NetworkER Centric Warfare: Outcomes of the Human Dimension of Future Warfighting Task

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Abstract

NCW is currently the "dominant logic" (Schmidtchen, 2005, p.9) of military operations - a major conceptual platform from which modern militaries will address the challenges of future operating environments. In Australia, NCW is considered a key *capability enabler*, a means by which to enhance the overall warfighting effectiveness of the ADF. The Australian *NCW Roadmap* isolated two dimensions of NCW. The first was the *network dimension*, referring to the physical systems providing connectivity between sensors, commanders and those involved in engaging the adversary. The other dimension articulated by the *Roadmap* is the *human dimension* (Australian Department of Defence, 2005). To date, the vast majority of work in the NCW domain has been conducted with the network dimension in mind. In contrast, efforts to progress the human dimension of NCW are still embryonic.

Over recent years, researchers have been increasingly moving into the domain of social and organisational issues to enrich our understanding of the human in the loop. Furthermore, there appears to be a shift in emphasis from the network to the 'networker'. One such research study, DSTO Task STR 03/242 *The Human Dimension of Future Warfighting*, is in its concluding months, and this paper gives an overview of its outcomes.

The aim of the Task was to investigate: how ADF personnel make sense of an NCW environment; how does that understanding affect their behaviours; and what are the implications of this with respect to the ADF's planned transition to a seamless NCW force?

STR 03/242 comprised three interrelated pieces of research. The first was a review of the literature concerning NCW and future warfighting. The second was a series of 100 in-depth interviews with ADF personnel returned from deployment to the MEAO. The third was the development of the *Go*Team* simulation software. *Go*Team* was developed to assist in further investigating observations from the interview program. Specifically, *Go*Team* is an artificial game environment that simulates aspects of NCW that appear to have particular relevance to the human dimension. The outcomes of each of these will be discussed in this paper, and some of the recommendations will be outlined.

1. Introduction

In Australia today, the most significant organisational adaptation underway is arguably that being conducted within the Australian Defence Organisation (ADO), in particular, the Australian Defence Force (ADF). The context in which the ADF operates has changed dramatically over the past two decades. During this time, the internet has revolutionised communication, globalisation has expanded exponentially and transnational terrorism has replaced the Cold War as a major national security issue. The battlespace of 20 years ago was easily divided into land, sea, and air components. Today, these traditional divisions are less clear and the need for 'jointness' is taken for granted. As the ongoing Coalition operations in Iraq illustrate, the battlespace is now one where the temporal, social and political dimensions of war are far more salient than ever before. Working with non-traditional allies is fast becoming the norm, and it is now imperative for the ADF to interface with a variety of non-military organisations.

The future context and the challenges this presents to the ADF were articulated in what are now the early conceptual contributions of *Force 2020* (Department of Defence, 2002) and the *Future Warfighting Concept* (Department of Defence, 2003). Both documents draw attention to the range of operations the ADF must now perform, a spectrum that extends from emergency relief operations to general warfighting and matters of national

survival. They outline key transitions to be undertaken by the ADF in the coming years including new ideas for training and organisational structures. However, the centrepiece of these early efforts is the plan to transition the ADF toward Network Centric Warfare (NCW). It is this plan that has laid the foundation for the recent keystone publication of the *NCW Roadmap* (Department of Defence, 2005). The Australian *NCW Roadmap* isolated two dimensions of NCW. The first was the *network dimension*, referring to the physical systems providing connectivity between sensors, commanders and those involved in engaging the adversary. To date, the vast majority of work in the NCW domain has been conducted with the network dimension in mind. The other dimension articulated by the *Roadmap* is the *human dimension* (Australian Department of Defence, 2005). It is this bilateral transition toward NCW that defines the ADF's adaptation to the demands of a 21st century context.

As stated earlier, efforts to progress the human dimension of NCW have only just scratched the surface. This is likely to be partly due to the nebulous nature of the human dimension as it arguably includes anything to do with people that may bear relevance to military operations. The Australian Department of Defence is attempting to define and address the vast scope of this dimension. To that end, in its official articulation of NCW (Department of Defence, 2004), the human dimension was described as follows:

> *The human dimension is based on professional mastery and mission command, and requires high standards of training, education, doctrine, organisation and leadership. This dimension is about the way people collaborate to share their awareness of the situation, so that they can fight more effectively. It requires trust between warfighters across different levels, and trust between warfighters and their supporting agencies.*

Together, the human and network dimensions of NCW are assumed to provide a basis upon which the operational capability of the ADF will be greatly enhanced. NCW is seen by many as an opportunity to improve the level of situational awareness - to lift 'the fog of war' (Schmidtchen, 2005). It is associated with dynamic information transfer at the 'edge' of the military organisations, knowledge-rich environments and more adaptive command and control arrangements. Moreover, the vision of the network-centric force is one of 'seamlessness' underpinned by high levels of interpersonal and intergroup cooperation (Department of Defence, 2005).

