sharing enhances the quality of information and shared situational awareness; 3) shared situational awareness enables collaboration and self-synchronization, and enhances sustainability and speed of command; and, 4) these, in turn, dramatically increase mission effectiveness.

The profound changes that would accompany a transformation from an Industrial Age military to an Information Age one has given cause for concern. As Alberts point out, concerns have been voiced regarding the impacts of new and increased information flows on decision-makers and changes to command processes. A recent study published by the Naval War College found that officers seemed generally uninformed regarding future threats outside their own tactical specialties and therefore are not in a position to make appropriate decisions (Mahnken and Fitzsimonds 2003, 111). Other concerns focus on the new or increased vulnerabilities associated with reliance on Information Age systems and processes. Moreover, our ability to design and acquire secure robust, reliable and coherent systems given the reality if our increased use of commercial-of-the shelf hardware and software, and the ever-shrinking technological life-cycle, is becoming increasingly challenged (Alberts 2002, 55-56). These concerns outlined here have a direct impact on the military as they relate to information overload, changed military decision-making dynamics, systems vulnerabilities and different requirements for Command and Control and acquisition models.

The US DoD is moving toward a network centric approach to operations, inclusive of tactical-to-strategic levels of activity and across the spectrum of missions from major war to peacekeeping/support operations. NCW will support the emerging "Functional Concepts" (and their derivative operational capabilities) of "Battlespace Awareness", "Command and Control", "Force Application", "Protection", and "Focused Logistics". NCOW includes the presence of a ubiquitous, secure, and robust network grid (Global

Information Grid, GIG) populated with all information including intelligence, non-intelligence, and raw and processed system data. Central to this approach is the concept of task, post, process, and use. Tasking includes user requests for information and is network-centric. Data-providers and users alike post information to the grid. Information and computing power is continuously shared with users over high bandwidth network communications. Processing in the NCW context includes exploitation and analysis. Information is posted to the GIG and becomes available to all appropriate users from that Grid. Users can access information on the Grid by either pulling information or subscribing to information, i.e., receiving information based on pre-defined criteria. The concept of post and use subsumes the traditional concept of pushing information from point to point. These basic principles remain valid in the NCW context. However, architecture products are expected to evolve as more experience is gained in developing architectures that portray NCW. Technologies are needed to facilitate network centric concepts and processes to be implemented for integrated force battle management command, including vertical and horizontal coordination and self-synchronization within and across warfighting and support functional areas. Technologies and knowledge products are also needed to ensure robust human systems integration across the spectrum of missions and throughout the tactical-to-operational levels of military activities. This aspect relates to the socio-cognitive aspects outlined in the introduction.

Below is a discussion of some key socio-cognitive related aspects of NCW identified at the TTCP workshop:

Shared Situation Awareness/Understanding

Within NCOW there is a need to understand the military operational situation to include disposition of forces, capability of forces, analysis of possible courses of action, analysis of the environment, inferences of threat intentions for near, mid and long term periods of time, and network security status. The ability to achieve a heightened state of shared situational awareness and knowledge among all elements of a Joint force, in conjunction with allied and coalition partners (interoperability), is increasingly viewed as a cornerstone of transformation. Emerging evidence from recent military operations and a broad range of experimentation supports the relationship between shared situational awareness, knowledge, and increased combat power enabled by NCW concepts.

We need to understand cognitive issues. What are the key aspects of human and organizational behaviors that will help us understand and manage complex networks, and ensure the quality of information, collaboration, awareness, and shared situational awareness (including awareness of social and cultural issues)? How can visualization, virtual displays and smart rooms, facilitate the gathering of information throughout the grid and convert it to knowledge to achieve a consistent battlespace understanding? How can information from the GIG be provided to disadvantaged users, dismounted users, and draw from remote sensors and remote processing nodes? How can technology provide timely, accurate information and sensor fusion from heterogeneous sources to achieve consistent military operational situational awareness?

