

## Archived Content

Information identified as archived on the Web is for reference, research or record-keeping purposes. It has not been altered or updated after the date of archiving. Web pages that are archived on the Web are not subject to the Government of Canada Web Standards.

As per the [Communications Policy of the Government of Canada](#), you can request alternate formats on the "[Contact Us](#)" page.

## Information archivée dans le Web

Information archivée dans le Web à des fins de consultation, de recherche ou de tenue de documents. Cette dernière n'a aucunement été modifiée ni mise à jour depuis sa date de mise en archive. Les pages archivées dans le Web ne sont pas assujetties aux normes qui s'appliquent aux sites Web du gouvernement du Canada.

Conformément à la [Politique de communication du gouvernement du Canada](#), vous pouvez demander de recevoir cette information dans tout autre format de rechange à la page « [Contactez-nous](#) ».

CANADIAN FORCES COLLEGE / COLLÈGE DES FORCES CANADIENNES  
AMSC 4 / CSEM 4

**21st CENTURY TECHNOLOGY-ACHILLES' HEEL OF MILITARY COMMANDERS!**

By/par

Colonel Gordon D. Ward

25 October 2001

*This paper was written by a student attending the Canadian Forces College in fulfilment of one of the requirements of the Course of Studies. The paper is a scholastic document, and thus contains facts and opinions which the author alone considered appropriate and correct for the subject. It does not necessarily reflect the policy or the opinion of any agency, including the Government of Canada and the Canadian Department of National Defence. This paper may not be released, quoted or copied except with the express permission of the Canadian Department of National Defence.*

*La présente étude a été rédigée par un stagiaire présente étude a été rédigée par un stagiaire du Collège des Forces canadiennes pour satisfaire à l'une des exigences du cours. L'étude est un document qui se rapporte au cours et contient donc des faits et des opinions que seul l'auteur considère appropriés et convenables au sujet. Elle ne reflète pas nécessairement la politique ou l'opinion d'un organisme quelconque, y compris le gouvernement du Canada et le ministère de la Défense nationale du Canada. Il est défendu de diffuser, de citer ou de reproduire cette étude sans la permission expresse du ministère de la Défense nationale*

## **ABSTRACT**

The Persian Gulf War was a showcase for advanced weapon systems of the coalition forces. Sensors, satellites, communications systems and information technology combined to create highly effective command control systems and other weapons of destruction. The technology enhanced the commander's near real-time situational awareness, provided him with instantaneous communications and data sharing, gave him the precision-guided munitions to destroy targets with minimal collateral damage, and this war was fought with minimal casualties.

The victory in the Gulf precipitated what the United States called a "Revolution in Military Affairs." However, the "technocentric" thinkers viewed the results as more of a testimonial for the power of advanced technology. It is with caution that one should proceed if advocating technology itself as the only edge needed by the military to win wars. It certainly is capable of reshaping the battlespace, but it must not be viewed as the only tool in the arsenal of the commander who practices the operational art of war.

This paper will examine challenges and vulnerabilities associated with focusing on technology as the panacea for commanders going into battle. If they are not cognizant of the limitations and do not practice the full spectrum of RMA, technology will become their Achilles' heel.

## **21<sup>ST</sup> CENTURY TECHNOLOGY- ACHILLES' HEEL OF MILITARY COMMANDERS!**

“...proposing a new concept of weapons does not require relying on the springboard of new technology, it just demands lucid and incisive thinking. However, this is not a strong point of the Americans, who are slaves to technology in their thinking.”

Qiao Liang and Wang Ziangsui, Chinese Military Analysts<sup>1</sup>

### **INTRODUCTION**

The use of high-technology (aka high-tech) weapons to “win” the Persian Gulf War in 1991 triggered a shift in military thinking.<sup>2</sup> Military planners started to view technology and its successful application as the overarching and decisive advantage held by the United States and its Western allies. Technology provided an ever improving and changing range of candidate solutions to the problems posed by enemy capabilities,<sup>3</sup> vastly increasing the number of options available to the commander in executing his plan. Advanced sensors, satellites, communications and information technology all combined to prepare the battlespace for the platforms delivering the precision guided munitions with minimal loss in friendly forces. Had technological change won the war without the soldier? This was “technocentric” thinking at its best: the belief that an edge in technology was enough to win.<sup>4</sup> Technology was set to lead the charge in the next revolution in the conduct of war.

---

<sup>1</sup> Qiao Liang & Wang Xiangsui. Unrestricted Warfare: Thoughts on War and Strategy in a Global Era. China: People’s Liberation Army Arts Publishers, February 1999: 24.

<sup>2</sup> Michael O’Hanlan. Technological Change and the Future of Warfare. Washington: Brookings Institution P, 2000: 7.

<sup>3</sup> Col Richard Szafransk. “Annulling Marriages: Reframing the Roles, Missions, and Functions Debate.” Airpower Journal. Winter 1993: 65.

<sup>4</sup> Mackubin T. Owens. T. “Technology, the RMA and Future War.” Strategic Review. Vol XXVI, no. 2, Spring 1998: 68.

Marshal General Nikolai Ogarkov, the Soviet Union's chief of the general staff in the 1970s, would have called the Gulf War a military discontinuity. In this context, he would simply acknowledge the lesser role played by the operational art given the overwhelming effects technology and the new weapon systems had on the outcome of the campaign. He penned the phrase "military-technical revolution"<sup>5</sup> to describe these discontinuities.

The Gulf War represented more than just a discontinuity to the U.S. military. It had a much greater effect on them and, in their view, on the operational art of war. For the U.S., technology became the catalyst for a revolution because of the resultant decisive victory coupled with the very low casualty rates;<sup>6</sup> yet, the military also needed to account for the non-technical dimensions of military organizations and operations. This was going to be their "revolution in military affairs" or RMA.<sup>7</sup> Today, opinions and writings on the RMA and its role in shaping military thought abound, and its effects are being felt throughout the world's forces, including Canada's *Strategic Overview 2000*.<sup>8</sup>

Whether or not we are in the midst of a military-technical revolution or it is an RMA is an issue that will be left to others to discuss. The focus of this paper is on a prevalent belief of commanders that a superior edge in technology is enough to win every conflict.<sup>9</sup> Those who practice the operational art are becoming dependent on the promises of 21<sup>st</sup> century technology and are letting it dominate their thinking and restrict

---

<sup>5</sup> Stéphane Lefebvre, Michel Fortmann, and Thierry Gongora. "The Revolution in Military Affairs: Its Implications for Doctrine and Force Development within the U.S. Army." eds. McKercher & Hennessy:173.