Recently the inevitability of such outcomes has been questioned. As work in the NCW domain shifts slowly from the network to the human dimension, NCW commentators have challenged the prevailing conception of NCW on a number of fronts. Core to many challenges is the primacy of the human dimension, that is, the reliance of *all* aspects of NCW upon people being able to think and behave in particular ways. There is little point in enhancing people's connectivity, for example, if they do not have the cognitive capacity to process the information provided. Similarly, flooding a network with information would, in some circumstances, only serve to undermine situational awareness. DSTO Task STR 03/242 *The Human Dimension of Future Warfighting* has sought to shed light on such questions.

2. The Human Dimension of Future Warfighting (HDoFW) Task

STR 03/242, the Human Dimension of Future Warfighting Task, was initiated in October 2003 and completed at the end of March 2006. The primary research objective of this Task was to investigate, from an ADF perspective, the human issues that need to be considered and supported to make the most of the future Network Centric Warfare (NCW) environment and to understand the changes that should ideally take place to optimise this form of warfare. Three key research questions were posed:

1. How do ADF personnel make sense of an NCW environment?
2. How does that understanding affect their behaviours?
3. What are the implications of this with respect to the ADF's planned transition to a seamless NCW force?

This final question opened the way for a range of issues to be explored including the ADF's preparation and training regimes, command and control arrangements and interoperability with other nations.

STR 03/242 included three interrelated pieces of research. The first was a review of the literature concerning NCW and future warfighting[1]. The second was a series of 100 in-depth interviews with ADF personnel returned

[1] Warne, L., Ali, I., Bopping, D., Hart, D. and C. Pascoe. (2004) *The Network Centric Warrior: The Human Dimension of Network Centric Warfare (U)* DSTO Report CR-0373, Defence Systems Analysis Division, ISL, Defence Science and Technology Organisation, Department of Defence, Edinburgh, S.A. (Approved for Public Release).

from deployment to the current conflict in the MEAO. The third was the development of the *Go*Team* game software. *Go*Team* was developed to assist in further investigating observations from the interview program. Specifically, *Go*Team* is an artificial environment that simulates aspects of NCW that appear to have particular relevance to the human dimension.

2.1 Literature review

The first step taken in this task was a review of the existing literature concerning the human dimension of NCW. To this end, literature derived from both internal and external sources was reviewed. The former included relevant ADO publications as well as material gained from other DSTO tasks examining NCW-related issues. The literature was reviewed with several considerations in mind. Primary amongst them was: (i) the defining characteristics of NCW, and (ii) the implications of NCW for how ADF personnel will think, make decisions, and interact with one other. In terms of the latter, particular attention was paid to the training and skill requirements brought about by NCW and to the importance of less tangible factors, such as cultural and political dynamics. The review also outlined the difference between traditional warfighting and that articulated by NCW, and summarised transformation paths that the ADF might exploit in its move toward supporting NCW organisationally.

While the literature review can be considered to be an independent piece of research, its primary function was a scoping and supporting one for the task as whole. Specifically, on the basis of the review, a program of interviews with ADF personnel returned from the MEAO was developed and refined. Given that the review stands alone as an independent piece of research, it will not be discussed further in this paper. The interested reader is directed to Warne, Ali, Bopping, Hart & Pascoe (2004).

2.2 Interview program

Interviews were conducted with a purposive but representative sample of ADF personnel with MEAO experience. The interview questions were largely based on future-warfighting issues prevalent in the current NCW literature.

One hundred ADO personnel returned from deployment to the Middle East, since the 2003 invasion of Iraq, participated in the interviews[2]. Of these, 99 were ADF personnel with the remaining person a civilian member of the Department of Defence. ADF personnel were drawn from each of the three Services and from both the commissioned and non-commissioned ranks.

