Future Force

Concepts for Future Army Capabilities

Future

FOREWORD

As the 21st century unfolds, Canada continues to face an international arena marked by uncertainty, volatility and risk. While many threats have receded, others have grown in importance and still others have arisen in their place. One need only consider the terror bombings of 11 September 2001, and the events that have marked their aftermath, to appreciate the fact that the world remains a highly unstable and dangerous place.

Simply put, the predictability and stability of the Cold War is gone. The threats we now face are far more complex. The proliferation of advanced weaponry (and the apparent willingness of individuals, groups and states to use them), the problems of failed and failing states, as well as the growing reality of information operations, just to name a few, clearly demonstrate the need to remain vigilant and prepared. Notwithstanding rapid progress in many areas of human endeavour—instability, armed conflict and war continue to remain distinct and ever present realities in international life.

It is within this uncertain context that Canada's Army must continue to operate to meet the nation's national security needs and expectations. However, this entails an inherent requirement to do so not only in the short-term but also in the long-term. As such, the Army must work towards a fuller understanding of the character of the future security environment, and its implications for armed conflict. Moreover, it must foster doctrine and operational concepts that are clear, relevant and forward-looking. Finally, it must seek capabilities that ensure its effectiveness in the future battlespace.

Future Force: Concepts for Future Army Capabilities addresses those issues. Building upon past work completed by the Directorate of Land Strategic Concepts, it examines the future security environment, and the various geo-political, military, economic, social and scientific and technological trends at work within it. In addition, it expands and elaborates on the key operational functions (i.e. *Command*, *Sense*, *Act*, *Shield* and *Sustain*), to further examine their meaning and linkages. The document concludes with a consideration of what the Army will require to ensure its effectiveness throughout the entire spectrum of conflict in the future battlespace and identifies a myriad of tangible capability requirements likely to be essential for the Army's success in the future.

But let us not be presumptuous. The aim of *Future Force* is not to try and sell a specific template or blueprint for the Army for the future. Instead its purpose is to identify a conceptual framework that will assist the Army leadership and staff working on Army of Tomorrow constructs. Its development has been fundamentally independent and is unabashedly a "thought piece" that is designed to encourage introspection and discussion.

In sum, *Future Force* attempts to provide a portfolio of concepts of future Army capability requirements. As such, we must all strive to consider these ideas with an attitude of openness, tolerance and risk acceptance. We must not reject concepts merely on the basis of our own experiential baggage. However, we must also be discerning and rigorous in our analysis. After all, what is at stake is the very relevance and effectiveness of the nation's army. In the end, enlightened discussion and the efforts and ideas of the collective whole will ensure that the Army of the future is strategically relevant, knowledge-based, tactically decisive and sustainable.

R.J. Hillier
Lieutenant-General
Chief of the Land Staff
Canadian Army

INTRODUCTION

To be so bold as to presume insight into the future is fraught with risk. However, armed with an understanding of the past, a comprehension of the present and a vision of future trends, it is possible to lay down a strategy for moving forward with purpose. This is not to imply that there is a choice. Looking into the future is essential because of the lead-time required to develop new doctrine, equipment, tactics, techniques and procedures. In a world of accelerating change, if an institution does not advance, it dies. Quite simply, it becomes an anachronism—irrelevant to the society it serves.

Arguably, there have been few instances in history where the nature of warfare has changed so significantly and so rapidly. The post Cold War world ushered in after the 1989–1990 collapse of the Soviet empire created an international power vacuum that has transformed the stability that was integral to the nuclear standoff between two global superpowers during the Cold War, to the chaos and uncertainty of a fragmented world order.

The only certainty now is that future conflict will be continual, increasingly violent and unpredictable. Intra-state rather than inter-state war will be the norm as an increasing number of failed states will continue to flounder in anarchy and violence fuelled by conflict over ethnicity, nationalism and religious fundamentalism, as well as struggles for power and wealth by warlords and organized crime.

However, despite the preponderance of intra-state violence, inter-state conflict will not disappear. Territorial concerns, sponsorship of terrorism, weapons programmes and conflict over social issues such as human rights, over-population, mass migration and the depletion of resources (e.g. water, energy, timber, minerals) will continue to provide catalysts for war. Moreover, terrorism will continue, if not expand, as a result of ideological and religious fanaticism. Disenfranchisement with the global order (e.g. poor versus rich states / cultures) will only exacerbate this reality.