<sup>6</sup> Owens, 64.

<sup>7</sup> Jeffrey McKittrick, et al. "The Revolution in Military Affairs." eds. Schneider & Grinter: 65.

<sup>8</sup> Canada. R.P. Jakubow, et al. *D Strat A Project Report 2000/18: Strategic Overview 2000*. Ottawa: Dept. of National Defence, Directorate of Strategic Analysis, Sep. 2000: 104-107.

<sup>9</sup> Owens, 68.

their innovativeness. They must ensure the weapon fits the war and not the war fit the weapon.<sup>10</sup>

In the 21<sup>st</sup> century, major advances will be occurring over a much broader range of operational disciplines,<sup>11</sup> from the lethality of weaponry to real-time awareness of battlespace operations. Do these advances warrant doctrinal shifts and changes to organizations to best take advantage of them, or are they simply bigger and better tools at the disposal of commanders? Without understanding the limitations and the vulnerabilities of the new technology, commanders risk having that same technology become their centre of gravity. In what follows, it will be argued that an inordinate reliance on 21<sup>st</sup> century technology will be the operational level commander's Achilles' heel. With the arguments in place highlighting the issues, a series of imperatives will be presented as guide markers to ensure that the Canadian Forces successfully integrates the positives that technology has to offer into its future plans.

## **DISCUSSION**

In his essay titled "Calvary to Computer: The Pattern of Military Revolutions," Andrew Krepinevich defined a revolution as "a recognition, over some relatively brief period, that the character of conflict has changed dramatically, requiring equally dramatic—if not radical changes in military doctrines and organizations."<sup>12</sup> According to Krepinevich, there were as many as ten military revolutions since the 14<sup>th</sup> century, not all of which resulted from a technological breakthrough. Napoleon's *levée en masse*, for

---

<sup>10</sup> Major Daniel S. Roper. "Technology: Achilles' Heel or Strategic Vision?" Military Review. Volume LXXVII, no. 2, March-April 1997: 90.

<sup>11</sup> Thomas K. Adams. "Radical Destabilizing Effects of New Technologies." Parameters: Journal of the US Army War College Autumn 1998. 12 Sep. 2001 <<http://carlisle-www.army.mil/usawc/parameters/98autumn/adams.htm>>.

<sup>12</sup> Andrew F. Krepinevich. "Calvary to Computer: The Pattern of Military Revolutions." The National Interest No. 37, Fall 1994: 31.

example, reflected a dramatic change in the raising of armies, where men were more willing to fight for a nation than a crown.<sup>13</sup> The invention of the six-foot yew longbow in the early 1300s did however have an impact on the conduct of war at the time. The longbow gave the archer the tool to penetrate the armour of the cavalryman at much greater distances than the crossbow. Though a highly effective weapon, it was not until the longbow archers were integrated with dismounted men-at-arms was a formidable infantry force created. The archer was less expensive to equip and train than the men-at-arms, so smaller kingdoms could now muster large, inexpensive ground forces and engage the mounted armies of other larger forces and be victorious.<sup>14</sup> It is important to note that technology provided the longbow, but only when combined with innovative doctrine and organizational changes did it result in a major change in the conduct of war.

In a more contemporary environment, advances in technology continue to play a defining role in the operational art of war, where operational art “requires the ability to visualize the synergistic effects of all available capabilities in the achievement of the strategic goal.”<sup>15</sup> With this in mind, technological change should not be taken in isolation but as a component of a more dynamic and encompassing concept. Since the Persian Gulf War, American planners have embraced the idea of a revolution in military affairs, incorporating its concepts in their strategic planning documents. Canadian and other military strategists have accepted the RMA definition provided by the U.S. Department of Defense’s Office of Net Assessment to be “a major change in the nature of warfare brought about by advances in military technology which, combined with dramatic

---

<sup>13</sup> Ibid., 34.

<sup>14</sup> Ibid., 31.

<sup>15</sup> Canada. Canadian Forces College Handbook. CFC 106 (3) CJ SOH: Combined and Joint Staff Officer’s Handbook. Dept. of National Defence, 6 Jun. 2001: II-1-3.

changes in military doctrine and organizational concepts, fundamentally alters the character and conduct of military operations.”<sup>16</sup>

The three accepted tenets of an RMA are organizational adaptation, doctrinal innovation and technological change. Both organizational adaptation and doctrinal innovation emphasize the need to address the fundamental construct of the military, and how it plans for and conducts the war. A fourth element was added more by inference than anything else - that of systems' development,<sup>17</sup> where new capabilities or systems are spawned when combined with other technologies, whether current or advanced themselves.<sup>18</sup>

Despite the accepted definition of RMA and its three tenets, the primary focus has been predominantly on technology as the way ahead. Analysts and policy makers within the military are giving it an inordinate amount of attention. To truly be representative of an RMA there must be a commensurate effort expended incorporating organizational adaptation and doctrinal innovation. The recent Vice Chief of the Defence Staff, Vice-Admiral Garnett talks holistically of RMA and is very committed to it as the way ahead for the Canadian Forces. In an article written for the *Canadian Military Journal*, he stated, “We need to revitalize our doctrine, our equipment and our force structure, and I see a clear link between embracing this change and RMA.”<sup>19</sup> Vice-Admiral Garnett recognizes that the ongoing revolutionary changes invite us to rethink both the kinds of

---

<sup>16</sup> Earl H. Tilford Jr. The Revolution in Military Affairs: Prospects and Cautions. Carlisle Barracks, PA: Strategic Studies Institute, 1995: 3; and, Royal Canadian Military Institute (RCMI). A Wake-up Call for Canada. The Need for a New Military. Defence Studies Committee, Royal Canadian Military Institute: Toronto. Spring 2001: 9.

<sup>17</sup> LtCdr J.A. Harley. “Information, Technology and the Center of Gravity.” Naval War College Review Vol L, no. 1, Winter 1997: 71.

