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Warfare in the 21st Century

"NETWORK-CENTRIC WARFARE":

Fulfilling the 3C's Litmus Test

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ABSTRACT

For too long, many military organizations around the world have unique definitions and different responses to the challenges of conceptualizing Network-Centric Warfare (NCW) as a part of the Revolution in Military Affairs (RMA). **This 'think-piece' will endeavor to show that the advent of new information and communications technology when accompanied by doctrinal adaptation and organizational changes that will make NCW complete and "better" as a new *tao* of warfighting.** The approach begins by identifying possibilities of new thinking for NCW and to offer the view that NCW can be conceived as a new way of warfighting at the operational level. Following that, it offers a set of three criteria, known as the *3C's litmus test*, with which to evaluate and guide the proper use of NCW as a part of the RMA.

The three criteria or tests for evaluating and guiding the proper use of NCW are *Cognitive Adaptability*, *Creativity in Complexity* and *Construct Metamorphosis,* which this paper will discuss at the operational level. First, operational commanders need to develop *cognitive adaptability* through *conceptual thinking* if they are to use NCW as a new way of fighting wars. Second, cultural changes are required in a military organization to facilitate *creativity in complexity* by creating the *avant-garde space* and the *synoptical connectivity* needed to create "Machiavellian" operational commanders. Third, a workable plan for a *construct metamorphosis* will require a *mandate for interoperability* and *prioritized fiscal prudence*.

Introduction

The concept of Network Centric Warfare (NCW) originated from the United States (US).[1] However, since its genesis, many modern military forces worldwide have unique definitions, varying emphasis to the key components of NCW and different responses to the challenges and opportunities of the Information Age. Examples include the United Kingdom's network-enabled capability (NEC),[2] Australia's network-enabled warfare (NEW),[3] Canada's network-enabled operations (NEO),[4] and Sweden's network-based defense (NBD),[5] to name a few.

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[1] Arthur K. Cebrowski (Vice Admiral), and John J. Garstka, "Network Centric Warfare: Its Origin and Future," *Naval Institute Proceedings* (January 1998). Available from http://www.usni.org/Proceedings/Articles98/PROcebrowski.htm; Internet; accessed 26 September 2005.

[2] The UK's Network Enabled Capabilities (NEC) distinguishes it from the theory of NCW in a number of ways. NEC is "commander-centric" rather than "network centric". See UK MOD Joint Services Publication (JSP 777 Edn 1), 5-8. Available from http://www.mod.uk/linked_files/issues/nec/nec_jsp777.pdf; Internet; accessed 26 September 2005.

[3] The Australian Defense Force regards Network Enabled Warfare (NEW) as "a simple concept that involves the linkage of engagement systems to sensors through networks and the sharing of information between force elements". The ADF wanted a pragmatic approach and sees this as being a mechanism for seeking a Joint capability focus. See Ed Kruzins and Jason Scholz, "Australian Perspectives on Network Centric Warfare: Pragmatic Approaches with Limited Resources," *Australian Defence Journal*, no. 150 (Sep/Oct 2003), 19-32. Available from http://www.defence.gov.au/publications/dfj/adfj150.pdf; Internet; accessed 26 Sep 2005.

[4] The Canadian Forces' (CF) current conception of Network Enabled Operations (NEO) has a number of hidden assumptions that derive, on the one hand, from simply extending the US conception of NCW to fit a uniquely Canadian perspective and, on the other hand, from a lack of research regarding the potential benefits and challenges. NEO is interpreted in light of the new security environment and what role the CF will likely play. See Michael H. Thomson and Barbara D. Adams, "Network Enabled Operations: A Canadian Perspective," Report Prepared for Defence Research and Development Canada – Toronto (Guelph: Human*systems*® Incorporated, May 2005), iii. Available from http://pubs.rddc.gc.ca/inbasket/CEBsupport.050513_1410.CR%202005-162%20final.pdf; Internet; accessed 26 September 2005.

Perhaps because of the ambiguous potential and disruptive nature of NCW, these military forces have tended to regard it as a technological enabler that permits them merely to *do things better*. Other reasons for a "go slow" attitude have included the vast financial and material resources required to network systems within and across services, lack of talented military thinkers, stifling institutional environments and service parochialism.

Some members of the above-mentioned military forces understood that in addition to the above general problems, there were the operational ones identified by the Executive Summary to the US Department of Defense, *Network Centric Warfare: Report to Congress* (27 July 2001):[6]

- Lack of secure, robust connectivity and interoperability
- Lack of understanding of key aspects of human and organizational behaviors
- Lack of NCW-related technology investments.

Such uncertainties surrounding NCW's potential returns of investment have clouded the general understanding and conceptualization of its full potential. These military forces had chosen to treat the networking of well-informed geographically dispersed forces during operations as merely "network-enabled operations" or *doing things better* for the Information Sharing and Shared Situational Awareness. Hence, the true essence of NCW has been under-appreciated.

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network-based defence," *Framsyn Magazine*, no. 6 (2003). Available from http://www.foi.se/FOI/templates/Page___3787.aspx; Internet; accessed 26 September 2005.

[6] US Department of Defense, *Network Centric Warfare: Report to Congress* (27 July 2001), i. Available from http://www.dod.mil/nii/NCW/ncw_main.pdf; Internet; accessed 26 September 2005.