The interview program explored a range of issues including:

- pre-deployment preparation and training
- duties whilst deployed
- decision-making processes
- command and control (C2) arrangements and processes
- cooperation between Services, nations, or other agencies
- information gathering and sharing
- formal and informal communication flows
- important skills and competencies
- lessons learned

2.2.1 .Emerging issues

Many questions arise when military personnel deploy and the quality of pre-deployment training plays a major role in reducing uncertainty and building confidence. With regard to this issue, previous operational experience and participation in exchange programs and/or multinational exercises was regarded as the most valuable preparation for deployment. Likewise, effective handovers, when in-theatre, provided a basis for confidence and the reduction of role uncertainty. Of concern was the variability concerning the amount of information

[2] A sample of 16 personnel from Operation *Sumatra Assist* were also interviewed and it is envisaged that interviewing of such personnel will continue in the follow-on task. However, the results discussed in this report are based on interviews conducted with personnel returned from the MEAO only.

provided to personnel prior to deployment, including notice to deploy. Furthermore, the importance of familiarity and trust of fellow team members was underscored.

With respect to C2, interview data indicated some issues with command and an overload of human cognition, exacerbated by multiple command lines, cultural differences and unpredictable tempo. It is important to recognise that there is a limit to the extent to which training can assist in improving this issue. Furthermore, the data obtained suggests that increased levels of connectivity may, in fact, mean decreased levels of devolved authority.

Participants in the interview program also described their experiences working with the Americans. They spoke of the factors affecting the degree to which this working relationship was an effective one, and emphasised human rather than technological issues. These included the critical role played by embedded, liaison, and exchange staff, and the impact of secrecy and compartmentalisation of information. Trust proved to be a positive and defining element in these respects, facilitating the role of liaison officers and the sharing of classified information. Cultural differences involving command philosophy, skills and specialisations, and legal and doctrinal frameworks emerged.

Interviewees demonstrated an appreciation of jointness and a willingness to promote jointness in order to work effectively in the MEAO. Having said that, issues relating to service identity may still impede the achievement of a totally seamless joint force. A consistent view was that prior joint experience is the most enabling factor for working effectively in joint operations. An important consideration concerns the difference between gaining experience of jointness in a theatre of operations, as opposed to within Australian exercises. There is a need for more joint training and for continuous and comprehensive rehearsal.

It is generally believed that the human dimension is the least understood and researched domain of NCW. Yet, there appears to be a shift in emphasis from the network to the 'networker', that is, the individual person. The research data clearly indicate the critical role occupied by the networker. A willingness to collaborate and connect with others are necessary ingredients for building situational awareness, achieving agility and, ultimately, securing successful mission outcomes. Trust is the 'glue' that keeps networkers together and provides an underlying foundation for collaboration and the sharing of classified information. Our data shows that personal networks provides a means to obtain situational awareness when the availability of secure communication networks could not be guaranteed.

The importance of contextual factors and the relative inability of electronic communication methods and information systems to provide these came across strongly in the interviews. Moreover, the assumption that more data and information is almost necessarily better than less was also called into significant question. A person's understanding of not only their own situation but also that of the others with whom they communicate with plays a very important part in shaping how that communication takes place (and possibly even if it occurs at all) and, consequently, in its effectiveness in conveying intentions, meanings and implications. Technological interconnection therefore provides, manifestly, only the barest of bare bones on which to build a successful communicative infrastructure through which the ambitions of network-centric warfare can be achieved.

2.3 Go*Team

A parallel activity of the HDoFW Task was the development of a simulation to further investigate the observations and findings from the interview program and other research performed by the team. That is, the purpose of this activity was to create an artificial environment that simulates aspects of NCW that appear to have particular relevance to human and group functioning in this kind of environment.

The outcome of this was a computerised team version of the ancient strategy game of Go, which is believed to have been originally developed in China between three and four millennia ago. The game is called Go*Team, and forms part of a research effort investigating how people and groups coordinate, cooperate and share information, especially in a military network-centric environment. Of particular interest in the research are human or group related factors that may impede or even prevent the successful achievement of such coordination, cooperation and information sharing despite the availability or presence of the technological capability to support it.