<sup>18</sup> LtCdr J.A. Harley. “The Role of Information Warfare: Truth and Myths.” Naval War College 14 June 1996. 19 Sep. 2001 <<http://proquest.umi.com>>.



forces we should develop as well as how best to use them. Technology will play a role to enhance our capabilities, but “at the same time [the CF should] not be oversold on technology.”<sup>20</sup> There are imperatives in his words. However, it appears that in practice the CF is embracing technology first in order to avoid being left behind other militaries. Only then does it commit to a review of organizational structures or doctrines. This is not the approach that the CF should follow in order to take up the RMA challenge.

The CF has a history of procuring technology and then finding a mission for it. Currently, there is serious consideration being given to procuring two uninhabited aerial vehicles (UAV). No mission needs analysis has been conducted nor has an operational deficiency been identified. This appears to be another example of a “buy and try” program. Rather than look at the missions to be performed in the CF and determine if there is a place in our doctrine for a UAV, the system will be procured, “played with,” and then a mission will be assigned and architecture to support it established. Will this be another example of finding a mission to fit the weapon, rather than a weapon to fit the mission?<sup>21</sup>

### **The Technology**

Technology is a fixture of RMA, and to make the best use of its potential requires knowledgeable commanders capable of understanding how best to employ it. The 21<sup>st</sup> century will see further changes as a result of ongoing developments and advances in technology. An area of continued effort is that of information technology. The rapid growth in computer processing cycles and advances in telecommunications have

---

<sup>19</sup> Vice Admiral Gary Garnett. “The Canadian Forces and the Revolution in Military Affairs: A Time for Change.” Canadian Military Journal Volume 2, no. 1, Spring 2001: 5.

<sup>20</sup> *Ibid.*, 8.

<sup>21</sup> Roper, 90.

profoundly influenced both the military and commercial sectors. The greatest effects have been in the areas of electronics, artificial intelligence and computing, and advanced materials. In turn, the integration of technologies continues to foster the pursuit of overarching system-of-systems such as C4ISR (command, control, communications, computers, intelligence, surveillance, and reconnaissance).<sup>22</sup> Situational awareness is giving way to the transparent battlefield, where a commander on another continent sees the enemy, fires a single “kill” shot, hits the target, and then assesses the battle damage information being relayed back to his command centre in near real-time. Essentially, the advances in the technology have accelerated the speed at which the “observe, orient, decide and act (OODA)” cycle is executed.<sup>23</sup>

There are several elements to information systems that have seen significant improvements. Rather than quantify every development and its associated effects on the conduct of war, technological advances can be discussed under the three generalized functional categories of lethality, visibility and agility.<sup>24</sup>

The lethality of a weapon system is a reflection of the amount of firepower needed to render a target non-effective. This was once measured in terms of tonnage-on-target, but it has since given way to precision or accuracy over volume.<sup>25</sup> Precision is “the ability to locate fixed and mobile targets; to strike them with a high degree of confidence; to re-engage as necessary; and to achieve this in a timely fashion while minimizing collateral damage, fratricide, and enemy counterstrikes.”<sup>26</sup> To achieve the

---

<sup>22</sup> United States. Department of Defense. Joint Publication 1-02: Dictionary of Military and Associated Terms. Department of Defense. 2001: A-14.

<sup>23</sup> Andrew Latham. Understanding the RMA: Braudelian Insights into the Transformation of Warfare. Switzerland: Programme for Strategic and International Security, 1999: 37.

<sup>24</sup> *Ibid.*, 31.

<sup>25</sup> *Ibid.*, 32.

<sup>26</sup> *Ibid.*, 32.

accuracies demanded, there continues to be advances in target acquisition, fire direction and guidance systems.

The ability to observe and collect information on your forces and those of your enemy from the battlefield is called visibility. Lifting the “fog of war” and creating situational awareness can be accomplished with improved sensors and intelligence-gathering technology, both terrestrial and space-based. Enhanced visibility will enable the commander to obtain accurate, reliable, and detailed near real-time information regarding events in the battlespace.<sup>27</sup>

Agility is the ability to appropriately and quickly react to events on the battlefield to ensure a positive outcome. Agility encompasses the analysing, processing, and dissemination of information and guidance that lead to timely and decisive action.<sup>28</sup> Communications is a major component of this concept, and its instantaneous, worldwide accessibility provided by satellite systems is having a major impact on initiatives like dominant manoeuvre. Being able to put the right forces, at the right location, at the right time assists commanders in achieving their mission objectives.

### **The Issue**

The emphasis on technological change as the driving force behind RMA has inadvertently created some misunderstandings about its potential impact on military affairs. In his Harley summarized what he viewed as the prevalent military thinking about information technology use in future warfare: “...technologies will allow warriors to be omniscient about the enemy...armies themselves will become obsolete because war can now be conducted from afar through technologies vice raw force on the

---

<sup>27</sup> Ibid., 34.

<sup>28</sup> Ibid., 37.

battlefield...[and] information itself can be a new centre of gravity which can and should be targeted to achieve victory.”<sup>29</sup> Harley viewed the statements as misleading and he did not support them. In fact, he proposed an anti-thesis to each of these statements, and addressed the difficulties discerning the truths from myths with all the claims being made about the direction technology will take the operational art.<sup>30</sup>

There are incongruous expectations of advanced technology. Most importantly, it is dangerous to assume that it can be the sole means to the end in the conduct of war – a type of panacea for the commander. This leads to this paper’s analysis of the challenges associated with an over-reliance on technology, to include: the transparency of the battlespace, the technical edge, the commercial-off-the-shelf paradigm, smaller force structures, technology in lieu of casualties, and the asymmetric threat. In the end, each of challenges can be considered vulnerabilities of a “technocentric” commander.

### **Transparent Battlespace**

The U.S. Army’s Training and Doctrine Command (TRADOC) Pamphlet 525-5, *Force XXI Operations* appears to have overstated the importance of technology to RMA. It predicts that “21<sup>st</sup> century commanders will have the capability to see the entire battlefield in depth, identify key targets—and attack with a wide choice of joint, as well as Army systems, whenever and wherever the commander desires.”<sup>31</sup> Though this may be the desired end-state, it implies that there is a cooperative, if not complacent or incompetent, opposing force incapable of responding to this obvious supremacy.

The “fog of war” exists on every battlefield. Technology can provide the advanced sensors and the platforms to enable the commander to cut through it and gain

---

<sup>29</sup> Harley, “The Role of Information...,” 3.