Collaborative Environment

The basic tenants of NCW are a robustly networked force that improves information sharing. Shared understanding generates increased combat power, increased speed of command, higher OPTEMPOs, and increased survivability. The networked (interoperable) force means more than connectivity of computer architectures, but also a willingness to "trust" such collaboration and understand the decision making process for those in a networked environment. How will the teams develop this trust? How will multinational teams work together to solve complex problems with cooperation among machines and/or humans? What technology innovations will assist in the integration of data, information, models, simulations, domain specific tools, and virtual test beds to facilitate collaboration among multiple disciplines throughout the Joint/Coalition enterprise? What progress is being made in developing a demonstration of a multi-user multinational "Virtual Workspace" to facilitate the collaboration? This virtual environment provides visualization tools, process and workflow management as well as the necessary collaboration tools to enhance seamless cooperation and problem solving. Can the development of Cooperative Intelligent Software Agents make all of this easier?

Human-Systems and Coalition Organizational Integration

Human factors play a significant role in how information is accessed and displayed and are also a strong influence in the design and operation of systems. If human factors are not represented in the NCOW, then factors affecting design, manpower, training, and other human systems integration issues may be overlooked to the detriment of overall systems performance and mission accomplishment. Modest investment in human systems integration during architecture development has the potential to reduce total ownership costs. The creation of an intuitive easy to use interface that provides for near optimal interaction among the users and the GIG is needed. This interaction includes text, speech, and nonverbal indications.

NCW is based upon the ability of a military force to develop shared situational awareness in the cognitive domain. Technical interoperability will get us to the point where the information is correctly represented in distributed systems, but does not ensure that the individuals in different locations, in different organizations, at different echelons have a similar understanding even though they "see" the same thing. With the added complexity of coalition operations that involve different cultures, the problem is greatly compounded. Semantic interoperability is the capability to routinely translate the same information into the same understanding. This is, of course, necessary to develop the shared situational awareness upon which mature forms of NCW are based.

How can the multinational team members with different organizational; structure, cultures, and languages examine complex situations and information with the associated capability to display and understand the operational scenario, potential consequences, network security, information integrity and operational plans? How will the coalition

develop semantic interoperability? What is the technology forecast for machine understanding of the concepts and situations portrayed in the textual information across cultures? Will Semantic differences be able to be mediated to account for cultural variations in joint and coalition forces interactions?

Modeling and Simulation (M&S)

NCW is a much more complex environment than previous technology enabled warfighting capability. Collaboration of distributed forces is a complex problem in and of itself requiring the use of modeling and simulation to help plan, execute, replay, and train forces. There is a need for new modeling and simulation applications, elements of which can be local or remote, which can operate in a rapid, integrated fashion to support commanders in their assessment of options for planning, replanning and execution. Current programs that exploit web technologies to enable models, simulations and simulation data to exist as enterprise services are beginning to situate simulations as net-centric capabilities. The ability to model cyber threats including interruption of service, denial of service, corruption of information, dissemination of information and hacking is in its infancy at a time when this capability is critically needed. Explorations into the use of massively multi-player on-line gaming have, among their goals, an understanding of how different populations groups and cultures react, often non-linearly, to unexpected situations, tactics, environment and complex events. While these methods hold promise of being a laboratory in which to observe human performance and interaction, we have yet to determine either the range of capabilities and limitations inherent in the data collection and analysis. Our understanding of network centric operations is limited by our ability to compose simulations at different levels of abstraction and complexity.

A recent paper by Curts and Campbell states that a major technical goal of the next ten years will be the utilization of an architecture that allows interoperability between operational C4I systems and M&S efforts (Curts and Campbell, 2003). In fact, warfighters should be able to train on the same C4I systems that they will use in the field using M&S. Current programs that focus on establishing a common taxonomy between C4I systems and simulations, establishing web-based services for linking tactical databases to simulations and using software agents to track and monitor changes in the common operational picture constitute the initial steps at linking simulations and operational systems.

Directly related to the above, many note that NCW raises fundamental systems of systems engineering issues associated with the design, acquisition, integration and support of the complex socio-technical systems (TTCP 2004). These challenges include:

- Creating an environment in which we can investigate and evolve future concepts enabled by NCW – including analysis, experimentation and simulation.
- Managing the complexity associated with a network enabled system including integration, management, configuration, interoperability with legacy and peer systems and future migration.