These trends will have dramatic implications for Canada. Conflict and inequity around the world will require that Canada assist economically, politically, and potentially militarily, to stabilize the global order. Nonetheless, or perhaps as a result of its participation, some of the conflict may actually be brought into Canada. Globalization, as well as cheap, accessible and highly effective technology has increased the capabilities of even the smallest terrorist movements and has made homeland security

more challenging than ever. Our proximity to the United States exacerbates this likelihood. Moreover, the mass immigration of people trying to escape bloodshed, or merely attempting to secure a better standard of living will import into Canada a myriad of opportunities, but also a plethora of challenges (e.g. ethnic strife, differing cultures, values and norms, disease, etc.) that the government and Canadian society will have to react to.

The changes in the geo-political security environment, however, are not occurring in isolation. Corollary changes to the methodology of battle are also transpiring. The attritionalist approach focusing on physical mass and firepower against a templated symmetrical enemy, meeting on a carefully crafted linear battlefield with its choreography of fronts, boundaries, phase lines, timings and carefully detailed sequencing is already gone. In its stead is a battlespace that encompasses the realms of land, sea, air and space, as well as the electro-magnetic spectrum and cyber domain.

Quite simply, information technology, situational awareness and networked connected forces are transforming how we fight. Smaller, more mobile, lethal and agile forces will dominate increasingly larger areas. Access to timely assured effects (the ability to strike or influence an opponent's behaviour or activity) will create a battlespace that is non-linear, non-contiguous and less dense. However, technology will enable it to be more lethal. Sensor to shooter interconnectivity, combined with precision munitions and platforms will create an environment where if you are seen or sensed—you will be hit.

Societal pressures will also affect the way armies will operate in the future (i.e. with heightened transparency, accountability, speed and precision). Currently, the information age / globalization is increasing connectivity across the world. The net effect is the virtual dismantling of borders and cultural barriers. With this comes a previously unattainable level of global awareness and economic, humanitarian and political concern that is feeding discontentment, protest and demands for action. Canada will not be immune.

Exacerbating this information-saturated society is a voracious media that feeds near real-time news reports around the globe. Using sensationalism to attract viewers, the average news clip is 60–90 seconds and often devoid of context. However, they generate compelling images that can dramatically sway public opinion. This in turn fuels Government and public expectations of how and what a military can and should achieve.

Increasingly this process has driven governments, largely influenced by a very impatient and intolerant media-fed public to expect, if not demand,

clinical / sterile wars. In addition, recent conflicts (e.g. Kosovo—1999, Afghanistan—2001, Iraq—2003) have shown an expectation of almost instant military success measured in days, predicated on precision warfare. Quite simply, the Government, media and public seemingly envision conflict with no military casualties, no collateral damage, no delays or mistakes, and quick victory. This thorny issue of political will and staying power makes it difficult to deploy military forces long enough to fix the root cause of very complex problems.

Another key determinant for the Army in the future will be governmental policy. Without question, the Government will continue to use the military as a key foreign policy tool. The employment of military forces abroad will ensure Canada has a voice / seat at the table of international affairs, organizations and coalitions. This is key to Canada as a trading nation. It will also be critical to maintaining Canadian relevance and influence on the world stage and fundamental to sustaining relevance in our military and political alliances. In sum, global stability will remain a vital national interest to Canada both economically and politically as a responsible global citizen.

It is within this context—political, societal and emerging international security environment—that the Army will operate in the future. As the military will always be responsive to its Government and society, it will be necessary to be cognizant of the environment in which it exists, and in which it will have to operate. In light of the realities and trends identified, to achieve governmental and societal expectations in the above geo-political environment, the Army will need to be robust, agile, tactically decisive and strategically relevant. Therefore, it will have to be knowledge-based, combat-capable, interoperable and capable of operating in a volatile, lethal, complex environment. Furthermore, it must continue to make a meaningful, timely contribution to a coalition and above all else, it must be affordable.

In this light, *Future Force: Concepts of Future Army Capabilities* provides a view to the future. It describes the outlook and trends that reach out well into the future. As such, it provides recommendations to allow the Army to transform itself to meet and conquer the challenges it will face in 2025. These recommendations have been developed by a team of experienced post-command serving officers, defence scientists and operational researchers based upon a detailed and wide ranging study of contemporary and foresight literature, reports and seminars.

