9th International Command and Control Research and Technology Symposium

Coalition Transformation: An Evolution of People, Processes and Technology to Enhance Interoperability

Symposium Theme: Network Centric Applications

Title: The Future Warrior

Point of contact: Leoni Warne

Leoni Warne
Defence Science and Technology Organisation
Fern Hill Park
Department of Defence
Canberra ACT 2600
Phone +61 2 6256 6219
Fax +61 2 6256 6233
Email
Leoni.Warne@dsto.defence.gov.au

Irena Ali
Defence Science and Technology Organisation
Fern Hill Park
Department of Defence
Canberra ACT 2600
Phone +61 2 6256 6252
Fax +61 2 6256 6233
Email
Irena.Ali@dsto.defence.gov.au

Derek Bopping
Defence Science and Technology Organisation
Fern Hill Park
Department of Defence
Canberra ACT 2600
Phone +61 2 6256 6226
Fax +61 2 6256 6233
Email
Derek.Bopping@dsto.defence.gov.au

Dennis Hart
School of Business and Information Management
Australian National University
Canberra ACT 0200
Phone +61 2 6125 3588
Fax +61 2 6125 5005
Email
Dennis.Hart@anu.edu.au

Celina Pascoe
School of Information Management and Tourism
University of Canberra ACT 2601
Phone +61 2 6201 2912
Fax +61 2 6256 6233
Email
Celina.Pascoe@canberra.edu.au

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Leoni Warne
Defence Science and Technology Organisation
Fern Hill Park, Department of Defence
Canberra ACT 2600, AUSTRALIA

Irena Ali
Defence Science and Technology Organisation
Fern Hill Park, Department of Defence
Canberra ACT 2600, AUSTRALIA

Derek Bopping
Defence Science and Technology Organisation
Fern Hill Park, Department of Defence
Canberra ACT 2600, AUSTRALIA

Dennis Hart
School of Business and Information Management
Australian National University
Canberra ACT 0200, AUSTRALIA

Celina Pascoe
School of Information Management and Tourism
University of Canberra ACT 2601, AUSTRALIA

Abstract

This paper posits that the human, not the technological dimension of future warfighting is pivotal and central to its success. The authors are involved in a research project in which the primary objective is to investigate the human issues that need to be considered and supported to make the most of the future Network Centric Warfare (NCW) environment. In addition, the research is intended to enhance understanding of the changes that should ideally take place to optimise this form of warfare. Within this context, one of the desired outcomes is to identify the new information demands, skills and characteristics that will be required of future warfighters.

The authors discuss traditional warrior characteristics, and the group interaction and information sharing requirements of NCW to propose a future warfighting context that will dictate the ideal future warrior characteristics. In addition, the authors have highlighted some of the concerns that have arisen during the course of their research and suggest further research is required on salient human issues for the Future Network Centric Warrior.

1. Introduction

Recent concept development effort has provided a better understanding of some of the key issues in future warfighting, especially the implications of enhanced connectivity, distributed warfighting and the linkage and interaction of national policy, government agencies and military operations. NCW (Network Centric Warfare) can be simply described as the style of warfare that is potentially possible when individual combat units are robustly connected by information. If this is achieved, many familiar constraints may disappear, as units should become able to interact in many more productive ways than are possible under traditional systems of command and control. Furthermore, it is now generally accepted that an NCW environment is likely to necessitate interaction between force elements with little or no history of cooperation. However, while most of the effort expended on working towards NCW has been expended on connectivity problems, platforms and technology, the authors of this paper believe that the human, not the technological, dimension of warfighting is pivotal and central to its success.

The authors are involved in research investigating the human issues that need to be considered and supported to make the most of the future NCW environment. In addition, the research is intended to enhance understanding of the changes that should ideally take place to optimise this form of warfare. Within this context, one of the desired outcomes is to identify the new skills and characteristics that will be required of future warfighters.

The paper reports on interim findings from this research and is largely based on a review of literature and current research, with a particular emphasis on the context of NCW for future warfighting, in terms of the commonly accepted characteristics of traditional and future warfighters and the future information demands, skills, competencies and workforce requirements for NCW.

2. Background

NCW is an attempt to translate a business concept of the 1990s into military practice. During this decade, a number of companies attained dramatic competitive advantages in their fields by creating comprehensive, complex communication and information networks. These companies, facilitated by the increasing efficiencies and speed of information technology, remained flexible and adaptable to change. NCW is the military application of these concepts. In many ways the environment in which the military forces operate does not differ from that of the business environment. It is characterized by constant change and uncertainty, and exposed to the vagaries of the political and economic climate. Therefore, the military, like other modern organizations, will require the capacity to deal with complexity and a system that facilitates learning from experiences, continuous learning and innovation in learning. Specifically, it attempts to exploit the increasing interconnectedness between organizational units to allow better communication, information sharing, cooperation and therefore flexibility, adaptability and effectiveness. NCW might offer a whole range of warfighting advantages, including the ability to focus limited resources using superior knowledge, increased protection for forces through information, and an ability to share information quickly and securely across current boundaries.

