Chapter 7 – TECHNOLOGY

by

Yvonne R. Masakowski

7.1 INTRODUCTION

This chapter will examine the impact of technology on multinational military operations, and the ways in which technology has helped to shape military missions in the 21st century. It will also discuss how culture influences the use and effectiveness of technology in multinational operations. The issues addressed in this chapter are complex and related to topics in all of the other chapters in this report. Many of these issues have been discussed earlier; thus, this chapter will highlight technology issues related to multinational military operations rather than discuss them in detail.

The role of multinational military missions has changed over time within the context of globalization. Traditionally, military teams were called upon to provide support against threats to their nation's borders. Today, the military role has expanded to include global missions such as peacekeeping, humanitarian aid, and disaster relief. These operational changes have resulted in changes in each nation's strategic plans and have expanded military requirements to meet the demands of this wide range of missions, each of which incorporates technology to support its military objectives (Britt & Adler, 2003).

In recent years, there has been a shift in the international security environment as a result of terrorist acts, warfare, and natural disasters. These have necessitated technologies to support the detection, prediction, and prevention of crises and humanitarian aid efforts. Through the rapid evolution of digital technologies has emerged a critical capability to shape the ways in which nations can work together to address both natural crises and potential threats.

As military operational requirements evolve, technology continues to spiral to new levels that present both opportunities and challenges to conducting military operations within the global security environment. Since the end of the Cold War, attention has turned toward developing information management technologies that will enable the rapid transfer of information within a secure environment. This capability to rapidly transfer information is essential for ensuring effective international collaboration and cooperation in military operations. As a result, there is an ever-increasing demand for information and tools that will accelerate the distribution of information. Thus, in order to be effective in the future security environment, we must leverage technological advances in computing power to address requirements for rapid and secure transfer of information.

Historically, there are many examples that illustrate the ways in which technology has transformed warfare. Inventions and innovations such as radar, airplanes, aircraft carriers, and tanks have given tactical advantages to nations and have helped to shape history. Similarly, advances in computing power have given rise to the 21st century cyber warfare. Collaborative technologies have become increasingly important throughout the last decade with nations becoming increasingly dependent upon the capacities of the internet and networks (Alberts, 2002; Alberts & Hayes, 2005). Such networks have come to be known collectively as "cyberspace" and serve as enablers for network-centric warfare (NCW) or Network Enabled Operations (NEOps). Communication technologies play a pivotal role in multinational operations as nations seek to achieve situational awareness on a global scale (Endsley, 1995).

Network-centric warfare mandates the need to develop tools that will lead to global situation awareness, accelerate the decision cycle, and permit the synchronization of multinational forces (Alberts, Garstka, & Stein, 2000). The range of issues related to cyber security impacts all levels of military life and

operations. For the military, cyberspace affords the opportunity to distribute information and develop a common operational picture. However, cyberspace also presents opportunities for potential adversaries who seek to exploit flawed networks.

Cyber technologies have brought dramatic challenges in the way that each country's military will operate in the future. Issues related to information sharing within the command and control (C2) domain have been highlighted as critical to the success of military operations among joint forces and multinational operations (Christman & Postal, 2005). Effective C2 of multinational land force operations requires fully interoperable tools to support the exchange of information among nations.

Network-centric warfare is enabled by 21st century technology advances and will continue to permeate all domains, cultures and individuals on a global scale. Further, culture affects how, why, and when technology is used; conversely technology also has the power to transform culture. Modern cultures are filled with examples of the impact of the internet and the ways in which it influences our cultural concepts. Instant messaging and the internet have afforded soldiers the ability to transmit their observations around the world. The impact of these perspectives from the battlefield helps shape our understanding of the cultural consequences of warfare. News media from around the globe also report their unique views of the battlespace, thereby contributing to the shaping of each nation's perspective of world events as they unfold. Cyberspace serves in this way as a medium and tool for communicating information that can be used strategically and tactically to impact geopolitical events and shape cultures themselves.

As technology helps to forge cultural experiences, access to technologies, or the lack thereof (e.g., limited or restricted access to the internet), has its own unique set of consequences with regard to the development of a nation's perspective on global events. This means that we need to understand the ways in which technology transforms both cultural exchange and military collaboration.