<sup>30</sup> *Ibid.*, 3.

the situational awareness advantage. Unfortunately, the operational picture presented may lack some essential elements of enemy information needed to make a more comprehensive assessment of the situation. An enemy can exploit our military's reliance upon technology, devising low-technological (aka. low-tech) methods to circumvent or dupe the systems to maintain the "fog of war", and in the process increase their survivability.<sup>32</sup>

After a month of air operations in the Former Yugoslavian Republic that included over 3000 sorties on potential targets, very little had been done to dissuade President Slobodan Milosovic to end his campaign of ethnic cleansing.<sup>33</sup> With such an aggressive air campaign, why was this? The effectiveness of the "one-shot, one-kill" precision-guided weapons was not in question. However, the air campaign would have been more successful had the Serbian forces cooperated by travelling during the day, staying out in the open, or even remaining in their barracks. Instead, they dispersed and concealed their forces, employed low-tech camouflage and decoys, travelled during cloudy days or at night, and avoided direct engagements.<sup>34</sup> During the same operation, the U.S. had at its disposal the Joint-Surveillance and Target Attack Radar System (J-STARS) to isolate and track the enemy ground forces. To negate the advantage of the J-STARS, the Serbian forces stayed off the roads located on the bottom of valleys and travelled on the mountain

---

<sup>31</sup> Roper, 87.

<sup>32</sup> Charles J. Dunlap Jr. "21st Century Land Warfare: Four dangerous myths." Parameters: Journal of the US Army War College Autumn 1997: 5.

<sup>33</sup> Steven L. Myers & Eric Schmitt. "One Month: No NATO Victory, No Serb Loss." The New York Times. 24 Apr. 1999.

<sup>34</sup> United States. Department of Defense. Kosovo/Operation Allied Force After-Action Report. Department of Defense. 2000: 60-63.

roads that were not in the line-of-sight of the aircraft as it flew its mission track.<sup>35</sup> The radar was thus ineffective in “seeing” through the mountains.

In the Balkans, the terrain had an impact on the effectiveness of the J-STARS and hence the value of the picture provided. In the Gulf War where the terrain was very open with very little foliage, the system provided a more complete situational display of the forces on the ground. Unfortunately, it could not reveal the locations of the Iraqi armament that was dug-in. In the final analysis it may have looked good on a CNN television broadcast but the quality, completeness, and accuracy of the battlefield presentation in both scenarios was suspect and could not be relied on by the commander.

When there is an obvious or even lopsided technological advantage, the military’s expectation can be for a quick and decisive victory. The war in the Persian Gulf started with an unchallenged bombing campaign and ended with an almost uncontested ground offensive. This all took place over a short period of time in comparison to other U.S. conflicts. Did this set the precedence for future conflicts? The Vietnam War should have taught us that the technological advantage does not always produce decisive and positive results. The Russians learned the very same lesson in Afghanistan.<sup>36</sup> The nature of war is a “complex interaction of political objectives, human emotions, cultural and ethnic factors and military skills.”<sup>37</sup> With all of inherit complexities of war it precludes simple non-empirical conclusions.

The transparent battlefield can profoundly affect command over the area-of-operation and also the conduct of operations. The commander needs to have confidence

---

<sup>35</sup> David A. Fulghum. “Rough Balkan Terrain Forces Change in Joint-Stars’ Tactics.” Aviation Week & Space Technology 1 Jan. 1996: 66-67.

<sup>36</sup> Carl H. Builder. “Looking in the Wrong Places? The Real Revolution in Military Affairs is Staring Us in the Face.” Armed Forces Journal International May 1995: 38.

in his systems but he must not be over-reliant on them. The information presented by advanced sensors must be tempered with the external influences affecting it. It is a major planning shortfall when a commander accepts the data as satisfying his mission essential requirements, ignores the limitations of the systems that provided the operational picture, and then continues to make critical command and/or targeting decisions. The implications of taking actions in such a scenario could be catastrophic. It is very difficult, if not impossible to have absolute battlespace awareness...at best, one can achieve situational awareness.

### **Technical Edge**

On the battlefield, advanced technology can be the deciding factor that leads to victory, and there is a perception that in the 21<sup>st</sup> century that only the developed Western nations have that technological superiority. Leading this elite group is the U.S., which is well out in the front of all others.<sup>38</sup> With the resources and technology at their disposal, the U.S. will virtually dominate any future conflict.<sup>39</sup> The only threat to this standing would be from a peer competitor. A peer competitor for the U.S. would be a nation or nations rising to challenge their national security interests, and they are considered to be at a relatively equal technological footing across a full range of military capabilities.<sup>40</sup> Only the former Soviet Union once held the status of superpower and peer competitor. Russia no longer has the resources to follow the latest U.S. lead in research and

---

<sup>37</sup> Tilford, 1.

<sup>38</sup> Anon. "The Future of Warfare." The Economist 8 March 1997. 26 Sep. 2001 <<http://proquest.umi.com>>.

<sup>39</sup> Dunlap, 1.

<sup>40</sup> McKittrick, 71-72. eds. Schneider et al.

procurement, and the remaining aggressors are either regional with only a limited set of military capabilities or terrorist groups involved in low-intensity conflicts.<sup>41</sup>

A former Chairman of the Joint Chiefs of Staff, General Henry H. Shelton, pointed out in April 1998, “The proliferation of advance technology with military applications is so extensive that many of our adversaries in the next century will have capabilities they could only dream about in this one [20<sup>th</sup> century].”<sup>42</sup> This technological diffusion<sup>43</sup> concerns senior planners and bureaucrats alike. Officially released 3 January 1999, *The Cox Report*<sup>44</sup> highlighted the extent and impact of American technology being stolen, purchased or just handed to China. For example, as a result of this information flow to China, they have advanced their space program. Conservative estimates indicate the Chinese have acquired over 10 years of military technology that essentially took the U.S. 50 years to develop.<sup>45</sup>

There are other sources of information that undermine the technical edge held by the U.S. and other developed nations, most of which are available to any nation or individual which has the financial resources to acquire them and the imagination to exploit them. For situational awareness in any area of interest, there is sufficient satellite imagery on the open market to provide a potential adversary with good intelligence of

---

<sup>41</sup> Anon., 2.

<sup>42</sup> Commander William K. Lescher. “Network Centric: Is it worth the risk?” Proceedings Vol. 125, Jul. 1999: 59.