However, this wiring together of the force does not guarantee that NCW or its benefits will naturally follow, since network centric warfare, as currently conceived, is inherently a behavioral, tactical, bottom-up phenomenon. It entails more than just the possession of large amounts of information. In fact, simply flooding the network with information will more than likely ensure that shared awareness does *not* occur. Information must be absorbed and interpreted by the people within the connected and communicating units, within the broader context of commander's intent, in order for the desired benefits to materialize.

Underlying most NCW discussions there are some important assumptions about how humans and organisational elements will be structured and function in this new environment. For instance, the assumption that existing organisational structures, procedures and processes will be able to seamlessly incorporate and make use of it, is, at least potentially, a mistake. Conversely, the opposite assumption that any organisational and human changes needed to take advantage of new technological capability will always be achievable is, almost certainly, equally rash. There remain uncontested challenges originating from human capabilities to function in such an environment, such as the ability to deal with, interpret and act upon vastly increased information flows. Clearly, a close examination of the issues that should be considered is required. In the next section, this process begins by discussing what is known about the primary characteristics of past and current warriors.

3. **Warrior Characteristics**

Traditionally, warriors are required to exhibit qualities such as discipline, fitness, decisiveness, leadership, obedience, patriotism, sacrifice and loyalty.

In her typology of the Warrior, Nuciari (2003) lists the following essential expectations of warrior types:

Discipline
To be fit for action
Decisiveness
Leadership
Obedience
Ability to undergo physical stress
Patriotism
Readiness to make sacrifices
Loyalty to the civil power.

The Cold War and the Vietnam War brought new concepts of warfighting to military organisations, and since the 1970s, military organisations have increasingly become involved in MOOTW (Military Operations other than War). Certainly, since World War II, the Australian Defence Force (ADF) has participated in over 25 United Nations and multinational peacekeeping operations, during the course of which the ADF has earned a reputation for professionalism, technical skill and humanity (Pratten, 1996). According to Nuciari (2003) the characteristics of the peacekeeper are:

Determination
Empathy
Expertise
Ability to easily make friends

Co-operativeness
Mental Strength
General Education
Open-mindedness
Taking responsibility

While there is a definite conflict between some of the elements of Nuciari's two sets of characteristics, she also identifies a third, emergent type which she characterises as "In Between" or "Flexible" having complementary characteristics from both the Warrior and Peacekeeper typologies, and being the type of soldier who is able to cope with a job that " 'is not a soldiers' job, but only a soldier can do it" (Nuciari, 2003).

The 1990s and the new century have brought three combat operations in the Middle East, each with technological refinements that have wrought new changes to the face of war and have involved Australians in MOUT (Military Operations in Urban Terrain). The comparisons of the Gulf conflicts in the 1990s and 2003 clearly reflect the transformational character of warfighting. The 1991 Gulf war was characterised by linear lines of operation with distinct phases, and deconfliction of the battlespace by forward planning. In the most recent war in Iraq, active deconfliction and more discriminating and economical combat power was deployed as well as far more integration of joint capabilities through NCW.

Finally, the ugly face of terrorism has brought new meaning to the term asynchronous operations. The warrior of today, therefore, must be prepared to act as a peacekeeper, take part in combat operations and live and work with ambiguity in an uncertain global environment. There is some evidence to suggest that the characteristics of Nuciari's Flexible Warrior are those that will carry us through this new century. However, in order for Flexible Warriors to function effectively, they will also need to learn to interact with others within their immediate group, be they fellow servicemen, coalition forces, or civilians.

4. **Group Interaction in NCW**

NCW is based on the idea that information is only useful if it allows personnel and units to act more effectively. This makes understanding the people and groups in the network, and more particularly their capabilities and limitations, fundamental to successful NCW. NCW aims to communicate the commander's intent while encouraging lower level units to self-synchronize in order to achieve the effects desired. However, this aim must be considered within the broader battlespace context envisaged by contemporary warfighting concepts such as multi-dimensional maneuver and effects based operations. These prescribe high levels of interoperability and jointness between military personnel and members of other agencies.