Cyberspace represents an unconstrained domain of networks that will influence and shape warfare on land, in sea, in air, and in space. Technologies such as the internet, mobile telephones, and Blackberries may be used in an unofficial or official manner to communicate on a world-wide scale. The speed of information warfare requires, from both a defensive and offensive perspective, tools, such as multiple levels of intelligent agents, to manage the plethora of incoming information. In addition, there is a need to understand the impact of this type of unconstrained information sharing across and among cultures. As noted by Friedman (2006), the world is becoming "flatter" and the role of cyberspace will exert a profound influence and impact on all multinational missions (see also Barnett, 2004). Nations must explore the broader dimensions of working in a coalition environment, with partners such as the United Nations (UN), Partnerships for Peace (PfP) nations, allies, and non-government organizations, using cyber technologies in order to understand the demands of full spectrum multinational operations.

If the performance advantages provided by cyberspace and network-based operations are to be exploited, then, it will be necessary to achieve a level of trust among multinational colleagues in order to sustain effective operations. Information management tools within the cyberspace environment extend the ability of an individual or nation to achieve shared situational awareness (Endsley, 1995), generate increased combat power, empower decision makers, and achieve a greater degree of synchronicity in combat and non-combat operations. However, it will be important to remain mindful of the need to facilitate effective collaboration and avoid information overload by providing commanders and staff with accurate knowledge, in a timely manner, and by developing and maintaining trust between multinational partners.

This chapter will focus on the role of cultural influences on technology exchange and use, challenges in the new strategic landscape, and technological factors impacting global collaboration. It will be shown that nations must remain vigilant with regard to the impact of these factors as they will influence the ways in which nations will be able to work together.

7.2 THE IMPACT OF CULTURE ON THE USE OF TECHNOLOGY IN MULTINATIONAL MILITARY OPERATIONS

Collaborative military teams are often united by mission and divided by their culture, military practices, and organizational structures. Thus, the multinational team must understand the cultural differences that may be at play in order to operate effectively. Cultural influences play a critical role within a range of operational contexts and impact on the ways in which technologies can be employed during multinational operations. While it is difficult to generalize about any group or population, multinational teams brought together to work in a coalition environment are often challenged by their diverse organizational structures, practices, and rules of engagement (see McKee, Chapter 2). For the military, a lack of cultural awareness and understanding may have negative consequences and potentially jeopardize military operations. Cultural barriers can disrupt communications, C2, and decision making (Klein, 2007). One potential consequence of these differences is that a technology from one nation may be incompatible with the technological or cultural practices of another nation (Klein, 2007). Therefore, it is essential that each nation's military organization address differences in cultural beliefs and practices as a means of providing insights into how multinational collaborative and coalition teams can effectively work together.

Lack of cultural awareness has been a major contributing factor in multinational security and military failures (McFate, 2005). Recently, the United States (US) Department of Defense attempted to address this lack of cultural awareness by embedding anthropologists within military units to inform and guide these units on cultural practices, organization, and social rules of engagement, as a means of supporting mission objectives. However, it remains to be demonstrated whether embedding civilian social scientists within military units is effective in achieving these aims (Shweder, 2007).

It cannot be assumed that technology will provide all of the answers to military challenges. Rather, an understanding of the culturally complex operational environment and its unique requirements is needed as the number of multinational missions continues to increase. For instance, cultural differences may impose constraints on multinational teams and often serve as impediments to the ways in which an individual soldier can participate, make decisions, act independently, and have access to information. Further, as coalition forces move into environments which are more culturally diverse, it is critical to achieve cultural awareness with regard to differences in perspectives, practices (e.g., gestures, behaviors) and the social rules of engagement within the local population. Cultural differences also reflect cognitive processes which capture unique perspectives and serve as a filter for interpreting interactions from outside the culture (Klein, 2007). There are unique heuristics which are culturally derived and serve to shape an individual's perspective and approach to problem solving (Klein, 2004; Masakowski & Hardinge, 1999; Peng & Nisbett, 1999).