"Dominant battlespace awareness means … having the means to anticipate and to counter all opposing moves".[7] We can fully exploit the capabilities provided by the Information Age to transform NCW. Instead of NCW being a mere technological enabler, more of the world's militaries can consider turning it into a conceptual *tao*[8] of warfighting that transcends existing military structure and processes, and the marginal improvements in capabilities they promise.

To support the above theme, this 'think-piece' will endeavor to show that the advent of new information and communications technology when accompanied by doctrinal adaptation and organizational changes will make NCW "better" as a new *tao* of warfighting. We will begin the analysis by identifying possibilities of new thinking about NCW and offering the view that NCW can be conceived as a new way of warfighting at the operational level. Following that, we will offer a set of three criteria, known as the *3C's Litmus Test*,[9] which interested militaries might want to adopt in order to evaluate and guide their use of NCW as a part of their transformation efforts. As Robert Leonhard wrote, "the reality of Information Age warriors will be something less that omniscience personified. But, we will make progress toward that goal."[10] Let us now try to make sense of how NCW can be conceived as a new way of warfighting.

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[7] Frederick W. Kagan, "War and Aftermath," *Policy Review* 120, (Jul-Aug 03): 7. Available from http://www.policyreview.org/aug03/kagan_print.html; Internet; accessed 26 September 2005.

[8] The word *tao* refers to a conceptual *way* or *approach*.

[9] The term *litmus test* refers to *a set of criteria which serves to evaluate the state of NCW as a conceptual tao of warfighting.*

[10] Robert Leonhard, *The Principles of War for the Information Age*, (Novato, CA: Presidio Press, Inc., 1998), 128. Available from CFC Library [355.02 L5 1998].

Making Sense of NCW

The clearest and most detailed definition of NCW is given by David S. Alberts, John J. Gartska, and Frederick P. Stein, who defined it as "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."[11] In other words, by effectively linking knowledgeable entities seamlessly together throughout a battlespace (by providing them a common operational picture), NCW translates information superiority into combat power more rapidly and more precisely, with greater effect on an adversary who is not similarly equipped. And it does these things by taking place simultaneously in and among the physical, the information, and the cognitive domains.[12]

The physical domain refers to the traditional domain of warfare where strike, protect and maneuver actions take place across the environments of ground, sea, air and space with all elements of the force robustly networked to achieve secure and seamless connectivity.[13] The information domain is the domain where information is created,

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[11] David S. Alberts, John J. Garstka and Frederick P. Stein, *"Network Centric Warfare: Developing and Leveraging Information Superiority,* 2nd ed. (Washington, D.C.: National Defense University Press, September 1999), 2. Available from http://www.iwar.org.uk/rma/resources/ncw/ncw_2nd.pdf ; Internet; accessed 26 September 2005.

[12] David S. Alberts, John J. Garstka, Richard E. Hayes, David A. Signori, *Understanding Information Age Warfare*, (Washington, DC: DOD-CCRP, 2001), 10-14. Available from http://www.dodccrp.org/publications/pdf/Alberts_UIAW.pdf; Internet; accessed 26 September 2005.

[13] Ibid., 12.

manipulated and shared among war-fighters to facilitate the command and control of modern military forces with the commander's intent conveyed.[14] The cognitive domain is the domain of the mind of the war-fighter wherein, as a result of sense-making, decisions are made.[15]

How do these three domains interact? Through the networking of sensors and communication nodes across the entire battlefield, commanders at the operational level seek to gain superiority in the information domain. This is achieved through an establishment of shared situational awareness and sharing of knowledge amongst forces at all levels and across all services. This, in turn, will enable the networked force to gain superiority in the cognitive domain through shared battlefield understanding and superior decision making, and the physical domain through synchronization of actions and effects across the battlefield.

In brief, these academic proponents of NCW continue to reinforce the view that greater information sharing and collaboration will enhance the quality of information and shared situation awareness of the battlespace, increase the speed of command and decision-making, lead to self-synchronized activities with dispersed forces, and increase combat power and mission effectiveness. In this regard, NCW has been perceived as a mere technological enabler to *doing things* (operations) *better*.

So how can NCW be conceptualized as a part of the RMA and as a means of *doing better things*? I believe that NCW is a new way of warfighting that relies upon real-time shared data and converted knowledge among networked and integrated forces to achieve coordinated actions to shape the mindset of the adversary. I also agree with

[14] Ibid., 12-13.

[15] Ibid., 13.

Edward A. Smith, who reminded us that the real advantage of NCW is not combat efficiency but the effectiveness of "foreshortening combat by causing the enemy to yield long before his means to resist have been exhausted".[16] This effectiveness revolves around the ability of a networked and integrated force to consider an effects-based outcome-oriented approach[17] that focuses on shaping or influencing the mindset of the adversary. Thus, the thrust of NCW is not just in the physical realm but also in the cognitive realm, with greater emphasis mostly on the latter. If NCW were to concern itself with attrition only, then improvement in combat efficiency would require only an increase in the size, precision and frequency of attacks. In fact, NCW as a form of warfare focuses on the adversary's psyche, his decision-making process and his ability to take action in some coherent manner. It must serve to get inside the adversary's OODA (Observe, Orient, Decide and Act) loop[18] and to induce or exploit chaos in his decision-making. It requires us to operate in multiple and interacting OODA loops or cycles of different adversary units and forces to "create a condition of "lockout," in which the enemy can no longer rationalize and react coherently".[19]

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[16] Edward A. Smith, "Network Centric Warfare: What's the Point?" *NWC Review*, (Winter 2001); Available from http://www.nwc.navy.mil/press/Review/2001/Winter/art4-w01.htm; Internet; accessed 26 September 2005.