4.1 *Force Mixing*

Future warfare will almost certainly involve more collaboration across services, across nations and with civilians and reservists. The Strategic Workforce Planning Review Report (Defence, 2003) suggests that this workforce mix will be a likely component of future operations. The Review cites the East Timor experience, which, although it was not part of the overall planning, evolved a workforce mix as the

operational risk diminished. Substituting industry civilians and Professional Service Providers for Permanent Force members eased the pressure on sustaining the force, particularly in logistic support. While this model was not applied to recent deployments to the Middle East, the review suggests it could have been. The report recommends that future ADF exercises include industry participation as a standard part of the planning, including workforce mixing in the area of operations and associated risk management, and contingency and operational plans that include workforce mix options. This workforce mix has implications for the education and training of both the military and their industry co-workers (Defence, 2003).

If workforce mixing is the way of the future, then training in this way becomes essential. The British have used this form of integration in what they call "force packaging", i.e. modular structures defined as a "series of coherent, self-contained, mix-and-match sets of units borrowed from the various organic commands for a given mission. Such modules can be assembled at short notice to form a mix of force appropriate for the specific demands of unforseen crisis demanding the use of armed forces"[1]. This requires serious changes in training and education of military personnel of all ranks. It also requires the development, of 'cultural interoperability', i.e. the development of a joint organisational culture encouraging effective cooperation among different service cultures (Manigart, 2003).

4.2 *Information Sharing*

The concept of NCW is based on the connecting together of the elements of a military or mixed force so they can readily communicate needed information in real time, or close to it, using software applications built for that purpose. The vision is to use that information to make better decisions, faster, and to communicate those decisions to the executors of them more quickly and precisely than one's adversary. But to achieve this requires not only an effective underlying technological capability but also a highly proficient, well-organised and trained force that is able to take advantage of the resources the technological capability makes available to it. Most particularly, it requires the ability and willingness to discern and focus on what is of importance in the volume of available information, and to trust and share it with others who may need or be able to make use of it.

The essence of the NCW vision is that the technologies and information they can provide and disseminate across and through the military force will allow involved personnel to achieve a shared understanding of the situation with which they are faced, as well as the intent of their force commanders, so that the opponent's vulnerabilities and any opportunities for action can be identified and exploited. However, achievement of this vision is not likely to be as straightforward as has sometimes been assumed. For example, issues of information overload due to the volume of information, time constraints in filtering, assessing and interpreting it, variations in the reliability and quality of the information, and the presence of disinformation and conflicting information. Furthermore, other issues that arise relate to the presentation of information, the willingness of personnel and groups to share information, the potential for misunderstandings and differences of meaning, and

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[1] Citing from citing from Dandeker (1999) *Further uncertainty: flexible forces for the Twenty-first Century*, Karlstad, Swedish National Defense College, p. 30.

readiness to trust and cooperate with previously unknown others. While some possible approaches exist or have been proposed for dealing with these problems, they are not yet well understood or validated.

4.2.1 Trust

Effective and efficient exchange of information underpins the success of all military activities. Without such exchange, the collective action and cooperation necessary for the accomplishment of military goals, particularly in operational contexts, is impossible. However, effective information exchange in a warfighting context is often more difficult than it first appears. Factors can emerge which obstruct an individual's willingness to volunteer information or to provide it to others on request, particularly when the information of concern is highly sensitive and when the potential recipient is largely unknown. Concerns over how others might use valuable information often restricts one's readiness to part with it (Erickson, 1979).

A large amount of research has demonstrated that the extent to which an individual trusts another has a significant impact on their willingness to exchange valuable information with others (e.g., Fine & Holyfield, 1996). Despite this extensive empirical attention however, consensus on a definition of trust has not been forthcoming (Barber, 1983; Kramer, 1999). For present purposes, trust can be defined as the subjective expectation of positive treatment under conditions of vulnerability (Mayer, Davis, & Schoorman, 1995). In other words, we trust another to the extent that we believe they will act beneficially (or at least not detrimentally) towards us if we choose to engage them in some form of cooperation and when cooperating involves some degree of risk (Gambetta, 1988). Thus, trust is especially relevant when there is uncertainty or ignorance as to the motives and actions of others. When these can be predicted with absolute certainty, trust is not required. When they cannot, as in most 'real world' circumstances, a degree of trust is necessary to make human action and interaction possible.

The idea that important military outcomes, like information exchange, are shaped by the presence or absence of trust is particularly salient when the characteristics of future warfighting are examined. There is widespread consensus, for example, that the future activities of the ADF (and, indeed all 'modernised' defence organisations) will be characterised by greater levels of interdependence and cooperation between previously disparate individuals, groups, and organisations (Hinge, 1996). Moreover, it is widely believed that future warfighting will be conducted in contexts that are increasingly uncertain and unpredictable. The breakdown of the relative certainty associated with the bi-polarity of the Cold War has meant that the activities which military forces must now perform (e.g., peace-keeping and peace-enforcement) are more diffuse and less predictable in nature than ever before (Dorman et al., 1998). As a result, military personnel will have to be more willing to be vulnerable toward each other than ever before. Put simply, the need to trust others will be a fundamental and paramount dimension of the future warfighting context.