As mentioned throughout this report, one of the principal research programs that has focused on the impact of differences in national values and cultures was first conducted by Hofstede (1980, 1983, 1984). One of the key constructs in this body of work is the discussion of four cognitive dimensions used to describe and classify national cultures. Hofstede identified individualism-collectivism, power distance, uncertainty avoidance and masculinity-femininity as cognitive dimensions that shape mental models, values, and culture and determine an individual's perspectives and behavior. Power distance refers to the extent to which members of a group expect and accept the uneven distribution of power (Hofstede, 1980). The importance of power distance can be seen in an analysis of multicultural work environments (Helmreich & Merritt, 1998). Multinational teams and operations may be negatively impacted by differences in power distance. Those with low power distance expect that their ideas will be evaluated based on merit, whereas those with high power distance maintain their leadership role and make decisions (Dorfman & Howell, 1988). The concept of power distance has implications for technology and multinational operations such that low power distance countries would tend to share their technology and expect that others would do the same. High power distance countries, on the other hand, would see sharing of technology as based on power, including national status, economic advantage, and military authority.

Multinational coalition forces which include high power distance countries do not often share technology or information equally.

Individualism versus collectivism is a cultural dimension related to whether the rights of the individual or the rights of the group take precedence (Hofstede, 1983). Coalition force members from countries high on individualism may exert an independent perspective on a coalition team which may function, instead, from a collective perspective. This potential clash of cultural identity may well impede their ability to work together, and, like power distance, may determine whether technology is shared in a collective mode or technology is used as a basis for competition.

There are also cultural differences with regard to the cultural dimension of uncertainty avoidance. Individuals from nations high on uncertainty avoidance may often reduce stress by adhering to rules and structure and tend to resist change that can generate uncertainty (Lane & DiStefano, 1992). However, the distributed operational environment is a complex and uncertain one, and coalition teams with nation members high on uncertainty avoidance may find such an operational environment particularly threatening. Once again, such teams may be reluctant to share information or technology, due to concerns about security risks.

The Global Leadership and Organizational Behavior Effectiveness (GLOBE) study, a major study that focused on understanding cultures and leadership around the world, provides evidence of the impact of cross-cultural issues that can help researchers to focus on the intersection between technology and culture. The GLOBE research program was established to focus on culture and leadership in 61 nations (House & Hanges, 2004; House et al., 1999). This study explored the interrelationship between cultural values and organizational leadership. The results have implications that extend to the multinational military setting, its organizational practices and leadership.

The GLOBE study attempted to answer questions regarding leaders' behaviors, attributes and organizational practices in the context of varying cultures and organizations. Cultural context provides a key for unlocking a culture's shared motives, values, identities, and interpretations of significant events. GLOBE researchers applied Hofstede's theory and examined societal-cultural values in terms of a leader's attributes; they determined that leaders who were consistent with the culture that they were operating in were successful in working with the team and its organization. This means, for example, that if the leadership style and way of perceiving the world of a coalition leader is not congruent with those of his or her team, then conflicts will arise (see Febbraro, Chapter 3). These will extend to how technology is used within the group.

Contemporary news headlines provide a glimpse of the impact of cultural biases and perspectives on multinational collaboration. Recently, there has been a great deal of dispute over the possibility of establishing a missile defence system in the Czech Republic (BBC, 2008). Russia has challenged the motivation surrounding this defence strategy and perceives it as a threat to its security and stability. Russians are experiencing a level of uncertainty with regard to the change in their strategic environment. Similarly, some citizens of the Czech Republic have objected to this strategic plan. The debate between these nations serves as a an example of the importance of understanding culture in that both nations have their own views of events based on their threshold for uncertainty, the impact of power distance, and their respective cultural perspectives, as these events impact each nation's security strategy. Each culture interprets world events, especially those within their geographic boundaries, within the context of their cultural history. Whether threats are real or perceived, nations form their security strategies within the context of their respective nation's history and culture. What this means is that nations must understand the sociocultural environment in which technologies will be employed, as culture affects how, when, and where technology will be employed successfully in multinational operations.

As mentioned earlier, team members are increasingly being challenged by complex environments, which may include the incorporation of advanced technologies. It would therefore be helpful to identify

cultural differences in cognition and other potential cultural barriers in order to deal with the differences effectively and forge a more efficient team. As will be discussed, the use of advanced technologies may be one way of dealing with that complex environment.