[17] EBO seeks to establish influence over the mind of an adversary to affect his will to act while, at the same time, keeping collateral damage as well as combatant and non-combatant casualties to a minimum. See Edward A. Smith, *Effects Based Operations: Applying Network Centric Warfare to Peace, Crisis, and War*, (Washington, DC: DOD-CCRP, 2002), 105-112. Available from http://www.iwar.org.uk/rma/resources/ebo/effects-based-ops.pdf; Internet; accessed 26 September 2005.

[18] The OODA loop is a decision-making concept for information warfare developed by Colonel John Boyd (1927-1997). See Robert B. Polk, "A critique of The Boyd Theory — Is It Relevant to the Army?" *Defense Analysis,* Vol 16, No 3 (December 2000), 257-276.

[19] Edward A. Smith, "Network Centric Warfare: What's the Point?"

The information, knowledge, precision, speed, and agility brought about by a networked and integrated force constitute the credentials for transcending from the physical realm into the cognitive realm of battle. NCW requires us to put the right forces on the right vulnerabilities at the right time so as to produce the effects we desire.[20] It exploits the unity of effort between network-based operations and effects-based operations to break the will and overcome the adversary in the cognitive realm of warfare. But if we are to operate successfully across a spectrum of conflict, we must begin to use NCW in meaningful ways to create conditions or situations at the operational level of conflict[21] where relatively small applications of combat power applied at the right time and right place result in highly disproportionate and potentially decisive impacts on the adversary. Then, will NCW yield greatest result at the operational level of conflict against a conventional adversary and, even possibly, against an unconventional (networked state or non-state) opponent.

Indeed, the massing of forces may no longer be required in NCW. A networked and integrated force can be broken down into smaller, self-synchronized units that can be dispersed over a wide geographic area to conduct a range of smaller tactical actions that when amassed present a cumulative impact on the adversary. The massing of forces will be replaced by the massing of effects.[22] NCW will demand that those tactical actions,

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[20] David S. Alberts and Richard E. Hayes, *Power to the Edge*, , (Washington, DC: DOD-CCRP, 2003), 171; Available from http://www.dodccrp.org/publications/pdf/Alberts_Power.pdf; Internet; accessed 26 September 2005.

[21] The operational level of conflict is the level at which campaigns and major operations are planned, conducted and sustained against an adversary to accomplish operational or strategic objectives.

planned and orchestrated at the operational level, be properly and promptly coordinated to attrite the opponent's will. The requirement for coordinated actions does not necessarily equate to having a centralized control system over our forces. With a networked and integrated force, the control of forces and units can be decentralized. In fact, decentralization and self-synchronization of forces and units promote asymmetrical fighting, akin to guerilla or asymmetric warfare. One could now confront a technologically superior opponent who uses large formations under centralized control but could not respond coherently, as seen in the Vietnam War. On another dimension, a networked and self-synchronized force can also help us confront an opponent that employs low-tech asymmetry so long as the adversary's actions can be anticipated early and responded to promptly with the ability to mass superior effects against his will.

As we gradually frame and/or reframe a working concept of NCW, what appears clear is that this emerging way of warfighting seeks to shape the mindset of the adversary through a series of decisive and coordinated actions brought about by an information-superior networked and integrated force. However, it is not the intent of this paper to develop a working concept of warfare or to provide all the answers. It is simply to identify possibilities of new thinking for NCW and to offer the view that NCW can be conceived as a new way of warfighting by more militaries at the operational level. Only when the new information and communications technology is translated into a concept of warfare will NCW be complete and "better".

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[22] David S. Alberts, *Information Age Transformation: Getting to a 21st Century Military*, (CCRP Publication Series, 2002), 19; available from http://www.dodccrp.org/publications/pdf/Alberts_IAT.pdf; Internet; accessed 26 September 2005.

Having now established what NCW is and what it has to offer *as a form of warfar*e, our remaining task is to propose a set of three criteria, known as the *3C's Litmus Test*, which interested militaries might want to use in order to evaluate and guide NCW as a part of their own transformation.

The *3C's Litmus Test* for NCW

To evaluate if a *tao*-level approach to NCW is indeed being adopted by interested militaries, the author believes that they would be wise to subject their efforts to a *3C's Litmus Test.* The three criteria are not a set of be-all and end-all conditions for evaluating an emerging concept of NCW in any particular military organization. Certainly, in the context of the length of this paper, there is only room to ponder over a few key criteria and to elaborate on them. There may possibly be other criteria that are deemed equally important but have to be regrettably omitted here. Nevertheless, the basis of the three criteria is aligned with the three key characteristics of a RMA.