- Developing the means to optimize the system to support the needs of the commander while exploiting the innate capability of the human in the system to maximum effect.
- Providing the analytic framework to model the socio-technical system, including an adequate representation of cognition and team interactions, justifying the necessary balance of investment in enablers/soft elements.

Challenges exist in the provision of resilient network infrastructure to underpin NCW, particularly in complex environments (such as urban operations) or in the face of deliberate countermeasures. The increasing use of adaptive and reconfigurable systems on the battlefield, will raise fundamental safety critical design and vulnerability management issues. The design of data mining, fusion and inference techniques will continue to be a priority area for research, as we struggle to identify key indicators in the wealth of data collected by increasingly numerous and distributed sensors.

Command Centric Warfare in the Information Age

Command in the Information Age is not the sole responsibility of any single individual. Instead it is a shared, distributed and collaborative responsibility. With the increasing importance of information in operations, the lines of responsibility for task information collection, analysis and distribution will become as important as command arrangements (TTCP, 2004, 10)

In order for the system to become truly command-centric, the domains in which command during conflict takes place must be fully understood and the impact of networking appreciated by those who are in the face of battle. Military entities and activities are located in four domains: the physical, information, cognitive, and social domains. The physical is where strike, protect and maneuver take place across the environments of sea, air, land and space. The information domain is where information is created, analyzed, manipulated, value-added and shared. It can be considered the "cyberspace" of military operations. The cognitive domain is where the perceptions, awareness, understanding, decisions, beliefs and values of the participants are located. These intangibles are crucial elements of network centric operations. The social domain is where military force entities interact, exchanging information, awareness, understandings and making collaborative decisions. It overlaps with the information and cognitive domain but is distinct from both. Cognitive activities by their nature are individualistic; they occur within the minds of individuals. However, shared sense-making, the process of going from shared awareness to shared understanding to collaborative decision-making, can be considered a socio-cognitive activity in that the individual's cognitive activities are directly impacted by the social nature of the exchange.

Our mental models, ideas, preconceptions, biases and values serve to influence how information is interpreted and understood. In the context of multinational operations, this becomes even more complex, yet also increasingly important. As Bowman and Pierce

have found in a recent study, there are several cultural barriers to teamwork, both cognitive and organizational (2002, 1). In their study they found that culture influenced the cognitive fundamentals of teamwork, such as communication, coordination, understanding and decision-making. Culture also influenced the organizational barriers through national rules and procedures for training and personnel selection. In the Information Age, these factors are significant given the shortened decision-making loops and the need for highly trained skill sets.

NCW necessitates the focus to shift toward the individual and as the focus shifts, their actions and intentions, this will challenge many of our traditional surveillance and tracking techniques. The use of expert systems, decision aids, and intelligent agents will become increasingly commonplace as augmentations (or in some cases replacements) for human decision-making. We will focus greater attention on the interface between the human in the loop and the systems that support and interact with them. This will include a deeper understanding of how human cognitive processes operate, and the way in which we structure and organize information to best support these processes. Simulation and modeling will be key to developing our understanding of many of these complex interactions, as well as to the visualization of the operation of the system of systems as a whole and its interaction with other lines of development.

There will be a greater emphasis placed on the need to understand how individual operators work together enabled by technology, including: our ability to form agile mission groups, to understand and work across cultural and ethnic barriers, to ensure commonality of intent across a distributed structure, and to analyze and optimize the performance of the system as a whole.

Research is needed to improve our understanding of the cognitive issues and key aspects on human and organizational behavior, to understand and manage complex networks (including predicting network status and assessing network security), to ensure the quality of information, collaboration, and shared situational awareness (including awareness of social and cultural issues). If we are to take advantage of the information for which NCW allows, then the issue of interoperability entails more than the connectivity of computers, it also entails a willingness to 'trust' the connectivity and understand the decision-making process for those in a networked environment.