7.3 COMMUNICATION TECHNOLOGIES

Communication technologies can contribute significantly to the success of multinational missions. It is, therefore, critical to select technologies that will facilitate communication and collaboration among nations.

Tools that would enhance communication and cooperation among teams would be of value in ensuring effective operations. Technologies have been developed to assist in the development of language skills, such as the US Army's Phraselator. The phrase-based translation concept was originally developed by the Defense Advanced Research Projects Agency (DARPA). Linguistic capabilities were highlighted by the military during Operation Enduring Freedom and have given rise to new developments in the language translation capabilities required for diverse cultural missions. The US Foreign Area Officer (FAO) program similarly highlights the need to achieve language skills as well as regional expertise.

However, there is a critical need for tools for those commanders who must function within the shared C2 environment. For example, the Coalition Chat Line (CCL) was developed to provide a C2 capability to support coalition forces during operations such as Operation Iraqi Freedom (OIF). The CCL works on a laptop computer and translates text to text, thus providing a capability that allows coalition partners to communicate in a chat environment in real time (Campbell & Hillenbrand, 2005). Today, this technology continues to support multinational missions and to enable commanders to communicate with each other in real time and in their native language. As such, it contributes to the successful collaboration of leaders and teams in the context of multinational operations, as well as the achievement of situational awareness and a common understanding of the operational environment.

7.4 TRAINING TECHNOLOGIES FOR EFFECTIVE MULTINATIONAL MILITARY OPERATIONS

One of the most significant challenges of multinational military operations is training. Yet, training is vital to the success of multinational operations. Unfortunately there is not always an opportunity for forces from differing nations to train together; therefore, there is a need for training tools that will facilitate and enable multinational teams to work effectively in culturally disparate environments. Technologies such as virtual environments, gaming, and simulated training systems provide a unique opportunity for multinational teams to learn to cooperate and collaborate.

To address this training challenge, the US Army has developed a virtual training system to prepare officers to interact with diverse cultures and communicate effectively within such an operational environment. Virtual reality training technologies afford individuals an opportunity to learn and to rehearse scenarios prior to deployment. This training provides cultural experience based on virtual interactions with the population, which, in turn, facilitates effective decision making and leadership. Such exercises prior to deployment are critical for preparing teams to work together in a multinational operation.

Training with other nations affords military personnel the opportunity to communicate their ideas and learn from each other how to forge a cohesive multinational force team. Initiatives such as the US Joint National Training Capability and the US Joint Forces Command (USJFCOM, 2007) provide opportunities for developing capabilities in support of multinational missions. It is essential for military personnel to be trained to be culturally aware and sensitive to the ways in which they and their communications are perceived by other cultures (Garfield, 2006). The US Joint National Training Capability provides a means

to train joint forces using a live, virtual, and constructive training environment. This program spearheads the transformation in joint training by providing realistic combat training and performance feedback that supports joint and multinational operations. Participants can gain global net-centric warfare experience and enhance their performance capabilities within the simulated environment (USJFCOM, 2007).

Technologies enable live and virtual test environments and mission rehearsal by linking training, C2, and simulation centers around the globe. This capability affords partners an opportunity to participate in the training exercises necessary for deploying with coalition partners and North Atlantic Treaty Organisation (NATO) members in multinational exercises and humanitarian and peacekeeping missions. The goal is to have the capability to train any audience by linking C2, training facilities, ranges, and simulation centers throughout the world (USJFCOM, 2007).

Multinational military teams need to identify cultural characteristics that affect team building and team performance. On this basis they may be able to develop innovative, flexible, and responsive plans and actions to dynamically:

a) Assess current and potential roles that others play in interactions;

b) Establish beneficial roles in these interactions; and

c) Develop an effective strategy in critical decision making that will ensure mission success.

Further, tools and technologies for cultural training will facilitate enhanced situational awareness and effective decision making among individuals operating within distributed teams. Training and education tools must be developed to address operational requirements of the multinational mission team, within which trust and security is often divided along cultural lines.