By one definition, any RMA is "a major change in the nature of warfare brought about by the innovative application of technologies which, combined with dramatic changes in military doctrine and operational and organizational concepts fundamentally alters the character and conduct of military operations".[23] By another definition, "new ways of warfighting can only come about when capability development [*technology*] is accompanied by organizational changes [*organizational*] and doctrinal adaptation

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[23] Frank Watanabe, "Understanding the RMA," *Armed Forces Journal International,* (August 1995): 6.

[*conceptual*]."[24] Both definitions suggest that an RMA requires conceptual, organizational and technological changes.

The three criteria of the *3C's Litmus Test* are outlined below and are termed as the *Cognitive Adaptability* test [conceptualization], the *Creativity in Complexity* test [organization/culture] and the *Construct Metamorphosis* test [technology/architecture].[25] The following discussion elaborates on these three criteria.

Test of *Cognitive Adaptability*

Determining if a military's use of NCW is conceptual rather than merely instrumental should begin by looking at the *Cognitive Adaptability* of a military organization. By its very nature, NCW involves new ways of thinking about how tasks and missions can be accomplished. *Cognitive Adaptability* is an ability that military organizations must develop to conscientiously learn and re-learn new concepts of warfighting more quickly than their opponents to gain a decisive advantage. Military organizations must continually seek to perceive and think of NCW as a way of warfighting that harmonizes different forms of emerging concepts of operations, and translating them into a creative warfare with clear concepts, decision processes and doctrines.

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[24] Andrew F. Krepinevich, "Cavalry to Computer," *National Interest* 37, (Fall 1994): 30-42. Available from http://www.keepmedia.com/pubs/NationalInterest/1994/09/01/528526?extID=10026; Internet; accessed 26 September 2005.

[25] The terminologies and definitions of the *3Cs* (or three criteria) as well as the construct of the *Litmus Test* are the author's original ideas. The examples that have been cited are based on some of the best practices in known militaries.

A networked force will enable a military force to approach warfare in the future differently. It will present alternative operational approaches and options to commanders to shape the mindset of the adversary. However, the conceptual thinking of how an emerging warfare unravels and the way the military will fight in the future will have to be determined by the military themselves. NCW will not achieve its full potential unless it is applied at the operational level in the context of its operating environment. The doctrine should also provide a clear and concise vision of NCW as a form of warfare at the operational level of conflict. It should explain how NCW, as a part of an integrated warfare, can be applied in planning, orchestrating and executing major offensive and defensive operations against a conventional or unconventional (networked state or non-state) adversary to attain the desired effects for achieving a strategic or operational end-state.

Conceptual Thinking: To develop the *cognitive adaptability* for transforming NCW from a mere technological enabler into a warfighting concept will require operational commanders and their planners to think systemically rather than systematically.[26] The increasingly emergent and diverse nature of different forms of warfare and threats presents a challenge to the *cognitive adaptability* of a military organization. The need is to be able to appreciate and amalgamate this emerging NCW to achieve the necessary operational or even strategic effect(s). It will demand that a fundamental change of orientation happens in the mind and is ensured by the cognitive

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[26] The word *systemically* connotes *bodily* or *wholly*. In contrast, the word *systematically* means *orderly* and *methodically*. The word s*ystemic* refers to the concepts in a mind-set that are mutually dependent. When one of the concepts of the set is called up, the mind tends to bring up also the other concepts in the set to validate it. Thus, the mind-set acts as a very strong mental obstacle resisting change.

ability to conceive of and apply a range of diverse forms. *Conceptual thinking* requires us to frame and reframe our thoughts about NCW as an emerging warfare in a systemic manner. It is an important prerequisite for *cognitive adaptability*.

For too long, the military has been mired within a readily recognizable form of information analysis and synthesis in a systematic fashion. In other words, we are well trained to think *in the box*. We are most adept in situational or linear thinking as we are repeatedly trained to handle a given or similar scenario. Our minds become confounded when a new scenario arises, as illustrated by Al Qaeda's attack against the United States on 9/11. Such an attack was inconceivable to American leaders and their military, and the systematic mindset and hierarchical command and control structure of the United States had been taken by surprise. The military needs to learn and re-learn the lesson and conceive NCW differently to fight in a way quite distinct from the way it used to. The military needs to be able to conceive NCW using a conceptual or systemic, rather than a systematic, approach.

Therefore, to successfully tackle complex problems, operational commanders and staff planners will require skill sets that transcend the existing modalities of rational planning and linear problem-solving. Softer competencies like pattern or spatial recognition and lateral thinking among inter-connected systems have to be encompassed. Though there is no single complete solution, some thinking methodologies [like Systemic Reframing Thinking[27] and Systemic Operational Design[28]] introduced in recent times in

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[27] The *Systemic Reframing Thinking* methodology is developed by *Praxis*. The method acts as a very powerful complementing enablers for activating the meta-cognitive skills of individuals and groups that are critical for accomplishing mind-set reframing. *Reframing* is a cognitive process by which our mindset's interconnected assumptions are elicited and represented in a form of explicit frame, only to be enriched and

various innovative armed forces, like the US Armed Forces and the Israeli Defense Force, have helped to expand their collective cognitive space to capitalize on emerging technologies and to define new concepts of warfare. The military should quickly put these skills to application and conceptualize how networked non-state adversaries can become a major threat to national security and how quickly NCW can be used as a new form of warfare to counter networked adversaries.