<sup>43</sup> O’Hanlan, 17.

<sup>44</sup> The release of the Cox Report (US National Security and Military/Commercial Concerns With the People’s Republic of China, Select Committee, US House of Representatives) by Representative Christopher Cox detailed problems with Chinese. Specifically it reviewed issues regarding spying on the US nuclear weapons labs, the sale of high-tech computers and the transfer of satellite know-how to the Chinese. This generated concern in both the DOD and within the defense industry at a time when changing and relaxing certain export controls had become a goal.

<sup>45</sup> Henry Sokolski. “America Helped Arm China. Now What?” The Wall Street Journal. 25 May 1999. 2 Oct 2001 <<http://proquest.umi.com>>.



friendly force location and capabilities.<sup>46</sup> There is also the proliferation of data and information on the Internet. If, for example, one is interested in nuclear-related information there are apparently over 500 websites on the subject.<sup>47</sup>

Advances in technology and the access to it are not restricted to friendly forces. This diffusion of power resulting from nations exploiting any information technology for their own benefit<sup>48</sup> erodes the advantages to be gained from being the most technologically advanced nation employing it. In this information age and with the degree of access individuals and/or nations have to it, it would be very difficult for any one nation to maintain a technological edge before a counter is developed.

### **Commercial-off-the-Shelf**

To keep pace with the rapid growth in the power of the processor and overall enhanced functionality that is possible with the newer technology, the military needs to procure the best possible hardware. With limited funding available, militaries are turning to commercial-off-the-shelf (COTS) products to satisfy operational requirements. The Canadian navy's Maritime Command Information Network (MCOIN) and the Canadian Forces Command System (CFCS) both rely on COTS hardware as does the U.S. Department of Defense's Global Command and Control System (GCCS). As well, all of these systems rely on commercial terrestrial and space-based telecommunications networks as their primary transport media. The U.S. DoD Defense Information Systems Agency estimated that 95% of the Department's information traffic was over commercial

---

<sup>46</sup> Joseph C. Anselmo. "Commercial Imagery Aids Bosnian Peace Mission." Aviation Week & Space Technology 5 Feb. 1996. 19 Sep. 2001 <<http://proquest.umi.com>>.

<sup>47</sup> Adams, 3.

<sup>48</sup> *Ibid.*, 3.

telecommunications networks.<sup>49</sup> This reliance upon commercial products and services is not prevalent in all fields, but it is becoming more the norm.<sup>50</sup> The objective may have been to get the latest technology with limited funds, but there is a risk associated with embedding COTS in military systems.

There was a time when the design and production specifications for military systems were extremely rigid. Systems had to be capable of continuing to operate under extremes in environmental conditions and physical mistreatment. For critical C2 systems, minimizing susceptibility to an electromagnetic pulse (EMP) was intended increased survivability.<sup>51</sup> A high-altitude nuclear burst producing an EMP would render most satellite assets useless and also cause significant electronics damage to anything within range on the ground such as radios, power grids, telephone systems and computers. Most, if not all, high-tech assets would be rendered inoperative.<sup>52</sup>

In January 1997, the U.S. Army War College war-gamed a scenario in 2020 where space control was deemed a critical success factor of the “blue” forces in a theatre operation. At one point, the ‘red’ forces launched and detonated multiple nuclear anti-satellite vehicles. The result totally blinded the ‘blue’ force, which subsequently sued for peace.<sup>53</sup> In the real world, a solar flare incident in 1998 disrupted a communications satellite and over four million cell phone users lost service for an extended period of time.

---

<sup>49</sup> MajGen David L. Grange and Col. James A. Kelley. “Information Operations for the Ground Commander.” Military Review March-April 1997:1.

<sup>50</sup> Lescher, 59.

<sup>51</sup> Roper, 90.

<sup>52</sup> Dr. Lawrence E. Grinter and Dr. Barry R. Schneider. “On Twenty-first Century Warfare.” eds. Schneider & Grinter: 269.

<sup>53</sup> Jonathon S. Lockwood. “Space Control Versus Space Denial in 21<sup>st</sup> Century Warfare: Achilles’ Heel of the RMA?” Defense & Foreign Affairs Strategic Policy. Aug. 2000. Vol. 28, Iss. 8: 2.

The economic impact was estimated to be in the millions of dollars (U.S.).<sup>54</sup> This event simply illustrates the vulnerability of the commercial communications network.

Advanced technology saturates our command and control structures, telecommunications networks, and weapon systems. Entire infrastructures are interconnected and interdependent, thereby creating vulnerabilities. To disrupt this worldwide data “superhighway”, there is a plethora of techniques, procedures and hardware at the disposal of whoever wishes to exploit this path. This is called information warfare. As the Western nations are the most dependent upon information technology, it creates asymmetrical courses of action for unfriendly forces.<sup>55</sup> With information technology systems so ubiquitous and communications “trans-national”, an adversary can make very effective use of the available resources to create havoc. For example, by “spamming”<sup>56</sup> an unclassified network with self-replicating message traffic, the nodes would become congested with packages of useless data, causing the network to crash or at least slowdown creating backlogs for official traffic. The resulting denial of service could likely effect classified systems as well because they typically use the same communications backbone, except the data is encrypted. For a smaller military force, there is a disproportionately greater return on investment if they can bring down a technologically reliant nation.

Though militaries are interested in gaining the greatest advantage with the most advanced technologies, there is a point at which the vulnerabilities surpass the benefits. COTS and commercial telecommunications use within the military is very high and this

---

<sup>54</sup> Ibid., 4.

<sup>55</sup> Grange, 1.

<sup>56</sup> NOTE: Spamming is intentionally and without authorization initiating the transmission of a bulk unsolicited electronic mail message to a computer.

increases its vulnerability to attack. Commanders have become dependant upon the information transiting these systems and without it they very quickly become incapable of continuing the engagement – they are essentially in the dark. System survivability must be a consideration in any future conflict against a threat that has the potential to use EMP, or one that can use the “world-wide-web” to cause disruption. And, commanders must be prepared to draw on other sources of information for battlespace awareness.