4.2.2 Volume of Information

Information technologies have advanced to the point where it is now possible to "produce, manipulate and disseminate information … much faster than we can process it" and "instead of better enabling a person to do their job [this] threatens to

engulf his or her control over the situation" (Edmunds & Morris, 2000). This phenomenon is now well known as "information overload". Other terms referring to the same thing are "infoglut" and "data smog" (Shenk, 1997), and the effect on those exposed and affected by it has been called "analysis paralysis" (Stanley & Clipsham, 1997) and "information fatigue syndrome" (Oppenheim, 1997). Four major factors have been found to contribute to information overload: the sheer volume of information, the difficulty or impossibility of successfully managing it due to time constraints, the irrelevance or unimportance of most of it, and the multiple sources from which it arrives. However, it appears that the volume of information (Farhoomand & Drury, 2002) and the time pressure aspect (Kock, 2000) are the most important.

NCW is predicated, as has been noted, on the connection of military force and supporting elements together to enable, as far as possible, unhindered information flow between them. It seems clear that this will result in orders of magnitude more information for military personnel and commanders to handle than ever before. This, combined with the often significant time pressure on military personnel to reach a decision, means that the issue of information overload of these personnel will become ever more important. Indeed efforts to understand the implications of this problem in a military environment have been and are still a topic of significant research interest (e.g. Entin et al, 1998; MacDonald & Oettinger, 2002).

In their study of information overload, Farhoomand and Drury (2002) find that filtering is the most commonly suggested solution to the problem. But the obvious question is 'how'? Any kind of automated filtering assumes that it is possible to identify what would be interesting, relevant or important in the information beforehand but in a typically unstructured, confused and chaotic military environment this is unlikely to be possible in general. On the contrary, loading the responsibility for filtering onto personnel trying to cope with other demanding tasks, such as understanding the information and deciding how or if to act upon it, is unlikely to work well either. Perhaps, therefore, there is a need for a dedicated new role – a person whose job it is, and who is trained specifically for the task, to scan incoming information for anything that might possibly be unusual, interesting or important in the incoming stream and pass it on to others for consideration, analysis and decision. That is, someone whose job amounts to being responsible just for picking out things and in effect saying "that's odd; you might want to take a look at it". This might counter the two major factors in information overload – volume and time constraints. First, volume could be coped with better because the responsibility would not be to assimilate the incoming information, just to note unusual features in it without any further analysis. Secondly, the time constraint would be alleviated because that is all such a person would be required to do. No other demands would be made of them. As an example, a whole range of oddities were individually known before the September 11, 2001 terrorist attacks (like people learning to fly airliners but who weren't interested in learning how to land them) that, if picked out and aggregated, could very probably have enabled prediction of the attack. But no one was tasked with picking out these oddities, just because they looked interesting, for others to analyse.

4.2.3 Shared Activities

With wider use of technologies to achieve routine or programmed tasks, the dynamic of human productivity in organisations has shifted into a 'meta-realm' of shared activity. Daneshgar (2003) notes that, in such contexts, it is not only what a person knows that is important but also what they believe should be shared, when, how and with whom. Thus, for most participants in such systems, the notion of awareness needs to be extended to include the emerging new roles that involve attending to the needs of other participants and related communication responsibilities. Other features of this 'meta-realm' include advanced strategic cooperation and increased communication aimed at shared applications of a range of knowledge emerging from a more complex and often more intense experiences (Crawford, 2003).

The new contexts often involve the management of large amounts of data and rapid decision-making between people who are not necessarily based in the same location nor indeed having similar experiences. People with particular perspectives, knowledge or information have a responsibility to share with other stakeholders. The contexts also often involve interpreting and acting on data, sometimes about other people, that has been obtained using machine capacities beyond human sensory capabilities. The shared human tasks in such a setting require an expanded set of individual (and group) capabilities that include:

> Defining the problem and collectively refining the objective of the shared activity.
> Scoping and reviewing the factors involved and interpreting available information and providing feedback and advice to other members of the group.
> Choosing, debating and designing a provisional shared overall strategy.
> Selecting provisional practical tactics to achieve the shared objective.
> Implementing provisional operational processes that have been decided on by the group.
> Evaluating the results, the incoming data, the changing context, the emerging governing variables, the original objective, learning from the ongoing experience, and revising the human activity accordingly (Crawford, 2003).

In such settings, much of the routine activity of the tools is networked and machine-to-machine interaction is usually outside the immediate awareness of people. In complex and rapidly evolving settings, with a high technical component, it is already recognised that operational styles and capabilities to carry out routine instructions obediently, accurately and without reflection are less in demand than in former eras[2]. Recent research indicates that new technologies are interpreted and used differently, with varying benefits by people with different styles (Crawford, 2003).