Developing an all-encompassing conceptual doctrine will remain a long-drawn monumental task for any military organization. Nevertheless, all military organizations must persevere to conscientiously frame or reframe its concept of NCW as a new way of warfighting at the operational level in order to remain relevant and be consistently ahead of their adversaries. Only by satisfying the test of *cognitive adaptability* will a military organization have laid the conceptual foundation for transforming NCW into a true warfighting concept and subsequently be ready to take on the second test.

Test of *Creativity in Complexity*

The second test for determining if a military's use of NCW is conceptual rather than merely instrumental should look at whether it is promoting *Creativity in Complexity*.

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modified. Available from http://www.praxis.co.il/methods_tools.htm; Internet; accessed 26 September 2005.

[28] The *Systemic Operational Design* serves to rationalize the rival system. The systemic conceptualization of the opposing entity in a conflict provides a cognitive reference for the framing of the operation. In turn, the conceptualization of the operation in spatial terms renders the systemic architecture for the definition of its logical and mechanical components. See Lecture by Dr Brigadier (Res.) Shimon Naveh, The Aharon Yariv Institute for Operational Studies, Department of Operations, General Staff, I.D.F. Available from http://home.no.net/tacops/Taktikk/Kadettarbeid/naveh.htm; Internet: accessed 26 September 2005.

Creativity in Complexity (CIC) refers to an attitude, desired of operational commanders and staff planners, that is fostered by the changes in the organizational environment of a military establishment to deal with the complex problems that arise from the construct of networking and complex adaptive cognition. No matter what cognitive adaptability that we may desire and what network architecture that we have constructed, there will always be many "unknown unknowns". Overcoming the resultant shock of "unknown unknowns" is the realm of CIC. The new paradigm will require the identification and development of creative Machiavellians who possess a keen eye and a critical mind to understand a complex context and blend multivariate possibilities to deal with those "unknown unknowns". To develop CIC that can transform NCW into a part of the RMA will require two essential changes in the environment to be fulfilled by a military organization at the operational level.

Avant-garde Space: First, there has to be an environment at the operational level of a military organization that supports experimentation and innovation. An *avant-garde space* is a creative environment that is conducive to building on existing processes and, where necessary, creates new ones to systemically allow good ideas of NCW at the operational level to be recognized and followed through into operational level experimentation and implementation. This creative *avant-garde space* should focus on the following types of experiments:

- ***Networking Component Experiments (doing things better):*** Such component experiments should focus on demonstrating the architectural relevance of key technological tools such as modeling and simulation designs, intelligent decision support agents, knowledge management tools, and

dynamic C2 systems and mobile C2 networks, among others.[29] Following from the networking component experiments, further development of the work processes and operational procedures that complement the given technological tools should be explored. These processes and procedures should be designed around the networked-enabled operational tenets of NCW.[30] Experiments, therefore, serve to provide architectural relevancy to the construct of networking.

- ***Demonstrating Warfare Capabilities (doing better things):*** Scenario-based and integrated-force capability demonstrations can showcase the nature of the capability at the operational level of conflict. The effectiveness of how NCW can be used in meaningful ways to create conditions or situations at the operational level of war where relatively small applications of combat power applied at the right time and right place can result in highly disproportionate and potentially decisive impacts on the adversary can be experimented. Developments in technologies and operational processes can then be enhanced with corresponding improvement in organizational force structure wherever applicable.

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[29] Journal of the Singapore Armed Forces, "Realising Integrated Knowledge-based Command and Control: Transforming the SAF," *POINTER* Monograph, No.2 (March 2003), 37. Available from http://www.mindef.gov.sg/safti/pointer/back/monograp/mono_ikc2/ikc2_all.pdf; Internet; accessed 26 September 2005.

[30] The tenets of NCW are:
- A robustly networked force improves information sharing.
- Information sharing enhances the quality of information and shared situational awareness.
- Shared situational awareness enables collaboration and self-synchronization, and enhances sustainability and speed of command.
- These, in turn, dramatically increase mission effectiveness.

See US Department of Defense, *Network Centric Warfare: Report to Congress* (27 July 2001), 4-1.

To create this *avant-garde space*, a fundamental paradigm shift in the very nature and practice of learning within any military organization will be required. By stimulating intellectual curiosity and promoting innovative military thinking, we hope to breed creative Machiavellians. As a requirement, intellectually gifted military commanders must seek and learn how things work, spot emergent trends and, thereafter, develop new, creative concepts. For this to happen, military training and educational institutions, in addition to teaching the "how", must transform to guide its learners to learn the "whys" of what they do. For example, the Singapore Armed Forces employs *Learning Organization*[31] principles and practices to challenge and stimulate its commanders to question the status quo and to prepare the third generation of leaders in its organizational and cultural transformation.[32] This is especially critical in grooming commanders for operational level planning. They need a paradigm shift to question, challenge and transform network-based and effects-based operations into NCW. Hence, it is critically important that such creative *avant-garde* spatial dimensions demand formal acceptance and recognition for them to be successfully implemented.