### **Smaller and More Lethal**

There are several assertions that war and technology have progressed to the point where we can actually reduce the numbers who are directly involved in the acts of hostility.<sup>57</sup> Through the use of a system-of-systems, the U.S. will be capable of applying “military force with dramatically greater efficiency than an opponent and do so with little risk to U.S. forces.”<sup>58</sup> The military expects to shape the battlespace with fewer personnel. Using integrated sensors, communications, and data fusion systems planners will access and process, in near-real time, critical campaign information, enabling them to retarget, redirect, or reengage their forces in a timely and opportunistic fashion. In his paper, Lescher also supports the idea that a highly advanced force can have a disproportionate effect in large-scale operation.<sup>59</sup>

Moving into theatres when and where needed could theoretically be achieved with total battlespace awareness, a force projection capability, precision-guided munitions and highly trained forces. Unfortunately the closer one gets to the actual battlefield, the less important it is to have the high-tech weapons. Most potential adversaries will likely have

---

<sup>57</sup> Harley, The Revolution... 7.

<sup>58</sup> Owens, 67.

<sup>59</sup> Lescher, 59.

access to the same families of high-tech assets,<sup>60</sup> and this will negate the perceived advantages. In a low-intensity conflict, the adversary could force the battle to be fought more at their low-tech level. Technology itself will be of little value in close combat where those more skilled in hand-to-hand techniques could determine the outcome.<sup>61</sup>

Those who espouse “technocentric” thinking would argue there is no need for armed forces to engage in combat anytime. The war can be fought using technology alone.<sup>62</sup> More realistically, a numerically smaller military force will be a by-product of technological dominance. To reduce the numerical advantages of larger forces will affect a military’s ability to support operations-other-than-war (OOTW). Many of the OOTW operations such as peace building and humanitarian assistance are manpower intensive, and a reduction in available manpower equates to less capacity to act.<sup>63</sup> In the final analysis, this could result in forces withdrawing from trouble spots because of a lack of capability to handle the situation.

On the other hand, as militaries downsize due to political pressures brought about by reduced budgets, it is expected that advanced technology will be necessary to increase the effectiveness of the smaller forces. The military views technology as the enabler to achieve a more flexibility response with fewer soldiers.<sup>64</sup> However, without the flexibility of having the soldiers to move into a theatre of operations the military has lost some of its capability for flexible response. The presence of troops, especially in OOTW cannot be overstated. Technology can be used to get them there, but if the forces are not structured or trained to respond to these situations their effectiveness will be questioned.

---

<sup>60</sup> Dunlap, 3.

<sup>61</sup> McKittrick, 94. ed. Schneider.

<sup>62</sup> Harley, The Role of Information... 7.

<sup>63</sup> Adams, 6.

Militaries need to maintain a posture of flexible response. Through proper training and innovative uses of the latest technology, these forces can prepare themselves to operate against all technological levels of advancement and at any level of conflict.

### **Technology in lieu of Casualties**

Nathan Bedford Forrest said, “War means fighting, and fighting means killing.”<sup>65</sup> War has but one objective - to inflict sufficient violence on an opposing force to win, and to fight any other way increases the risk of losing. Against this backdrop, the American population has developed a unique aversion - they are increasingly reluctant to see people killed in wars, either combatants or non-combatants.<sup>66</sup> The American reluctance to take casualties not only effects the conduct of war by the American military, but it provides an adversary with a perceived weakness – the will of the nation to continue the conflict in light of the potential number of casualties to be taken.<sup>67</sup> With this constraint, military planners must devise campaigns that protect life as much as possible (i.e. no indiscriminate killing) and yet achieve the objective of victory.

The assertion is that technology will be the enabler to achieve victory at minimal cost of life. Concepts like system-of-systems and battlespace dominance are intended to allow the military to more effectively use their tools of war, with much reduced risk to U.S. forces. As pointed out by Sapolsky and Weiner, the best way to keep American casualties down is to “blast away” at the enemy.<sup>68</sup> Rather than just “blasting away,” the American forces increased the lethality of their military with technology in order to

---

<sup>64</sup> Tilford, 2.

<sup>65</sup> Owens, 1.

<sup>66</sup> Harvey M. Sapolsky & Weiner, Sharon K. “War without Casualties.” Across the Board. October 1994. 2 Oct. 2001 <<http://proquest.umi.com>>.

<sup>67</sup> Harvey M. Sapolsky & Shapiro, Jeremy. “Casualties, Technology, and America’s Future Wars.” Parameters, US Army War College Quarterly. Summer 1996: 1.

<sup>68</sup> Sapolsky & Weiner, 3.

minimize the number of casualties taken. At the outset of the Persian Gulf War, Saddam Hussein correctly guessed that America was not willing to accept casualties.<sup>69</sup> He did not expect the U.S. military staff to mitigate this “centre of gravity.” The resulting operational plan consisted of a lower-risk air campaign, the extensive use of precision-guided munitions, and not engaging Iraqi forces until the battlespace was fully prepared. The plan minimized coalition casualties and minimized collateral damage. The Persian Gulf War may have been a lopsided victory, but it increased the resolve of politicians to force the military to continue to plan operations that would minimize U.S. casualties. Full integration of technology in the conduct of war was intended to make the reduction in the “body bag” count achievable.

It is a mistake to accept the premise that every war can be fought with advanced technologies to such a degree that the casualties taken will be negligible. Quoting from *Joint Publication 1*, Roper restated, “...modern technology will not eliminate friction, chance or uncertainty from military undertakings.”<sup>70</sup> It is this unpredictability that causes commanders to lose sleep because it is impossible to plan for every contingency. Even Martin van Creveld acknowledges that the demise of the state system is leading to more frequent low-intensity conflicts that make advanced military technology irrelevant.<sup>71</sup> All of this will force commanders to rethink the employment of platforms that may not have a role to play in the new world order. In the end, technology will not eliminate the need for the military to come in direct contact with the enemy forces and, as such, casualties must be planned for.

---

<sup>69</sup> Ibid., 5.

<sup>70</sup> Roper, 92.

<sup>71</sup> Lefebvre, 175. ed., McKercher.