Despite the claimed benefits of sharing data and information in organisations, and the undoubted and ever increasing capabilities of ICT to enable it, sharing evidently

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2 The OECD Growth Project reported that employment growth of knowledge workers grew significantly faster than that of other occupations during the period 1992 – 1999. OECD, The New Economy: Beyond the Hype. Final Report on the OECD Growth Project, 2001.

remains remarkably difficult. For example, a decade or so ago Davenport, et al (1992) said that "the rhetoric and technology of information management have far out-paced the ability of people to understand and agree on what information they need and then to share it [so] the information-based organisation is largely a fantasy" and, arguably, the situation has not changed much since. Kendall & Kendall (2002, p73), discussing the management of e-commerce projects, say "organisational politics can come into play, because often units feel protective of the data they generate and do not understand the need to share them across the organisation". Evidently, motivations for sharing data, information and knowledge – or perhaps even more importantly, motivations for *not* sharing (e.g. Hart, 2002) – need to be better understood than they are if the claimed benefits of NCW are to actually be achieved.

4.2.4 Context, Communication and Signs

It is not infrequently said that information is data in context. But the question immediately arises as to *whose* context? All communication occurs through the use of *signs* and, very often in the case of humans, specialized signs termed *symbols*. The study of signs and symbols is called semiotics, an area that has been of increasing interest in information systems research over recent years (e.g. Ramprasad & Rai, 1996; Liebenau & Harindranath, 2002).

Signs or symbols are always part of a "system of signification" that gives them their meaning. The importance of this is that "one agent may intend some signals [signs] to convey one meaning but the receiver takes them to mean something else, or fails to derive any meaning from them at all" (Benyon, 2001). Moreover, the risks of this happening are increased because:

"The new forms [of information and communication technology] multiply the capacity for information generation and dissipation; more people have access to the same stimuli to generate information, and more people can act upon the same information and dissipate it [to others]. As such there is increased scope for conflict as well as cooperation in interpreting the stimuli and determining the action to be taken based on the information" (Ramprasad & Rai, 1996)

NCW arguably has much in common with organizational decision support systems (ODSSs) in that both are focussed on the communication and coordination function in the organization and include "all systems that provide "borderless" and "seamless" decision-making support across functional, divisional and national boundaries" (Liebenau & Harindranath, 2002). They therefore face at least some similar issues, including, for example, the fact that often "group representatives tend to operate in an organizationally sub-optimal way as their first loyalty is to their own groups rather than to the organization" because different contexts and the resulting perceptions will often "conflict with one another, despite an overall shared organizational goal" (Liebenau & Harindranath, 2002).

As Stamper (1992) notes, computerized information systems, such as NCW systems, support the capture, storage, retrieval and dissemination of signs at only the lowest levels of the semiotic ladder but do not deal with the higher levels at which meaning and intent enter, and at which context is ever more important to the sign's effects. It cannot, therefore, be uncritically assumed (as much of the current discussion of NCW tends to do) that the provision of however much information will actually result in

"shared understanding" or a "Common Relevant Operating Picture" as the basis of decision-making regarding actions to be taken.

4.2.5 Reliability and Quality

Reliability can be a crucial information attribute, and is quite different from accuracy with which it is sometimes confused. For example, in comparing the early days of radio with the still early evolution of Internet communication technologies, Hargittai (2000) describes the situation of the Titanic in which "messages sent to the mainland [by the sinking vessel] were intercepted and mixed indiscriminately with other messages by amateur users, leading to information that made it seem the ship was heading safely towards the coast" which, of course, it was not. In this case, accurate information was there but buried and mixed up with other probably equally accurate material in such a way that the received message bore no relation to actuality. As eventually understood, the information was not reliable and, although this was almost certainly unavoidable anyway, the ship was lost along with most of its passengers and crew.

Stair & Reynolds (1998) say "Reliable information can be depended on". But reliability is a function of several factors other than the accuracy of the information itself. As in the example of the Titanic, combining (even accurate) information from different sources in ways that may seem obvious at the time but which in fact are inappropriate can be disastrous. And, beyond that, the collection method and source are also important reliability issues since, even if the information is completely accurate, if either of these is regarded as suspect for any reason then so also will the information sourced through them.

Information reliability is an aspect of information quality. But "although one can ensure the quality of data [from which information is derived], it is often hard to control for the quality of the information" (Sen, 2001). Moreover, the reliability and quality of a piece of information are not fixed since the information may be used for a variety of different purposes and, for some of these purposes, it may be of an entirely adequate reliability and quality but, for others, not. Reliability and quality are, therefore, relative to intended use and are not absolute measures applicable to information independently of its use context. But herein lies a dilemma. It is difficult if not impossible to predict *ex ante* how information might be used in a NCW environment (even more so than in a business environment, which is difficult enough) and therefore to rate its reliability and quality for these potential purposes. But, on the other side of the coin, the uses to which information might be put are themselves at least partially dependent on the reliability and quality it is assessed to have.