Synoptical Connectivity: Secondly, having created this *avant-garde space*, creative Machiavellians must be assigned and exposed to synoptically like-minded

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[31] Peter Senge (1990) defined the Learning Organization as "a group of people continually enhancing their capacity to create what they want to create." It is an organization with an ingrained philosophy for anticipating, reacting and responding to change, complexity and uncertainty. The concept of Learning Organization is increasingly relevant given the increasing complexity and uncertainty of the organizational environment. As Senge (1990) remarked: "The rate at which organizations learn may become the only sustainable source of competitive advantage." Available from http://www.infed.org/thinkers/senge.htm; Internet; accessed 26 September 2005.

[32] Journal of the Singapore Armed Forces, "Spirit and System: Leadership Development for a Third Generation SAF," *POINTER* Monograph, No..4 (August 2004), 20-21. Available from http://www.mindef.gov.sg/safti/pointer/back/monograp/mono_cld/CLDmono.pdf; Internet; accessed 26 September 2005.

military communities within their relevant NCW context. *Synoptical connectivity* refers to a comprehensive network of interested NCW communities that are closely connected to facilitate a sharing of different perspectives and cross-fertilization of ideas that expand the cognitive space of the creative Machiavellian for the purpose of furthering NCW as a concept of warfare. The creative Machiavellian needs to be exposed to a social network of diverse military communities and national defense establishments that can enable him to network with other similarly motivated individuals from a diversity of backgrounds in order to unleash his creative energy in a significant manner. The free flow of ideas, information and expertise, and resultant collaborative efforts are powerful means for meaningful experimentation and innovation in NCW. Furthermore, the friendly and occasional unfriendly exchange of perspectives and ideas guards against intellectual complacency and egoism, and can spawn interesting ideas. The combination of these military communities into a complex network will boost the capacity of the military organization, allowing it to tackle complex problems and harness the sum of its individual Machiavellian cognitive powers.

Therefore, internally, the top leaders of any military organization will have to think carefully about both the structural and cultural changes in the organizational environment for fostering CIC. Almost every military organization is guilty of information hoarding that is borne of turf guarding and non-receptivity to external probing. The challenge is to lift the veil of secrecy that permeates among the military services. In addition, youthful yet creative Machiavellians identified within that military organization for "high altitude" operational planning within their NCW context require a nurturing and supportive environment to thrive. By this, it means that this group must be

exposed to the created *avant-garde space* with assignments in deliberate operational planning on complex NCW projects. For example, creative Machiavellians could hypothetically be involved or exposed to the "think-tanks" that were responsible for the planning and conceptualization of the many NCW experiments conducted previously by the US Armed Forces, as discussed earlier. As a qualifier, youthfulness of creative Machiavellians must not be viewed as impediments relative to the amount of knowledge they contribute. More importantly, it is about how they translate obscure information in a complex theatre of operations into applicable knowledge to *do better things*. Military organizations must encourage creativity and youthfulness to work concurrently and allow for the natural emergence of radical solutions without imposing pre-conceived parameters of what NCW is or is not.

Externally, as the armed forces may not possess a full monopoly on knowledge and wisdom in all aspects of NCW, answers to some of these issues require expertise from external defense networks to facilitate the introduction of competing ideas that contest conventional wisdom. Some initiatives in the field of external networks could include the initiation of greater co-ordination and collaboration with other relevant defense agencies, and the institutionalization of policy exchanges with academic institutions, external consultants and philosophers. For example, the fundamental breakthroughs in NCW development can be attributed to the close cooperation between US Armed Forces and the R&D organizations from within the defense establishment, such as Defense Advanced Research Projects Agency.[33] The need for *Creativity in*

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[33] Journal of the Singapore Armed Forces, "Creating the Capacity to Change (C2C)," *POINTER* Monograph, No.1 (February 2003), 53-60. Available from

Complexity brings with it a new order of transformation in the environment of a military organization that will facilitate the conceptualization of NCW as the benchmark of warfighting.

Having fulfilled the first two criteria of *cognitive adaptability* and *creativity in complexity* do not necessarily imply that NCW has been fully transformed from a mere tool into a philosophy or form of war. That is only possible when a military organization additionally emphasizes *construct metamorphosis* within its network architecture.

Test of *Construct Metamorphosis*

For NCW to embody a form of war guided by an overarching concept on how to use information power in powerfully linked ways, it has to meet the third and final litmus test of emphasizing Construct Metamorphosis within its network architecture. The *Construct Metamorphosis* is an architectural plan for a progressive development of a desired physical infrastructure of networks for all combat systems and supporting equipment that must be compatible at multiple levels among all the military services and agencies[34], with due consideration for the availability of funds and inclusion of progressive improvement in technologies. The plan for a *construct metamorphosis* in the network architecture enables the military to embrace and realize technology into an operational capability that is also conceptual in nature. It must reflect a strong desire for

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http://www.mindef.gov.sg/safti/pointer/back/monograp/mono_c2c/c2c_all.pdf; Internet; accessed 26 September 2005.

[34] The term 'agencies' describes the collective elements or activities of government departments, non-government and commercial organizations engaged in a common effort.

joint-interoperability among the services of a military force and the prudent fiscal leadership in the prioritization and acquisition of the networks and systems.