## **Asymmetric Threat**

Is there such a thing as a “civilized” war? Thomas K. Adams put it very well when he said, “Violence will not disappear in this version of our brave new world; it is too useful for that to happen.”<sup>72</sup> In recent memory, nothing outraged and revolted the American public more than the CNN broadcast of the exposed corpse of a U.S. serviceman being dragged around the streets of Mogadishu. This scene shook the American public or at least the decision-making elites, and likely accelerated the U.S. departure from Somalia.<sup>73</sup> No amount of technology could have enabled them to foresee those events. It can be assumed that Somalia’s use of the CNN factor had three effects: to demonstrate their willingness to use violence to achieve their aims; to show off their successful downing of a high-tech U.S. helicopter; and, to see if the American military (read politicians) were willing to fight its version of low-tech urban warfare. This event was representative of the wars yet to come involving low-tech adversaries using asymmetric acts of violence – even terrorism. Asymmetric threats will create a highly unstable environment and increase the challenges facing military planners.

Against a more conventional threat, there are “rules” that govern the use of force: from the laws of armed conflict to other internationally recognized charters and treaties. Technology will not be effective when the belligerent does not hesitate to employ brutality as one of its tactics to exploit a perceived weakness; this is the unconventional approach. In a recently translated publication written by two colonels in the Peoples’ Liberation Army, the authors wrote extensively about the technological advantage the U.S. had achieved through their aggressive pursuit of RMA. To mitigate the risk would

---

<sup>72</sup> Adams, 6.

<sup>73</sup> Liang, 12.



require the isolation of U.S. vulnerabilities and then exploiting them. Though not formally sanctioned by the Chinese government, the paper does suggest the need to fight unconventionally, using terrorism, computer attacks, economic sabotage, and violations of the conventions of war. In other words, they propose to fight an asymmetric war to deny the U.S. its technological advantage.<sup>74</sup>

Charles L. Mercier, Jr. quoted sources that defined terrorists as groups or individuals that conduct “premeditated, politically motivated violence...against noncombatant targets...usually intended to influence an audience.”<sup>75</sup> Asymmetric warfighting is especially effective in negating a technological advantage. The military finds itself having to fight a threat that does not care about casualties and uses whatever weapons they have available to achieve objectives, including the bodies of their followers. Against this low-tech threat, high-tech tools have limited long-term effects and force the military to adopt unfamiliar or low-tech methods of waging war.

## **CONCLUSION**

The victory in the Gulf precipitated what the United States called a “Revolution in Military Affairs.” However, the “technocentric” thinkers viewed the results as a testimonial for the power of advanced technology, advocating it as the only edge needed by the military to win wars. Technology certainly is capable of reshaping the battlespace, but it must not be viewed as the only tool in the arsenal of the commander who practices the operational art of war.

---

<sup>74</sup> Jeffrey W. Bolander. “The Dragon’s New Claws.” Marine Corps Gazette Feb. 2001; and, NOTE: This article was Bolander’s review of the “Unrestricted Warfare: Thoughts on War and Strategy in a Global Era, written by Qiao Liang and Wang Xiangsui.

<sup>75</sup> Charles L. Jr. “Terrorists, WMD, and the US Army Reserve.” Parameters, US Army War College Quarterly. Autumn 1997: 2.

This paper posits that the challenges associated with being over-reliant on technology can become vulnerabilities. 21<sup>st</sup> century technology will play a key role in the conduct of war, as it will enable the commander to “integrate operations in time, space, resources and purpose to confuse, demoralize and destroy the enemy.”<sup>76</sup> However, simply advocating technology itself is not enough, and an inordinate reliance on it is dangerous. This paper advocates a more balanced approach to RMA implementation that would include the other elements, namely organizational adaptation and doctrinal innovation. If all of the tenets of RMA are not addressed, resources will be wasted, efficiencies lost and the success of operations evasive.

In the final analysis, there are several pitfalls that must be understood by operational commanders in order to avoid limiting their options, including: an absolutely transparent battlespace is no certainty; there is always a counter to a technical edge; COTS for military applications are vulnerable to trans-national threats; smaller force structures reduce flexibility to support the other demands placed upon the military like OOTW; high-tech weapons alone cannot guarantee a war without casualties; and, the effectiveness of a high-tech military can be negated by the surprise and aggressiveness of an asymmetric threat.

There is little doubt that technology markedly improves the planning for and execution of war in many ways; yet, technology must be leveraged and not idolized. Not all technology at the disposal of a commander can be optimally employed in every conflict; therefore, it cannot be the solution in every situation. Vice-Admiral Garnett had it right when he stated, “The challenge that we face is to choose wisely and exploit

---

<sup>76</sup> Roper, 89.

affordable, effective technology, doctrinal and organizational change.”<sup>77</sup> We now need others at all levels of command within the CF to believe in this as an all-encompassing first principle.

This leads to a series of imperatives that the CF should use as guideposts to capitalize on technology’s role in achieving an internal RMA:

- ❑ Technology change is but one element of the RMA and to overstate its importance is to the detriment of the other two elements of organizational adaptation and doctrinal innovation.
- ❑ We must be cognizant of the limitations of technology as it is not the solution for all of the problems within the CF.
- ❑ In order to avoid creating a mission for a weapon or a technology, a thorough operations analysis to clearly delineate mission shortfalls must be conducted at the outset. The process would generate defensible mission needs statements; and, these statements would then be the requirements for new doctrine, organizational change and/or technology.

Though advances in technology are key to revolutionary changes, they do not comprise the revolution itself. Commanders must strive to understand the role 21<sup>st</sup> century technology will play in their plans and its limitation, and to avoid an over-reliance on technology that could become their Achilles’ heel.

---

<sup>77</sup> Garnett, 5.