This publication is intended to be a speculative "thought piece" that presents a conceptual framework designed to assist the Army leadership and those staff working on the Army of Tomorrow constructs. Part I of the

document provides an overview of the future geo-political security environment and battlespace designed to set the contextual backdrop of the milieu in which the Army will find itself. Part II focuses on the five operational functions that provide the framework through which to examine the capabilities of the future Army. These concepts, used to define battlespace tasks, were originally introduced in 2001, however; they continue to be refined. Finally, Part III establishes a conceptual framework that outlines the target end state in the transformation of the Army of today, into the future force. As such, a prioritized capability requirements matrix, by core function, (i.e. strategically relevant, knowledge-based, tactically decisive and sustainable) is included. This matrix identifies those activities, concepts and equipments (i.e. capabilities) that the Army must possess to effectively operate in the future.

In sum, *Future Force* strives to articulate the conceptual framework of the future Army. However, it is simply that—a conceptual framework—a starting point for discussion, debate and improvement. Further input from all Army stakeholders is now required. Feedback will be collected, analyzed and incorporated so that this conceptual model can evolve into the future force construct that will provide the prioritized capability requirements that will drive research and development, as well as Director Land Requirements (DLR) capital equipment plans and programmes. In the end, it is far better to actively participate in shaping the future, rather than simply reacting to it.

TABLE OF CONTENTS

PART I—OUTLOOK TO THE FUTURE

PART II—INTEGRATION OF THE OPERATIONAL FUNCTIONS

PART I
OUTLOOK TO THE FUTURE

CHAPTER I
THE FUTURE SECURITY ENVIRONMENT

While no one can see the future, it is at least possible to indicate a few of the directions that change is likely to take.

Martin Van Creveld[1]

BACKGROUND

As the 21st century begins to unfold, Canada finds itself in an international environment marked by considerable uncertainty, volatility, and increasingly rapid change. Old familiar "rules of the road" are fading, new ones are just beginning to emerge, and events are unfolding at a speed and pace often exceeding the ability of decision-makers to effectively react. Not surprisingly, many analysts now claim that today's world is more chaotic and unpredictable than at any other period in history.

Nowhere are the challenges more evident than in the sphere of national security. While the threat of global war has seemingly disappeared, many dangers linger and new challenges are fast emerging. Threats of regional conflict, the proliferation of weapons of mass destruction (WMD) and dangers posed by trans-national terrorism not only endure, but also in some cases, are growing stronger. Problems of state failure and international organized crime also persist. And prospects for the conduct of electronic warfare and information operations (e.g. "cyber-terror") are on the rise.

Whether the present environment represents an anomaly, or is in fact "the shape of things to come," is unclear. Still, attempts to understand and if possible, anticipate future challenges are essential for effective security planning. This is particularly true for Canada, whose vast territory and relatively small population, places responsible force planning at a premium. Accurate security assessments are a must. In their absence, not only is any realistic determination of the character and level of resources needed to meet future challenges impossible, but the dangers stemming from the threats that ultimately arise will likely increase.

An examination of ongoing trends in today's international system provides some insight into the character of the future security environment—the threats and challenges it will pose to security planners and the general character of the policies and forces required to address them. Toward this end, this chapter identifies: the key trends now evident in the international system; their potential impact on the future security environment; and their implications for military forces in general and for the Canadian Forces(CF) in particular.

KEY TRENDS

Trends at work within the international system are varied in character and broad in scope. They span the technological, political, economic, demographic, and socio-cultural spectrum. Yet several are especially noteworthy in terms of their potential impacts on international relations generally, and the future security environment in particular.