Accordingly, Go*Team is designed to embed its players in an environment that involves conflict (with the other team or teams involved in the game), cooperation and coordination, but also competition (with and between the players in one's own team), uncertainty, complexity and information sharing (through the need to continually

synthesise, in a dynamic situation, multiple fragmentary and local perspectives into an overall situational picture), timely and appropriate decision making (through the need to balance the time taken for adequate situational analysis and the pressure to avoid being overtaken by events). In addition to these aspects, the game is designed to be played in a network-centric environment in which players can be required, or choose, to make use of modern communication tools such as email, voice over IP, group support systems, chat rooms and the like to effect the cooperation and coordination they need to successfully play the game.

*2.3.1 Differences between Go and Go*Team*

Go, in its standard form, is a strategy game played on a square board with 19 parallel, evenly spaced lines per side. The two opposing players each have a collection of "stones" (181 for black and 180 for white), each of which may be placed on an intersection of two of the lines on the board. Once placed, a stone cannot be moved or removed, unless later captured. The fundamental aim of the game is to encompass as much territory on the board as possible, which essentially involves not only attempting to surround "virgin" territory but also trying to capture opposition stones in order to remove them and thereby gain the territory previously held under their control.

In Go*Team, the opposing sides consist of two (or, possibly, more than two) teams of players rather than individuals. The reason for this is to introduce into the game the need to coordinate and cooperate within groups of individuals. Moreover, each individual player in a team has their own collection of stones, over which they have complete control regarding whether, when and where they are to be placed on the board. The reason for this is to give each individual in the team autonomy in terms of what happens to their stones. It is possible, for example, that the team, or at least the other members of it, may decide they want a particular player to put a stone in a certain position, but the ultimate decision whether and how much to cooperate with the other team members in the use of "their" resource is up to the player who owns the stone.

Individual players in a team each have only their own local view of the overall Go*Team "world" in which they are embedded. This view consists of a board showing the positions of their own stones plus any stones of the opposing team that are closer to their stones than those of any other player on their team. This modification is to introduce the problem of information sharing and integration into the game. Since each player has only a local and partial picture of what is going on, it is necessary that they share what they can see with the other members in order to develop an integrated overall picture of the state of the board – and even if they can successfully and accurately achieve this in the time available, they still have to decide not only what is the best next move, but who should make it. And further, the situation they are trying to grapple with is dynamic as well because the opposing team may have made one or possibly more moves in the meantime.

The overall winner of the Go*Team game is not a team but an individual player; the player whose team defeats the opposition, but who also has a greater proportion of their own collection of stones remaining on the board than any other player in their team. This is to introduce an element of competition as well as cooperation between the players in a team in that, while a player cannot win unless their team also wins (so they have to share information, coordinate and cooperate with the other team members in order to achieve this at least), they also have the motivation to work to their own advantage as far as is possible within the bounds of that overall cooperation necessary to ensure that their own team wins. The reader interested in more information about Go*Team is directed to Hart, Eronen, Jagiello & Warne, (2006), and Jagiello, Eronen, Tay, Hart, Warne & Hasan (2006).

*2.3.2 Current State of Go*Team*

Go*Team is now developed to a stage of readiness for practical application. Technically, the system is robust and functional. Protocols for running Go*Team sessions are currently being iteratively designed and tested. These include appropriate settings of system parameters, such as timing and communications media, as well as the identification and standardisation of constructs to measure suitable attributes of the players as individuals and as teams. Lessons learnt from the observation and analysis of sessions with Go*Team to date have shown that the system provides a holistic and realistic experience in situations where all these elements are influencing factors. These sessions have involved games between teams of between 2 to 4 who have communicated verbally or via electronic chat. Data on these sessions have come from observations of the playing of the game and through post-game reflective de-briefings.

The Go*Team game was designed to be a research vehicle that can be used to investigate a number of related issues. It is built on a simulation framework that gives great flexibility, in terms of varying the game parameters,

to suit a number of different purposes. The Go*team system has potential for researching in detail, through planned simulations, the conditions for optimised effectiveness in strategic network-centric decision making under stress.

It is evident from exercises to date that, in addition to its use for research, Go*Team can also be used for both training and profiling. It can be used to identify people with, and train them to further develop, those attributes that will enable them to perform effectively in the network-centric environment. Go*Team has the capability to be used for training in strategic team-based decision making under various forms of stress, including time pressures and conditions where information is distributed among disparate team members. Through observation and measurement of individual performance in Go*Team sessions, it also has a potential use in profiling an individual's capacity to work as a team player in a network-centric configuration.