NCW discussions often talk of a "Common Relevant Operating Picture" or an equivalent concept. But is it possible to have such a thing? The purposes to which an operating picture is to be put determine not only what information is relevant but also what counts as reliable information, of appropriate quality, to incorporate into it.

According to English (2001) quality information has the following characteristics. It:

is the right data/information
is complete
is in the right context

has the right accuracy and objectivity
is without redundancy
is in the right format
is at the right time
is at the right place
is for the right purpose

This, however, rather begs the question of what is "right" and how this should be judged given that what is right depends on the purposes the information consumer has in mind and also that purposes, in fluid and ambiguous circumstances such as warfighting, are often emergent in light of the information available at the time. Indeed, it has been argued that the focus on information first, separately from the questions it might potentially answer, is unbalanced and that a "question-centric" rather than an "information-centric" approach has significant advantages such as a high tolerance for ambiguity (Lauer, 2001). So, which comes first: right (i.e. reliable, high quality) information or purpose, and its associated questions? Or, if neither (or both), how is this joint dependency to be managed and supported?

4.2.6 Presentation

The way in which information is presented has important effects on how it is received and the effects it has. In particular, the communication medium used has been argued to have effects on levels of cooperation and trust between the communicating parties, although there is also evidence that this can depend on the cognitive styles of the consumers of the information as well (Barkhi, 2002).

Communication media can be characterized according to their "richness" and media richness theory argues that various kinds of media differ in their ability to convey information and to change understanding within a given time interval (Daft & Lengel, 1986). The richness of the medium is based on four criteria: its level of feedback, multiple cues, language variety and personal focus. Face-to-face is regarded as the richest communication medium, and computer- mediated communication is leanest. Moreover, the task-media fit hypothesis (McGrath, 1991) proposes that the nature of the task being undertaken and the richness of the communication medium involved interact and affect the effectiveness with which the task is performed. The hypothesis says, for example, that different kinds of tasks range in the potential communication richness required for success. In order of increasing required communication richness, the task types and their preferred media are (McGrath & Hollingshead, 1993):

generating ideas and plans – computer systems;
choosing correct answers; intellective tasks – audio or video systems;
choosing preferred answers; judgment tasks – audio or video systems; and
negotiating conflicts of interests – face-to-face.

The tasks that must be performed by military personnel, whether in an NCW environment or not, range across all of these types and, while empirical support for the task-media fit hypothesis has been mixed (e.g. Mennecke, Valacich and Wheeler, 2000), it seems clear that it is important to take issues of this kind into account when considering how to design and operate an NCW environment, and how to train personnel in its use. In particular, it seems evident that it will be necessary to provide

for information to be presented in different ways and at different levels of abstraction to suit the kind of task being undertaken as well as the users requirements and cognitive preferences.

4.2.7 Disinformation/Conflicting Information

Disinformation is so-called information that has been "manipulated or 'created' to provide the target, or its environment, a perception that develops behaviours beneficial to the attacker" (Hutchinson & Warren, 2000). The kinds of effects an adversary may set out to achieve through its use are typically:

> to undermine the cohesion, coordination, cooperation and effectiveness of the opposing military force by sowing confusion and doubt in the minds of its members; and
> to misrepresent the situation with which it is faced and therefore to encourage inappropriate or unproductive behaviours.

A well known example of the latter strategy was the creation, prior to the invasion of Europe by the Allies in 1944, of a dummy army, including phoney communications between and about the dummy elements of the force, opposite Calais in France in order to direct the attention of the German defenders to that area and away from the actual landing beaches in Normandy; a disinformation strategy that turned out to be highly successful in the end.

Disinformation works best when it is not seen for what it is. That is, when the consumers credit it as being, at least potentially, 'real' information. Even so, disinformation can still be effective even if this is not the case. For example, if those who consume and depend on the information stream suspect that *some* of what they are receiving may have been interfered with, falsified or created to deceive, but do not know *what* has been so affected, then they may be led to doubt *all* or at least substantial portions of it. Moreover, it may be that the information itself has not been compromised; it being sufficient to cast doubt on its origin or source to create the desired confusion and doubt.

Even in the absence of interference with information by the adversary there may be conflicting or dissonant information. Military operations are often, if not always, accompanied by high levels of uncertainty, confusion and ambiguity and it is thus almost inevitable that a certain portion of the information obtained or reported will be (unintentionally) false, mistaken or misleading, or inconsistent with other information. Indeed, as the number of interconnections between force, command and support elements increases – and NCW aims to connect all or at least most – this is more and more likely to be the case.