Command Centric Warfare in a Coalition Environment

Command centric warfare can be considered to be the linking of a system of systems that connects all key elements to produce one shared awareness network. The idea is to enhance situational awareness across the battlespace and allow for more effective and rapid coordination and response to opportunities created by the digitization of the battlespace (DLSC 2003, 101). Currently, military forces around the world are

transforming into digitized forces that embrace command-centric, networked enabled warfare, as a result of existing and emerging information technologies. The ability to operate in this domain will lead to a previously unreachable level of data and information. The inherent advantage gained by sharing and collaborating all the available information on a network-wide system will be a key enabler and will create the potential for dramatically improved shared situational awareness within any force.

To date, NCW has focused on the tactical and operational levels of warfare, but they impact all levels of military activity from the tactical to the strategic. At the operational level, NCW provides commanders with the capability to generate precise warfighting effects at an unprecedented operational tempo, creating conditions for the rapid lockout of adversary courses of action.

NCW requires that the militaries and national governments recognize that a critical mass of connectivity and interoperability is necessary to both encourage and support new ways of doing business. Therefore, networking the force will be the top priority. The means for accomplishing this is the Global Information Grid (GIG). The US DoD has committed significant funds to the development of the GIG infrastructure. The focus of advances should be on the development of applications and application interoperability as a means for coalition forces to interface into the common operational picture enabled by the GIG.

A key implementing feature of extending security into the coalition environment is a "Coalition Wide Area Network". This network will provide the computational and information transport and services for the coalition applications and connectivity to the GIG. The role of the human in this network is essential, and thus human factors play a significant role in how information is accessed and displayed. The development of intuitive interfaces is critical to shared awareness especially across different organizations and coalition partners.

NCW is based upon the ability of a force to develop shared situational awareness in the cognitive domain. Technical interoperability will get us to the point where the information is correctly represented in distributed systems, but does not ensure that the individuals in different locations, in different organizations, at different echelons have a similar understanding even though they "see" the same thing. With the added complexity of coalition operations that involve different cultures, the problem is greatly compounded. Semantic interoperability is the capability to routinely translate the same information into the same understanding. This is, of course, necessary to develop the shared situational awareness upon which mature forms of NCW are based.

Sharing information and collaboration are two different entities. One "shares" information in a sequential process that passes output from one stage to the next. Contrast this with a collaborative process where the product is formed and developed as a result of continuous interactions among key participants. Collaborative planning provides an example of this type of application. Integrated processes are essential ingredients for mature network-centric applications.

The Way Ahead for Enabling NCW

Overall there are several areas of research related to socio-cognitve factors that can be identified in the following categories: 1) performance characteristics of Information Age systems 2) cognitive processes, 3) behavior of distributed teams, 4) collaboration, 5) sense-making; and, 6) new command concepts (Alberts 2002). The following elaborations are derived from the outputs of the TTCP workshop on NCW.

Performance Characteristics of Federations of Information Age Systems

(1) We currently lack the S&T for building networks that behave like complex adaptive systems. Therefore, a new approach to understanding the dynamics of complex systems behaviour (the ecology of systems) is needed to help us understand and predict performance in all of the dimensions of interest. Included among these dimensions are system response times, availability, repeatability, security, and performance under stresses of various kinds. The basics of systems engineering (design, protocols, and approaches to hardware development and testing) need to be reviewed and new approaches better suited to federated systems in a hostile environment need to be developed

(2)The development of better approaches to engineering federations of systems. There will always be a crippling legacy problem if we do not develop new approaches to scalable "plug and play" approaches that involve dynamically negotiated protocols that give a collection of systems the ability to accept new players and to migrate itself to newer and better protocols. A number of "end to end" capabilities need to emerge from a collection of systems for the collection to be useful in military operations. These include assured delivery, authentication, security, and interoperability (both technical and semantic).

(3) A shift from information push to information pull is necessary to achieve the level of information sharing needed to support NCW. We need theories and models that help us understand the implications of this shift and to predict behaviors. We also need to develop the "announcements", browsers, and agents needed to recognize new sources of information as they emerge and incorporate them into anticipatory pull arrangements.

(4) Collaboration environments are required that adequately support the full range of collaborative behaviors needed for NCW.