Extensive military testing and research with the Go*Team simulation has been beyond the scope of the HDoFW task. However, there is enormous potential for research use of this software to test and quantify the human dimension of human issues in the NCW environment, and this will be investigated in the follow-on task.

3. Recommendations Arising from the Research

A number of recommendations have been made on the basis of the HDoFW task. They directly support the transition of the ADF from a network-aware force to a network-enabled force and inform future iterations of the *NCW Roadmap*. A selection of these recommendations is listed below:

With regard to Jointness:

- Opportunities to rehearse jointness should be provided at all levels (rank/task) as follows:
  - Practice jointness through elements of formal training, social learning, continuous education, socialisation and an awareness of each Service culture.
  - Ensure jointness rehearsals are conducted at strategic, tactical, and operational levels.
  - Promote cooperation within competitive situations using the Go*Team application.
- A capability for jointness should be developed as follows:
  - Address cross-cultural (i.e., service) awareness, interpersonal and communications skills and the ability to build trust.
  - Identify and practice the matrix reporting and authority structures required to support jointness and to meet the needs of each service (vertical reporting) and the objectives of the joint group (horizontal reporting).
  - Accommodate the dynamics of jointness by changing group composition and group exercises, and by performing exercises in diverse environments.
- The ADF should move towards Joint Competencies and Trades training, and increase opportunities for more Joint Education and Training to facilitate confluence.

With regard to Preparation and Readiness and 'Networker' Centric Warfare:

- The ADF should seek to continually improve the process whereby personnel are prepared for major deployments with a particular emphasis on reducing role uncertainty.
- Pre-deployment training should be specifically tailored to the situation, posting, and location to which military personnel are to be deployed (whether peacekeeping or battlefield operations).
- Due to the presence of the media in the battlefield, all ADF personnel should be made aware of media relations and associated legal considerations.
- The ADF must set in place policies that retain the most experienced of its personnel rather than risk losing those who are at their peak effectiveness (i.e. those at the 15-20 year service mark).
- ADF members' operational experience and preparedness should be increased by rotating more personnel through operating environments on shorter deployments, by encouraging exchanges and secondments to Coalition partners and by developing more realistic training exercises.
- Research should be undertaken into the potential application of electronic techniques for supporting relationship building and social interaction (e.g. virtual communities) as a means of encouraging the development of informal links and relationships between personnel from across the ADF and, possibly, appropriate international forces as well.

With regards to Command and Control

Training, preparation and experience should enable Commanders as well as other personnel to:

- understand the limitations of the human cognition and be aware of the ways in which the communication process can be managed so as to cater for the occurrence of "transmission errors".
- broaden their own perceptual skills so as to reduce their own chances of misinterpretation, and enable them to challenge prevailing mental models.

With regard to Communication, Context, and Signs:

- Opportunities for cross-posting between units, services and other military forces with whom there is a likelihood of interoperating should be maximised in order to assist in the development of personal contacts, informal networks and mutual knowledge and understanding that will aid in the effectiveness of communication between them. Such cross-postings should include training positions as well as operational positions.
- Increased training of Defence force members in electronically intensive, pressured, and joint environments should be undertaken so that they can become acquainted and accustomed to the opportunities, deficiencies and challenges characteristic of those environments.
- The all too common focus on technological interconnection between operational level units as well as higher authority in the Defence organisation should be better balanced by a similar focus on the non-technological issues related to communication effectiveness. Electronic communication protocol,s as well as a means to better address contextual issues and possibly increase the richness of the medium, should therefore be investigated.
- The Go*Team simulation environment should be used to facilitate the issues outlined above.
- Research concerning the relationship between sense-making and the information environment of the modern military operations (i.e., tempo, workload, information overload) should be continued.

3. Conclusion

The outcomes of DSTO Task STR 03/242 *The Human Dimension of Future Warfighting* substantiate the claim made by Albert and Hayes (2003) that NCW requires greatly enhanced peer-to-peer interactions. In other words, it requires the focus to be on the 'networker' rather than the network itself. Although Information Age technologies are claimed to have reduced the fog and friction of war, the human dimension remains pivotal in ensuring the co-ordinated effort required to realise commander's intent.

There is still much work to do in this area, and the team involved in the HDoFW task has now been doubled and is currently embarking on a new task, STR 06/117, the Human Dimension of Future Force Enablers, but details on this work will be the subject of a later paper.

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