The question, then, is not how disinformation and conflicting or dissonant information can be avoided. They will always be, or potentially be, present. Technologically based methods can only ever reduce, not eliminate their occurrence. Rather, the issue is how they can be dealt with successfully by the human information consumers and decision-makers with the least disruption to the successful functioning of the military force. A related risk, in an information intensive NCW environment, is the temptation to wait for, or pursue, a complete picture of what is going on – to attempt to identify and eliminate any disinformation that has crept in, to reconcile any conflicting information and to wait for the 'one last piece' of the jigsaw that will make it all come

clear. This can lead to self-induced decision paralysis and is a reflection of an addiction to information based on the assumption that it is possible to have what has been called a 'transparent' battlespace. But this is unachievable and care will have to be taken to train personnel operating in an NCW environment so they can strike an appropriate balance between the information they regard as essential to have before making a decision, and that they judge they can do without. The best commanders know when they know enough to go ahead.

4.3 *The Future Warfighting Context*

In terms of information demands, command and control and operating within the NCW battlespace, the primary issue is sense-making: "Once an understanding of a situation that requires attention has been reached, individuals and organisations engage in a process best know as sense-making, in which the relate their understanding of the situation to their mental models of how it can evolve over time, their ability to control that development, and the values that drive their choices of action"(Alberts, 2001) Once the sense-making process has resulted in a number of possible alternative actions, a set of criteria for evaluating the alternatives and an assessment of the alternatives, a decision can be made. However, many military decisions, particularly in the NCW context, involve considerable uncertainty, new situations and novel features that require innovative thought and sense-making in the cognitive domain. Research has shown that, in the military domain, complex decisions are best made by small numbers of individuals who have different backgrounds and different perceptions of the situation (Alberts, 2001). These analytical processes are often performed quickly, even subconsciously, by individuals, but in a NCW context shared sense-making and shared decision-making can become a crucial part of the process.

Two main themes emerge from a review of the future battlespace, both of which offer directions for future research efforts and organisational changes. The first of these concerns the mechanism whereby *influence* is exerted in the battlespace. In the future battlespace, an adversary is influenced as much by non-military (so-called 'indirect') means as by traditional military means. Indeed, these indirect means may involve elements of the adversary's own landscape (e.g., their domestic politics). Clearly, this shift in focus requires ADF personnel to be equipped with a greater knowledge of a given adversary's perspective so as to be able to identify the factors having the most leverage over them. Such an undertaking would involve a major transformation in how ADF personnel are trained to conceive military operations.

The second theme pertains to the fundamental importance of human cooperation. The future battlespace will demand that personnel cooperate to a far greater extent than ever before. Yet, the factors affecting the achievement of this outcome are more social and psychological in nature than they are technological. For that reason, efforts must be made towards understanding the psychological underpinnings of interpersonal and inter-group cooperation in military contexts through a program of systematic research, with an eye for change in military training structures.

Development of confidence, initiative and trust rests on education and training about Mission Command from the earliest stages of an individual's career. Military activities that place a heavy emphasis on unthinking obedience will be counter-productive to the development of initiative and trust. Ideally, all participants in a NC

force will need to be: skilled, confident, adaptable, intuitive, innovative, independent, always mindful of the Commander's intent, and good at building and sustaining relationships in the workplace. These characteristics are synonymous with those displayed by people with a high emotional intelligence index.

Successful exponents of emotional intelligence prepare by immersing themselves in the problem and information, incubate the information and possibilities, illuminate solutions and take action, even if it requires dogged persistence despite objections, setbacks and failures along the way. People with a high emotional intelligence index have a drive to achieve, commitment to the organization's vision and goals and initiative and optimism. They have 'the ability to be flexible, to take in new, even painful information without tuning out in self-protection, and to respond nimbly'. They know that 'an accurate understanding of the formal organisational structure is not enough, that what's needed is a keen sense of the informal structure and the unspoken power centres and they realise that "building relationships creates a reservoir of trust" for the future (Goleman, 1998). Fortunately, emotional intelligence is a learned capability and, as such, should become part of the education and training of the Future Warrior.

While much remains to be learned, it is already clear that the availability of more and more information through NCW technologies and capabilities will not, of itself, provide any kind of final answer to the problems involved in warfighting. In fact, it is more likely that it may only alleviate or put a new cast on some old problems but at the same time raise new problems of its own.