Training in cultural awareness and an understanding of cultural differences in language, communication style, and general cultural norms is important to the development of a cohesive multinational force (see Riedel, Chapter 6). Military personnel working within multicultural teams attempt to solve many complex problems with limited time and under severe resource constraints. In general, the diverse cultural environment of each mission requires that tools that will support the flow of information to all partners operating within the distributed environment are provided. To effectively address these challenges, decision makers require training and tools for achieving a cultural understanding and for developing strategies for decision making in culturally disparate operational environments.

Multinational military forces, whose membership shifts from mission to mission, are challenged by their cultural differences as they attempt to develop a cohesive team. Each military person approaches the situation from his or her unique cultural perspective, experience, and set of beliefs (Lindgren & Smith, 2006). Different languages, practices, and rules of engagement further impact the ability of the multinational team to form an identity as one team. While the level of cultural training has increased significantly since the Gulf and Iraq Wars, there continue to be important challenges as the long-term consequences of culturally contingent interactions, communication and behavior are often underestimated.

Indeed, in general terms, national groups differ in their thinking and perceptions. People approach problems, develop strategies, and communicate their ideas within the context of their respective cultural experiences and identities (Klein, 2005). These differences have implications for technology transfer, multinational collaboration, and military operations. Barriers to cooperation and trust emerge in multinational operations where teams are divided by their national cultures, hierarchies, and practices. Therefore, it is critical to provide training for the individuals who will participate in multinational operations so that they might acquire an understanding of these differences and gain insights that will serve to support their performance within a culturally diverse environment. It is important to facilitate the ability of the national components of a multinational team to work together effectively to achieve a shared understanding of problems and solutions so that they may move forward in a self-synchronizing manner.

7.5 DECISION MAKING AND CULTURAL DIFFERENCES

Lindgren and Smith (2006) describe the impact of culture on C2 decision making in a multinational team that was organized by the UN. The On-Site Operations Coordination Center (OSOCC) was created by the UN to provide a system for coordinating and directing the activities of an international relief effort. It provided a framework for humanitarian team workers to coordinate their activities. Representatives from culturally diverse backgrounds were brought together to coordinate humanitarian relief efforts and were challenged by the differences among team members from culturally disparate backgrounds.

Research has shown how cultural background influences and shapes the way that people think, act, and relate (Masakowski & Hardinge, 1999). Cultural heritage, education, and experience also serve as the framework for identifying problems and solutions (i.e., sensemaking) that serves as the foundation for future interactions and cooperative endeavors (Klein, 2000). Most of our decisions are based on our sensemaking. Sensemaking refers to the process by which individuals attempt to understand what is happening in a given situation (Klein, 2007). People want to understand their environment and the relationships among individuals, events, and actions. Once people have made sense of events they usually know how they want to act or react – they can make a decision by recognizing the option they want to pursue. When we cannot make sense of a situation, we risk having to select among options that may not be successful as we are often relying on others to inform our decision making.

Multinational team members who differ in their cognition and perception of events, that is, their sensemaking, face significant cultural challenges. These differences have implications for technology transfer, multinational commerce, and military cooperation (Klein, 2005). For example, issues of trust often emerge as a result of differences in military cultures, hierarchies, and practices. Developing a common operational picture is not easily achieved among team members who differ in their sensemaking framework and do not have a shared understanding of their environment. As discussed earlier, technology can provide support across and among team members in the decision-making processes.

7.6 CHALLENGES FOR THE NEW STRATEGIC LANDSCAPE

One of the key challenges that all nations face in the strategic landscape of the 21st century is global security. Nations must develop policies that enable them to reach across the globe and work collaboratively if they are to obtain global security. Advances in technology may well afford an increase in information; however, the issue of uncertainty will continue to impact operational success. Specifically, technologies such as sensors, satellites, systems, autonomous unmanned vehicles, and intelligent agent networks will continue to contribute toward the development of an operational picture. The success of the multinational mission can only be realized by a team's ability to respond accurately and effectively. Issues related to information overload serve as a fog in the battlespace and prevent decision makers from functioning effectively. Technology can and should provide a means of verification and validation in the operational environment where teams are distributed and multicultural.

Trust is another significant challenge in the net-centric environment in which team members are not only distributed but in which they also can participate anonymously. Teamwork is only achieved when members trust each other and establish a relationship as they work together (Salas, Sims, & Burke, 2005). Distributed collaboration among multinational teams can be a challenge in developing trusting relationships and working together to achieve a common understanding of the environment.