The US Global Information Grid (GIG) is an example of the product of such a planned *construct metamorphosis*.[35] An objective of the GIG is to attain a more fully, integrated, joint command, control, communications, and computer capability.[36] The GIG has provided U.S. war-fighters with secure global access to information and plays a key role in networking the force and extending and securing the war-fighters' information domain to enable network-centric operations.[37] Yet, another product of a planned *construct metamorphosis* is the Singapore Armed Forces' Enterprise Architecture (EA).[38] The EA is a strategic information asset base, which defines the mission, the information necessary to perform the mission, the technologies necessary to perform the mission, and the transitional processes for implementing new technologies in response to the changing mission needs.[39] Both network architectures continue to morph with due consideration for joint-interoperability, inclusion of latest technologies and available budget.

To fulfill the test of a credible architectural plan for a *construct metamorphosis* will require a military organization to have satisfied two important conditions.

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[35] Fried P. Stein, "Observations on the Emergence of Network Centric Warfare," Evidence Based Research, Inc. (1998); available from http://www.dodccrp.org/research/ncw/stein_observations/steinncw.htm; Internet; accessed 26 September 2005. See also David S. Alberts and Richard E. Hayes, 186-198.

[36] Arthur L. Money, "Report on Network Centric Warfare, Sense of the Report," (March 2001): 16. Available from http://www.dod.mil/nii/NCW/ncw_sense.pdf; Internet; accessed 26 September 2005.

[37] Ibid., 16.

[38] Journal of the Singapore Armed Forces, "Realising Integrated Knowledge-based Command and Control: Transforming the SAF," 24-27.

[39] Ibid., 24-26.

Mandate for Interoperability: The mandate for C4I interoperability among the services and inter-agencies is obvious.[40] Our failure to fight as a joint team to bring about coordinated actions to bear on the adversary is directly proportional to our lack of a clearly defined network architecture for joint-service interoperability within a military organization, notwithstanding other organizational and cultural factors. For a long time, service parochialism has always limited C4I interoperability in almost every military organization. Each service tends to build its own C4I systems, considering joint interoperability only as an after-thought. Interoperability is fostered when force planners and operational commanders develop a joint architecture that provides interoperable and compatible C4I networks among all the services. Functional capability can be made a reality by beginning with those tasks associated with command, control, communications, computers and intelligence. Budget and planning can be controlled and managed by a central agency at the joint level to demand for joint-interoperability in those areas. This serves to discourage the services from competing for limited procurement dollars for individual service systems and encourage them to mount a cooperative budget initiative for an integrated system. The pursuit of a networked and integrated force that employs diverse capabilities best complements all services.

Prioritized Fiscal Prudence: The *construct metamorphosis* recognizes that, for most armed forces, a networked force can only be progressively developed. However, the critical mass of connectivity and inter-operability is ultimately necessary to both encourage and support new ways of doing business. It is a necessary pre-requisite that has to be pursued and carried out by those military forces contemplating NCW. Based on

[40] David S. Alberts and Richard E. Hayes, 107-120.

each military organization's financial resource, the *construct metamorphosis* will serve to network its armed forces at a reasonable pace and with a clear goal on what priorities and how those milestones are to be achieved with fiscal prudence. All military organizations will need to determine their own construct of network architecture and plan their *construct metamorphosis* given the limited finances to develop the networks that support information sharing and collaboration across all the services, and, where applicable, inter-agencies.

Evidence from initial experimentations at the service level in the US Armed Forces[41] indicated "that focused, yet relatively small, investments in networking can have a disproportionate impact on the ability of a force to increase its combat power in high priority mission areas."[42] Ideally, in the long run, these experiments should be expanded to cover interoperability among its services in a joint-fashion. The implication here is to invest prudently and initially in networking the force in the areas that will have the highest payoff to commanders and at the operational level. Developing a prioritized and prudent fiscal plan for the *construct metamorphosis* enables a military organization to creatively manage its budgetary means to progressively realize a common and interoperable networked architecture within and beyond its military establishment. This plan for a *construct metamorphosis* will continue to pave the road for conceptualizing NCW as a part of the RMA.

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[41] These experimentations included the US Air Force Operational Special Project, the Fleet Battle Experiment Delta and the Army Digitization and Experimentation. See John J. Garstka, "Network Centric Warfare: An Overview of Emerging Theory;" *Military Operations Research Society Publication* (Dec 2000); Available from http://www.mors.org/publications/phalanx/dec00/feature.htm; Internet; accessed 26 September 2005.

[42] Journal of the Singapore Armed Forces, "Realising Integrated Knowledge-based Command and Control: Transforming the SAF," 50.

In the foreseeable future, the sensors will become smaller and cheaper, and numerous sensors can be netted to detect, locate, identify, and track targets achieving near real-time surveillance over vast areas. Computing power can be expected to increase significantly to process, collate, and analyze the vast quantity of sensor data, and to provide the means to distribute information to any recipient or "shooter" anywhere in the world at near-real-time speeds. Together, these trends can produce systems, at a relatively cheaper cost, that will provide the quantity and quality of data needed to create a "situational awareness" that is "global in scope and precise in detail".[43]

Thus far, we have discussed how 3C's criteria must be completely fulfilled by a military organization in order to ensure that it is properly evaluating, guiding and conceptualizing its use of NCW as a holistic, RMA-inspired form of war, and not just as an especially effective new tool.