5. **Future Warrior Requirements**

While the skills and competencies outlined above are important qualities in many circumstances, others emerge as potentially necessary in the new NCW context. These include a broad range of expertise, cooperativeness, open-mindedness to innovate within the context of command intent and to accept responsibility for initiatives taken. These qualities are seen to be increasingly relevant given the emergence of non-traditional military roles such as MOUT, MOOTW and so on, but may in some ways be incompatible with the more traditional picture of the warrior. Recent conflicts give some clues as to how the military and military organizations may need to transform themselves in order to take advantage of the possibilities of NCW. For example, the recent conflicts in Iraq and Afghanistan were characterised by more flexible and responsive patterns in addition to far more integration of joint capabilities and force mixing.

Interviews with personnel who served in the recent conflict in the Middle East, and observations and survey data from the Multi-National Experiment 03, have been used to capture the warfighters' perceptions of these issues. Personal skills and competencies most frequently cited as important included pragmatic needs such as general computer literacy, familiarity with the actual tools used as well as both more general and specialized knowledge of the battlespace. The dominant concern was the need for more training on the supporting computer tools and the importance of keyboarding skills. Warfighters also highlighted the need for more general communication and team building skills, battlespace knowledge, and cultural and political understanding of other nations. Knowledge of other contextual factors such

as civilian agency plans and operations also featured as important issues impacting on the successful functioning in a multi-national networked environment.

Less common, but equally interesting responses included: “Ability to stay awake”; “Being an educated and not a trained person”; “Patience, insomnia, endurance! Creativity, imagination, communication skills” and “I have to improve the ability to listen, watch, read and talk in the same time in different places. The three most important skills? Multitasking, multitasking, multitasking”.

Since the Future Warrior will be required to deal with war, peace, terrorism and any number of yet unknown situations, it would be desirable to have a mix of the following skills and characteristics: versatility, adaptability, flexibility, confidence, independence, initiative, intercultural competence; system thinking, relationship management; cognitive skills, emotional intelligence; and the ability to cope with uncertainty and ambiguity, to innovate and to improvise.

Furthermore, if the military is to work effectively in integrated teams it has to go beyond integrated infrastructure and encompass the social and psychological bases of interpersonal and inter-group cooperation, based on openness, information sharing and mutual respect. This basis lies in a shared sense of trust, identity and commitment amongst personnel, and manifests as effective information exchange and a willingness to engage in cooperative behaviours.

Personnel should be aware of the individual differences in habits of communicating and decision-making, including their own, and develop skills in recognising, communicating with and accommodating people of various styles and temperaments

Joint exercises, joint assessment and even joint years in military institutions, starting from recruit schools, should be considered to enculture jointery and working in integrated teams.

Clearly, to achieve optimum NCW capabilities will require significant changes in how military forces are internally organized and managed. Issues concerning training, education, promotion, rotation, specialization, recruitment and retention stand out as areas of concern that must be investigated and addressed.

6. **Further Research**

The authors are continuing their work in this area, and interviews of personnel returning from deployment in the Gulf are ongoing. A major aim of further research will be to try to identify ways in which force elements or other units that have not cooperated before can be encouraged to trust each other and negotiate through difficulties of understanding, thus aiding their pursuit of either mutual or individual aims through, for example, information sharing and joint decision-making. Small-scale simulations will be designed in the first instance, with a view to developing a larger scale simulation within the next 12 months. This simulation would be designed to investigate and where appropriate, test, in a broader and militarily realistic way, the concepts and findings that emerge from the earlier work.

However, it is clear that there are many more human and organisational issues that need to be investigated, and that there is a need for more researchers in more nations to take on these tasks.

7. **Conclusion**

There are a number of foundational human concepts that have the potential to form the bedrock of NCW. Given the emphasis placed on high levels of communication, sharing and mutual understanding between participants, concepts such as communication climate, social learning and learning style appear to have particular application in this context. Use of these concepts may lead to practical means through which the innovation, creativity and problem solving ability envisaged by NCW may be achieved. However, extensive further research is required to achieve this.

In this paper, the authors have highlighted some of the concerns that have arisen during the course of their research and given an overview of the salient human issues for the Future Network Centric Warrior, as they see them. While results to date are complex and intertwined there are a number of recurring themes that dominate the findings:

> the future Force will frequently function in mixed operational units, jointly, with coalition forces, with reserves, and supported by industry and humanitarian agencies;
>
> the future battlespace will be information rich, high tempo, unpredictable, require effective information sharing and collaboration and will operate under commander's intent rather than detailed direction;
>
> trust will be a vital component of the battlespace and collaborative operations;
>
> future warfighters will need to process, absorb, share and then make decisions using vast amounts of information presented to them in a variety of formats;
>
> operating under commanders' intent will be of paramount importance. This will profoundly impact on organisational culture, structure and the skills base required;
>
> new skills and competencies will be required in the NCW context. and
>
> new recruitment, education, training, retention and HRM policies will be required.

Further research is required to fully understand and optimise the human and organisational implications inherent in these recurring themes.

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