Cognitive Processes

(1) Higher levels of NCW maturity rely heavily on the achievement of shared awareness. Awareness is a property of human cognition. A top research priority needs to be how cognitive processes and the independent variables that influence these processes affect awareness and shared awareness in military situations.

(2) Research on how humans deal with uncertainty and risk. We need to better understand not only how to improve an individual's ability to deal with uncertainty and

risk, but to understand how differences that exist from individual to individual affect their interactions.

Behaviors of Distributed Teams

As NCW becomes a reality, distributed teams will perform more of the tasks that militaries undertake. Little R&D has been focused on how distributed teams work in the pressures inherent in military domains. The enormous improvements in the "richness of interaction" that are available are sure to affect the behavior of distributed teams. The ranges of expected distributed team performance need to be determined.

Collaboration

Collaboration is a key component of mature applications of NCW principles. Collaborative processes in military organizations, particularly collaboration across echelons and horizontal functional collaboration are relatively new and untested (both in a joint and combined context). Work needs to be done to identify the various forms of collaboration, understand their characteristics, and relate them to military tasks and situations. Collaboration in coalitions (particularly cross-cultural) presents a unique set of challenges that must be better understood.

Sense-making

Sense-making encompasses the range of cognitive activities undertaken by individuals, teams, organizations, and indeed societies to develop awareness and understanding and to relate this understanding to a feasible battlespace. A major research effort is needed to explore the issues in sense-making, the factors that influence our sense-making abilities, and how it relates to military situations. The bulk of sense-making performance at the individual, team, and organization levels falls largely within the cognitive domain. Sense-making in military operations involves streams of decision events that occur simultaneously over different functional areas. David Alberts in *Information Age Transformation* expects that the fields of cognitive psychology, group/team dynamics, organizational psychology, management science, sociology, political science, history and complexity theory will make substantial contributions in addressing the following clusters of research issues: (i) Structural Issues - How is tacit knowledge formed, organized, shared, reconciled, and used within the organization? , (ii) Process Issues- How are these various knowledge structures employed to reduce situational ambiguity or to cope with information overload?; and, (iii) Adjustment Issues- How do individuals and teams rapidly acquire new tacit knowledge in novel situations where previous experience, expertise, and culture are no longer relevant? Alberts also makes the point that, given the important influence of cultural differences on the effectiveness of sensemaking activities, this research needs to be conducted not only from a joint perspective, but also from a coalition perspectives as well (Alberts 2002).

New Command Concepts

NCW, in its most mature form, involves profound changes in the role of a commander and the relationship between a commander, a commander's staff, subordinates, and superiors who are widely distributed geographically. NCW impacts who has what information, how well the situation is understood, and the degree to which this understanding is shared. As a result, the information environment in which our forces

will operate differs considerably from the information environment that prevailed when our current approach to command and control was developed. Thus, we need to undertake a major research effort to understand the command and control implications of an Information Age Environment. We need to test and verify the tenets of NCW. Answers are required to the following: Under what circumstances does self-synchronization work? How can command intent be best articulated? What sorts of command interventions are needed to maintain control? Coalition command and control is an area that merits special attention. Experience with coalition operations over the last decade shows that preconceived ideas of how operations will work do not necessarily pan out in practice. Instead of having one objective function to maximize, as in the case where a commander is clearly in charge, coalition operations involve multiple objective functions in a state of tension. This research is needed to help focus growing experimentation activities.

Conclusion

This paper has attempted to identify the many challenges of Network Centric Warfare by looking at some of the conceptual, technical and culture barriers that need to be overcome. Upon reflection of the examples provided herein, it becomes evident that most of the significant challenges have the Operator, the human-in-the-loop, at their center. Therefore, attempts to overcome these challenges must also place the individual at the center.

Given the importance of the cognitive and social domains of the individual, it is crucial that the role of ideas, values, beliefs – culture – be taken into consideration in order harness the potential power of Network Centric Warfare. As Rear Admiral Nancy Brown said recently in an article on Network Warfare, " I think we're going to realize the technical piece is the easy piece…but the cultural piece will be more difficult." (New, 2004).

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