Globalization

The term globalization refers to the increased mobility of goods, services, labour, technology and capital throughout the world. While not a new development, this process has increased dramatically with the advent of new technologies, most notably in the area of telecommunications. In fact, the growing interaction which globalization is facilitating continues to revolutionize the international system. Not only has it worked to integrate national economies but whole societies—dramatically heightening the extent and pace of the flow of ideas, capital, and goods and services within and between societies.[2]

Figure 1-1: An Increasingly Integrated Global Economy
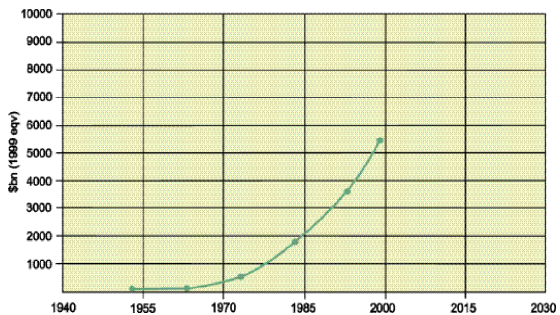
Source: Joint Doctrine and Concepts Centre, Ministry of Defence, United Kingdom, Strategic Trends-The Economic Dimension United Kingdom: Joint Doctrine and Concepts Centre; March 2003, 5.

Such "inter-connectedness" increases inter-dependence and encourages participants to adopt a shared stake in the continued welfare of the system and its parts. By creating greater uniformity across cultures and societies, it may also promote greater unity and openness. Indeed, to the extent that the benefits of globalization tend to favour open markets and societies, incentives to adopt more democratic, and arguably more benign, forms of governance may rise.

Yet, by eroding state sovereignty, the process has also heightened societal vulnerability to outside threats. External events and methods of attack ranging from information operations to physical assault pose increased potential for massive societal disruption. And growing access to information and technology is dramatically heightening the potential, both among state and non-state entities, to acquire the means by which to succeed (e.g. WMD and their means of delivery).

Beyond this, forces of globalization may fuel a backlash—either among those who are largely excluded from sharing in its material benefits, or from societies and cultures threatened by the norms and values that it promotes. Violent protest, increased governmental repression, growing intolerance and hostility toward Western influence, and presence abroad, represent some of the potential results.

In Canada, a number of these dangers are already apparent. In the wake of the terrorist attacks of 11 September 2001, politicians and policymakers struggle with concerns that porous national borders are creating opportunities for terrorist infiltration and the use of Canadian territory as a potential launching point for asymmetric assaults against the United States. Others worry that Canada may offer a safe haven under which trans-national organized crime may flourish. Recent outbreaks of Severe Acute Respiratory Syndrome (SARS) and Mad Cow Disease underscore varied dangers flowing from the migration of disease. And recent globalization protests in Montreal suggest rising public awareness and sensitivity to the political, economic and social injustices that globalization breeds along with a greater willingness to engage in civil disobedience to combat it.

Future impacts may be even more profound. Ultimately, globalization processes may work to fundamentally alter Canada's domestic social fabric, as well as international attitudes and interests. Waves of immigration may gradually change both the cultural, and linguistic mosaic of the country. Alterations in official language policy and in attitudes toward international affairs could follow. One result could be a decline in Canada's American and/or European focus toward another perhaps "Asia-centric" perspective. As interests and loyalties change, alterations in the character of foreign and

defence policy would likely shift as well. Whatever the ultimate impact however, the ability to remain aloof from the changes generated by the globalization process is bound to dwindle—both in Canada and elsewhere.

Rapid Scientific and Technological Innovation

The past decade has seen a marked increase in the pace and potential implications of scientific and technological innovation. Advances in areas such as information technology, biotechnology, "smart" materials and nanotechnology are occurring at an exponential rate, with potentially revolutionary consequences for humanity.

Such innovations promise a range of benefits in the quality of life including significant eradication of disease and illness, increased human longevity, and freedom from want and hunger. Changes in industry are apt to be equally profound. Increased computing power and the development of new improved materials will likely generate a dramatic improvement in the speed and quality of production.

Yet, dangers may arise as well. Unequalled access to advances in health and medicine may fuel tensions between rich and poor in both the developed and developing world. In fact, novel techniques such as cloning, stem cell research and germ-line engineering, raise the spectre of a new class system, differentiated by those possessing the ability to "enhance themselves and their offspring" via such methods and those lacking the means, or will to do so. Ultimately, such developments may even ignite new domestic and international conflicts, pitting advocates of such innovations against a growing neo-Luddite movement. Notably, debate over the moral, ethical, and philosophical implications that such technologies raise is on the increase. And, as they mature, controversies will doubtlessly intensify.