Constraints imposed by technologies or lack thereof must also considered. Nations that lack access to technologies and that are required to support collaborative planning will fail to achieve full collaborative partnership. Nations require tools and technologies that address security and trust issues related to sharing information within the operational environment. It is important to implement technologies that can provide

measures to evaluate the information and support trust among collaborators, as well as tools to facilitate information sharing in a distributed environment.

Today's operational environment challenges traditional approaches and mandates a nation's need to sustain access to information that will facilitate rapid response to potential threats in an asymmetric warfare environment as well as during humanitarian crises. Catastrophic events, whether these are natural disasters, or nuclear, economic or ecological warfare, may negatively impact global security and stability for generations. The ability to respond quickly and to adapt to any situation is critical to a mission's success, regardless of whether it is military or humanitarian.

However, the intent to share is sometimes out of step with a nation's ability to share information given issues related to formatting and legacy systems, which raise interoperability issues. Interoperability plays a fundamental role in the exchange of information in joint and coalition operations. Technological interoperability has often been the focus of research, workshops, and military operations as this topic presents numerous challenges in the field (Masakowski, Hess, & White, 2001). However, while there has been a great deal of focus on this topic, other aspects of interoperability need to be examined, including culture, organizational structure, procedures and training, which similarly exert significant influence on interactions between and among military forces (Clark & Moon, 2001). As they attempt to work together using technology, coalition forces often face cultural, organizational, and interoperability issues that often present barriers to successful operations. In order to address these issues, models such as the Levels of Information Systems Interoperability (LISI) model and the Organizational Interoperability Maturity (OIM) model have been developed to provide a framework for evaluating both the technological and organizational issues related to coalition and joint operations (Clark & Moon, 2001).

In coalition operations, effective communications and sharing of information serve as the framework for C2. Recently, the Multilateral Interoperability Program (MIP) has been cited by the US Institute for Defense and Government Advancement (IDGA) as an outstanding coalition partner in the advancement of network-centric warfare (2007). Specifically, this program instantiates a multinational C2 system for coalition partnerships and supports a shared understanding of exchanged digital C2 information. The MIP program is comprised of member nations that have acceded to the requirements of the baseline data model and information exchange mechanisms developed by working groups and agreed upon by participating nations (Christman & Postal, 2005). The MIP program highlights the benefits of developing tools for distributing information to support a shared understanding of a situation, and illustrates the need to develop tools that will support the multinational operational environment. Although the MIP has made significant strides in setting standards for the development of technologies to support the sharing of information among coalition nations, this program does not resolve all of the communication challenges but serves as a critical first step that will facilitate communication and the distribution of information among NATO nations. It lays the foundation for interoperability and future technologies that will enable collaboration in support of multinational missions.

Another issue that must be mentioned pertains to national differences in policies regarding the ability to share information within the context of national sovereignty rights and security strategies, as nations work toward a common goal. Achieving a common operational picture is often hindered by each nation's rules of engagement, sovereignty rights, and rules for the distribution of information.

The paradox of this objective, however, is that as each nation places its information in the environment to foster collaboration and cooperation, that information provides an opportunity for exploitation by potential adversaries. Each nation must then address its unique security requirements as it engages in the global environment to ensure its security strategies and objectives. However, as mentioned, nations must still develop policies that enable them to reach across the globe and work collaboratively, if they are to achieve global security.

7.7 CHALLENGES FOR TECHNOLOGY

Global connectivity enables people to form partnerships and strengthen alliances by sharing technologies and information that will offer support during times of crises and war and help to preserve the peace. The challenge for all nations will continue, however, as they strive to sustain security within their borders and also contribute to global security. Technology will continue to play a critical role in global maritime, land, and air security, national security, and multinational operations in the future. As situations and crises emerge, visualization tools will play a pivotal role in a nation's ability to respond collaboratively. Technologies must be designed to assist decision makers to focus on critical information required to conduct operations.