Conclusion

This essay has argued that the new capabilities embodied in NCW will remain just that – capabilities – if the potential of NCW as a new form or approach to war is not appreciated, as laid out in the first part of this paper. But how will a military force know if it had understood the potential of NCW properly AND actually adapt itself to use it effectively? To help answer these questions, the second part of this paper suggested a three-part litmus test that any military could use to determine if it is integrating NCW correctly – that is, as a *tao* of warfighting – within its self-transformation plans. The 3C's

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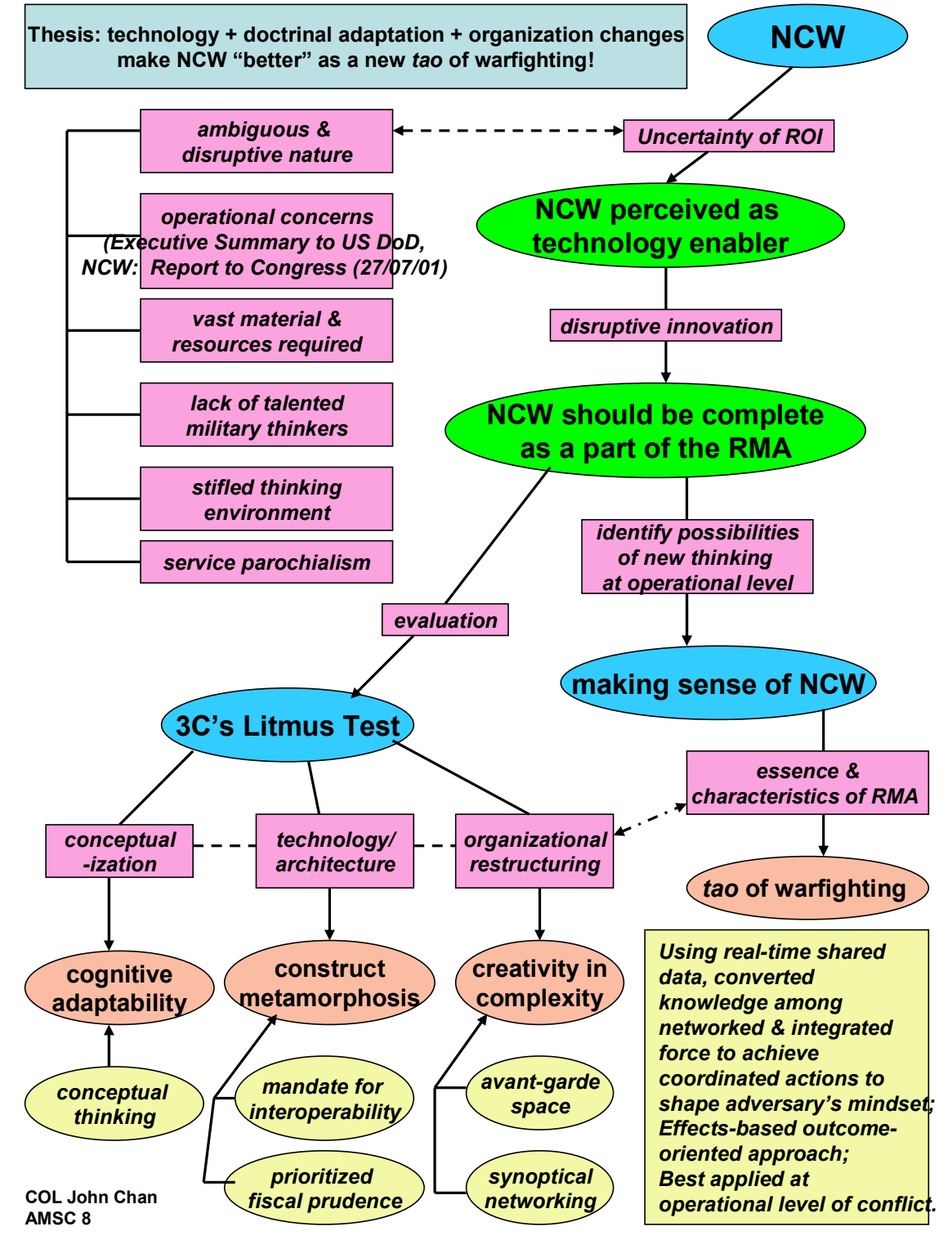
[43] Edward A. Smith, Jr., "Network Centric Warfare: What's the Point?"

Litmus Test includes *Cognitive Adaptability*, *Creativity in Complexity* and *Construct Metamorphosis*. Operational commanders must first develop *cognitive adaptability* through *conceptual thinking* in order to develop NCW into a genuinely new way of warfighting. The second criterion requires military organizations to facilitate *creativity in complexity* by creating the *avant-garde space* and the *synoptical connectivity* for creative "military Machiavellians" to flower. Thirdly, and finally, an architectural plan for a *construct metamorphosis* will require a *mandate for interoperability* and *prioritized fiscal prudence*.



Map: Construct of "Think-Piece"

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