Radical changes are also underway in the military sphere with recent years witnessing ever-greater integration of information management systems and advanced technologies into military organizations. Examples include enhanced sensing equipment and improvements in the precision, range, and lethality of weaponry. Such developments, along with strides in the areas of non-lethal weaponry and robotics, suggest the creation of forces that if properly employed may reduce considerably the number of civilian casualties that often accompany the use of force. Accordingly, force employment may become more humane, and accord more closely with widely held principles of proportionality and non-combatant immunity.[3]

However, other innovations may produce the very opposite effects. Work on highly powerful volumetric devices (e.g. enhanced blast, thermobaric, and fuel-air explosives), along with growing interest in the creation of

electromagnetic weapons, may result in changes that nullify the precision targeting and scalability of effects inherent in other technologies. In fact, developments in biotechnology hold the potential for engineering diseases capable of wiping out entire peoples.[4] Innovations elsewhere point to weapons that kill even faster. For instance, advances in laser technology will eventually make possible the capacity for near-instantaneous destruction in the form of directed energy weapons (DEW).

At present, the lion's share of such innovation lies in the West—the US in particular. Yet, given ongoing processes of globalization, possibilities for greater access to such technologies, by friend and foe, are increasing, raising potentially profound issues for future stability both regionally and globally.[5] The moral-legal issues that could arise, if and when such technologies are adopted, will be equally far-reaching.

Broadly speaking, Canada's stake in such developments mirrors those of the West generally, both in terms of the threats and opportunities that scientific and technological innovation poses. In fact, concerted efforts to adapt to the increasing pace of innovation and the potential opportunities it presents are essential, particularly in the security realm. Without greater efforts to tap into new defence related innovations, as well as an increased commitment to match procedures governing the acquisition and procurement of essential equipment to evolving technological realities, the Canadian Forces and the nation's value as an ally, may become increasingly anachronistic and irrelevant as time goes on.

Shifting Power Balances

Western global hegemony will endure for the foreseeable future. And while differences between Western nations exist in a variety of areas, organizational and institutional developments suggest that Western economic, political and military integration is increasing (e.g. North Atlantic Treaty Organization (NATO) expansion; development of the European Union (EU); and North American defence integration).

Nonetheless, challenges to US interests will inevitably arise. For instance, opposition to Washington's military presence in the Middle East and its support of Israel will continue to represent a source of potential unrest. And, to the extent that such conflict occurs, reliable US allies will be essential, both for insuring the stability of post-conflict environments and, more broadly, to help provide the international legitimacy required for intervention.

Whether allied solidarity will be sufficient to ensure that challenges encountered are effectively addressed is unclear. In fact, allies may well

differ—both in terms of threat assessment, and in the approaches and tactics they favour for insuring security. Accordingly, the ability of collective defence and security institutions to address future threats and challenges will vary. Much will depend on the ability of Western nations to seek out like-minded states and build "ad hoc" coalitions of the willing. Nevertheless, the chances of mounting a strategically decisive challenge against the US and its allies, in the Middle East or elsewhere, will remain low in the near-term. And moreover, the prospects for systemic (e.g. global) war are even more unlikely.

Over the longer run, however, US / Western dominance could grow more tenuous. Western interests and policies may clash increasingly with the growing and, at times, extra-regional ambitions of emerging regional hegemons (e.g. China, India, and Russia). In addition, well-armed "rogue" or "problem" states (e.g. Iran and North Korea) could seek to resist US encroachments in areas deemed crucial to their security—either through threats of direct attack or, more likely, through sponsorship of terrorist activity. Results could range from declining Western influence, to growing Western disunity and heightened insecurity. Regional conflicts could proliferate. And ongoing globalization will likely ensure that the economic, political and military consequences of such strife will extend well beyond the initial protagonists. Throughout, forces of globalization promise to heighten the dangers that such confrontations pose, thus, increasing possibilities for the diffusion of weapons and key weapon-related technologies, including weapons of mass destruction.

Western military power may well be sufficient to counter most threats. Yet, as time passes, the ability of Western states to bear the diplomatic, economic and military costs of such action may decline. Both the need for fiscal responsibility along with growing domestic and international sensitivity to casualties (both military and civilian) is likely to ensure that the ability to justify military involvement and military action will become ever-more important and difficult, particularly in cases in which core national interests are perceived as not at stake.[6] Whether policymakers will be capable of doing so, however, remains to be seen. In the event that they cannot, US-led Western hegemony and global presence may gradually give way to an international system featuring multiple centres of power.