## Works Cited

- Adams, Thomas K. "Radical Destabilizing Effects of New Technologies." Parameters: Journal of the US Army War College Autumn 1998. 12 Sep. 2001 <<http://carlisle-www.army.mil/usawc/parameters/98autumn/adams.htm>>.
- Anselmo, Joseph C. "Commercial Imagery Aids Bosnian Peace Mission." Aviation Week & Space Technology 5 Feb. 1996. 19 Sep. 2001 <<http://proquest.umi.com>>.
- Anon. "The Future of Warfare." The Economist 8 March 1997. 26 Sep. 2001 <<http://proquest.umi.com>>.
- Bolander, Jeffrey W. "The Dragon's New Claws." Marine Corps Gazette Feb. 2001. 21 Sep. 2001 <<http://proquest.umi.com>>.
- Builder, Carl H. "Looking in the Wrong Places? The Real Revolution in Military Affairs is Staring Us in the Face." Armed Forces Journal International May 1995: 38-39.
- Canada. Canadian Forces College Handbook. CFC 106 (3) CJ SOH: Combined and Joint Staff Officer's Handbook. Dept. of National Defence, 6 Jun. 2001.
- Canada. Jakubow, R.P., et al. "D Strat A Project Report 2000/18: Strategic Overview 2000." Ottawa: Dept. of National Defence, Directorate of Strategic Analysis, Sep. 2000. 19 Sep. 2001 <[http://www.dnd.ca/admpol/org/dg\\_plan/d\\_strat/strat\\_overview\\_2000\\_e.pdf](http://www.dnd.ca/admpol/org/dg_plan/d_strat/strat_overview_2000_e.pdf)>.
- Dunlap, Charles J. Jr. "21st Century Land Warfare: Four dangerous myths." Parameters: Journal of the US Army War College Autumn 1997. 19 Sep. 2001 <<http://proquest.umi.com>>.
- Fulghum, David A. "Rough Balkan Terrain Forces Change in Joint-Stars' Tactics." Aviation Week & Space Technology 1 Jan. 1996: 66-67.

- Garnett, Vice Admiral Gary. "The Canadian Forces and the Revolution in Military Affairs: A Time for Change." Canadian Military Journal Volume 2, no. 1, Spring 2001: 5-10.
- Grange, MajGen David L. and, Col. James A. Kelley. "Information Operations for the Ground Commander." Military Review March-April 1997. 10 Oct. 2001 <<http://proquest.umi.com>>.
- Grinter, Dr. Lawrence E., and Dr. Barry R. Schneider. "On Twenty-first Century Warfare." eds. Schneider & Grinter 267-279.
- Harley, LtCdr Jeffrey A. "The Role of Information Warfare: Truth and Myths." Naval War College 14 June 1996. 19 Sep. 2001 <<http://proquest.umi.com>>.
- Harley, LtCdr Jeffrey A. "Information, Technology and the Center of Gravity." Naval War College Review Vol L, no. 1, Winter 1997: 66-87.
- Krepinevich, Andrew F. "Calvary to Computer: The Pattern of Military Revolutions." The National Interest No. 37, Fall 1994: 30-42.
- Latham, Andrew. Understanding the RMA: Braudelian Insights into the Transformation of Warfare. Switzerland: Programme for Strategic and International Security, 1999.
- Lefebvre, Stéphane, Michel Fortmann, and Thierry Gongora. "The Revolution in Military Affairs: Its Implications for Doctrine and Force Development within the U.S. Army." eds. McKercher & Hennessy 173-192.
- Lescher, Commander William K. "Network Centric: Is it worth the risk?" Proceedings Vol. 125, Jul. 1999: 58-63.

- Liang, Qiao & Xiangsui, Wang. Unrestricted Warfare: Thoughts on War and Strategy in a Global Era. China: People's Liberation Army Arts Publishers. Feb. 1999. 12 Sep. 2001 <<http://cryptome.org/cuv.htm>>.
- Lockwood, Jonathan S. "Space Control Versus Space Denial in 21<sup>st</sup> Century Warfare: Achilles' Heel of the RMA?" Defense & Foreign Affairs Strategic Policy. Aug. 2000. Vol. 28, Iss. 8: 4-6. 2 Oct. 2001 <<http://proquest.umi.com>>.
- McKercher, B.J.C., and Michael A. Hennessy, eds. The Operation Art-Developments in the Theories of War. Westport: Praeger Publishers, 1996.
- McKittrick, Jeffrey, et al. "The Revolution in Military Affairs." eds. Schneider & Grinter 65-97.
- Mercier, Charles L. Jr. "Terrorists, WMD, and the US Army Reserve." Parameters, US Army War College Quarterly. Autumn 1997. 2 Oct. 2001 <<http://carlisle-www.army.mil/usawc/parameters/97autumn/mercier.htm>>.
- Myers, Steven L. & Schmitt, Eric. "One Month: No NATO Victory, No Serb Loss." The New York Times. 24 Apr. 1999.
- O'Hanlan, Michael. Technological Change and the Future of Warfare. Washington: Brookings Institution P, 2000.
- Owens, Mackubin T. "Technology, the RMA and Future War" Strategic Review. Vol XXVI, no. 2, Spring 1998: 63-70.
- Roper, Major Daniel S. "Technology: Achilles' Heel or Strategic Vision?" Military Review. Volume LXXVII, no. 2, March-April 1997: 87-92.

Royal Canadian Military Institute (RCMI). A Wake-up Call for Canada. The Need for a New Military. Defence Studies Committee, Royal Canadian Military Institute: Toronto. Spring 2001.

Sapolsky, Harvey M. & Shapiro, Jeremy. "Casualties, Technology, and America's Future Wars." Parameters, US Army War College Quarterly. Summer 1996. 2 Oct. 2001 <<http://carlisle-www.army.mil/usawc/parameters/96summer/sapolsky.htm>>.

Sapolsky, Harvey M. & Weiner, Sharon K. "War without Casualties." Across the Board. October 1994. 2 Oct. 2001 <<http://proquest.umi.com>>.

Schneider, Barry R. and Lawrence E. Grinter, eds. Battlefield of the Future, 21<sup>st</sup> Century Warfare Issues. Maxwell Air Force Base: Air University P, 1998.

Sokolski, Henry. "America Helped Arm China. Now What?" The Wall Street Journal. 25 May 1999. 2 Oct 2001 <<http://proquest.umi.com>>.

Szafranski, Col Richard. "Annulling Marriages: Reframing the Roles, Missions, and Functions Debate." Airpower Journal. Winter 1993: 55-67.

Tilford, Earl H., Jr. The Revolution in Military Affairs: Prospects and Cautions. Carlisle Barracks, PA: Strategic Studies Institute, 1995.

United States. Department of Defense. Kosovo/Operation Allied Force After-Action Report. Department of Defense. 2000. 20 Sep. 2001 <<http://www.defenselink.mil/pubs/kaar02072000.pdf>>.

United States. Department of Defense. Joint Publication 1-02: Dictionary of Military and Associated Terms. Department of Defense. 2001. 20 Sep. 2001 <[http://www.dtic.mil/doctrine/jel/new\\_pubs/jp1\\_02.pdf](http://www.dtic.mil/doctrine/jel/new_pubs/jp1_02.pdf)>.