In the future, networks of nodes and intelligent agents will be linked to support the decision maker in complex situations. Systems with flexible architecture will enable high level collaboration and augmented decision making for large-scale complex operations. Technology will provide situational cueing and the correlation of diverse data streams into a comprehensible, multimodal "big picture" that will empower the decision maker. Thus, the ability to respond to operational demands will depend in large part on the development of technologies that will enable multinational co-operation. However, that technology by itself is not the solution. Rather technology should be used to support the human decision maker in the conduct of effective multinational missions. Attention thus should be focused on the intersection between technology and culture as they contribute to successful multinational military operations.

7.8 CONCLUSION

This chapter has provided a brief overview of the critical issues related to technology and its role in shaping multinational military operations. Technology has advanced to support distributed, collaborative, and networked systems. However, it is worth repeating that technology by itself is not the solution. Rather, we must also address the role of the human and cultural differences in the implementation of these technologies. The material presented in this report discusses the costs and benefits of technology and some of the ways in which the intersection of culture and technology in the 21st century may be addressed.

The effectiveness of multinational military missions will be forged by each nation's commitment toward developing the doctrine and policies necessary to support information management and network capabilities. Advances in technology will continue to support multinational operations by facilitating information sharing, situational awareness, and distributed C2. However, national doctrine, policies, and strategies must be generated to guide the ways in which nations may share technologies and information, and determine a path for collaboration and cooperation. Nations must further assess trade-offs between their nation's security policies and the level of information sharing that will be allowed as they evaluate the benefit of investing in technologies to support their participation in multinational missions.

The breadth and extent of this new global environment presents challenges for multinational missions at the operational and tactical level. The ability to achieve connectivity and interoperability is the underpinning of each nation's challenge to achieve and sustain global situational awareness. Global connectivity enables the strengthening of alliances by sharing information that enables nations to work cooperatively and act in a coordinated manner. Multinational teams must achieve a coordinated response to the challenges that will be presented by natural disasters and by threats to global security.

Policies, doctrine and technology must be developed in synchrony in this demanding information environment. National strategies are necessary to support information sharing required to meet the demands of 21st century multinational missions. There is a need to transform capabilities and address the requirements for operating in a global, netted operational environment.

Technology provides a means for sharing information and achieving a common understanding among decision makers from all cultures. Network-centric warfare may be enabled by technological advances but the human element remains a critical component of any distributed C2 environment. Sensitivity to cultural differences must be a prerequisite toward understanding the ways in which technology can be used in multinational military operations.

National and international policies must be developed to establish trust and build relationships to support information sharing within the distributed collaborative environment. Trust is an essential component of the distributed collaborative operational environment. It is only through an understanding of the impact of cultural differences that progress can be made towards achieving a secure environment for sharing information.

Lastly, this discussion is only a first step toward identifying gaps in international policies for sharing information. It presents an opportunity for the reader to draw inferences regarding the implications of using technology within culturally disparate settings and offers challenges that merit further investigation.

7.9 REFERENCES

[1] Alberts, D.S. (2002). Information age transformation: Getting to a 21st century military. Washington, DC: CCRP Publication Series.

[2] Alberts, D.S., Garstka, J.I., & Stein, F.P. (2000). *Network-centric warfare: Developing and leveraging information superiority.* Washington, DC: Command & Control Research Program.

[3] Alberts, D.S., & Hayes, R.E. (Eds.). (2005). *Power to the edge: Command control in the information age.* Washington, DC: Department of Defense Command and Control Research Program.

[4] Barnett, T.P.M. (2004). *The Pentagon's new map*. New York: G. P. Putnam's Sons.

[5] British Broadcasting News (BBC). (2008, February 14). Putin repeats threat on missiles. Retrieved from: http://news.bbc.co.uk/2/hi/europe/7244495.stm.

[6] Britt, T., & Adler, A. (2003). *The psychology of the peacekeeper: Lessons from the field.* Westport, CT: Praeger.

[7] Campbell, J. R., & Hillenbrand, C. (2005). Coalition chat line for operational medical support. *Military Medical Technology, 9* (1).

[8] Christman, G.J., & Postal, M. (2005). *Coalition interoperability: A modeled approach*. US Department of Defense. Retrieved from http://www.dodccrp.org/events/11th_ICCRTS/html/presentations/003.pdf.

[9] Clark, T., & Moon, T. (2001). Interoperability for joint and coalition operations. *Australian Defence Force Journal, 151,* 23-36.

[10] Dorfman, P.W., & Howell, J.P. (1988). Dimensions of national culture and effective leadership patterns: Hofstede revisited. *Advances in International Comparative Management, 2*, 127-150.

[11] Endsley, M. R. (1995). Measurement of situation awareness in dynamic systems. *Human Factors, 37*(1), 65-84.

[12] Friedman, T.L., (2006). *The world is flat: A brief history of the twenty-first century* (expanded and updated edition). New York: Farrar, Straus and Giroux.

[13] Helmreich, R. L., & Merritt, A. C. (1998). *Culture at work in aviation and medicine: National, organizational and professional influences.* Aldershot, United Kingdom: Ashgate Publishing.

[14] Hofstede, G. (1980). *Culture's consequences: International differences in work related values*. Newbury Park, CA: Sage.

[15] Hofstede, G. (1983). National cultures revisited. *Behavior Science Research, 18*(4), 285-305.

[16] Hofstede, G. (1984). *Culture's consequences: International differences in work related values.* Thousand Oaks, CA: Sage.

[17] House, R.J., & Hanges, P.J. (2004). Research design. In R.J. House, P.J. Hanges, M. Javidan, P.W. Dorfman, & V. Gupta (Eds.), *Culture, leadership, and organizations: The GLOBE study of 62 societies* (pp. 95-101). Thousand Oaks, CA: Sage.

[18] House, R.J., Hanges, P.J., Ruiz-Quintanilla, S.A., Dorfman, P.W., Javidan, M.M., Dickson, & Gupta, V. (1999). Cultural influences on leadership and organizations: Project GLOBE. *Advances in Global Leadership, 1,* 171-233.

[19] Institute for Defense and Government Advancement (IDGA) Awards (2007). *Multilateral Interoperability Program.* Retrieved from http://www.mip-site.org.

[20] Klein, G. (2000). Analysis of situation awareness from critical incident reports. In M.R. Endsley, & D.J. Garland (Eds.), *Situation awareness analysis and measurement* (pp.51-71). Mahwah, NJ: Lawrence Erlbaum Associates.

[21] Klein, H.A. (2004). Cognition in natural settings: The cultural lens model. In M. Kaplan (Ed.), *Cultural ergonomics* (pp. 249-280). San Diego, CA: Elsevier.

[22] Klein, H.A. (2005). Cultural differences in cognition: Barriers in multinational collaborations. In H. Montgomery, R. Lipshitz, & B. Brehmer (Eds.), *How professionals make decisions*. Mahwah, NJ: Lawrence Erlbaum Associates.

[23] Klein, G. (2007). Corruption and recovery of sensemaking during navigation. In M. Cook, J. Noyes, & Y. Masakowski (Eds.), *Decision making in complex environments*. Aldershot, United Kingdom: Ashgate Publishing.

[24] Lane, H.W., & DiStefano, J.J. (1992), *International management behaviour*. Boston, MA: PWS-Kent Publishing.

[25] Lindgren, I., & Smith, K. (2006). *National patterns of teamwork during an emergency management simulation.* Presented at the Human Factors and Ergonomics 50th Annual Meeting, San Francisco, CA.

[26] Masakowski, Y.R., Hess, R., & White, D. (2001). *Technologies for optimized manning.* ONR Global Report (101): UK.

[27] Masakowski, Y.R., & Hardinge, N. (1999). *Cognitive task analysis of decision strategies of submarine sonar and Target Motion Analysis (TMA) operators*. Paper presented at the International Applied Military Psychology Symposium, Croatia.

[28] McFate, M. (2005). The military utility of understanding adversary culture. *Joint Forces Quarterly, 38,* 42-48.

[29] Peng, K., & Nisbett, R. (1999). Culture, dialectics, and reasoning about contradiction. *American Psychologist, 54,* 741-754.

[30] Salas, E., Sims, D.E., & Burke, C.S. (2005). Is there a "big five" in teamwork? *Small Group Research, 36,* 555-559.

[31] Shweder, R. (2007, October 27). A true culture war. *The New York Times*.

[32] United States Joint Forces Command (USJFCOM). (2007). *Report on Joint National Training Capability.*