Demographic Shifts

Population growth and urbanization will continue to have profound effects across the globe. In the developing world, increasing, often-young populations and ever-expanding cities are stressing some states beyond the breaking point. Growing societal demands frequently outstrip the capacity of host regimes to provide the necessities of life.

Global Population: 1950-2015

Figure 1-2: Global Population Trends
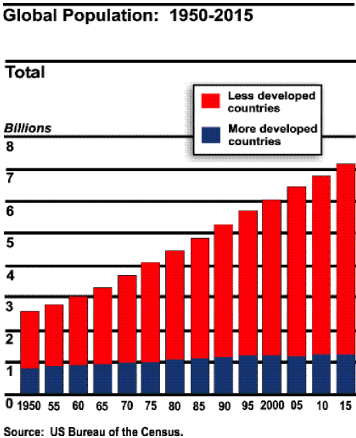
Source: US Bureau of the Census.

Source: Central Intelligence Agency,
*Global Trends 2015: A Dialogue About the
Future with Non-Governmental Experts*
Washington D.C.: National Foreign
Intelligence Council, December 2000, 28.

Urban areas are especially hard-hit, as natural growth combines with significant in-migration to magnify population pressures and overwhelm available services and infrastructure. Indeed, it is estimated that 25 to 50 percent of urban dwellers in developing countries currently live in impoverished slums with little or no access to water and sanitation.[7] As such dynamics continue, affected states will face increased poverty and disease, rising societal instabilities, and an erosion of legitimacy in some areas. Neighbours may become targets of massive trans-border refugee flows. And, the state weaknesses that over-population may create could threaten regional power imbalances that may well lead to tension and war.[8]
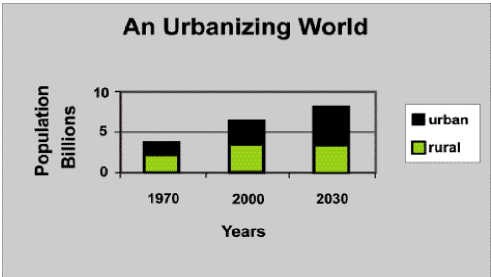
Figure 1-3: An Urbanizing World (Bar Graph)

Source: Central Intelligence Agency, *Global Trends 2015: A Dialogue About the Future with Non-Governmental Experts* Washington D.C.: National Foreign Intelligence Council, December 2000, 29.
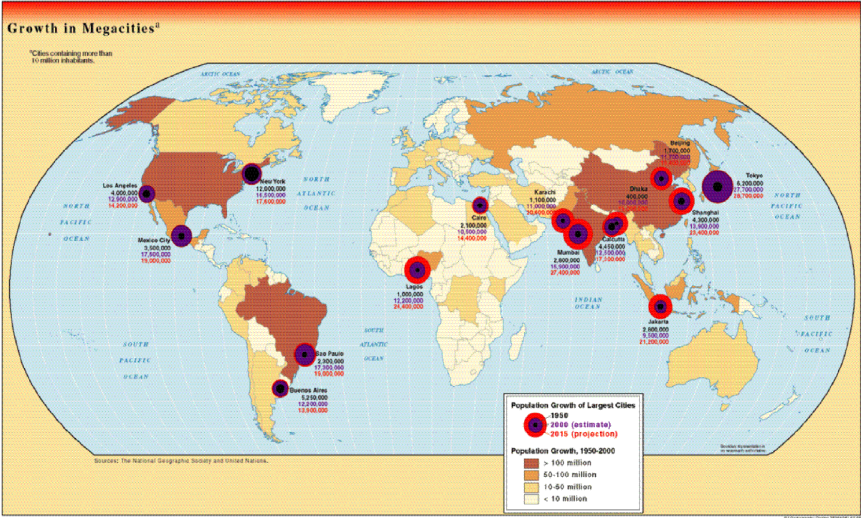
Figure 1-4: Predicted Urbanization (Map)

Source: Central Intelligence Agency, *Global Trends 2015: A Dialogue About the Future with Non-Governmental Experts* Washington D.C.: National Foreign Intelligence Council, December 2000, 29.
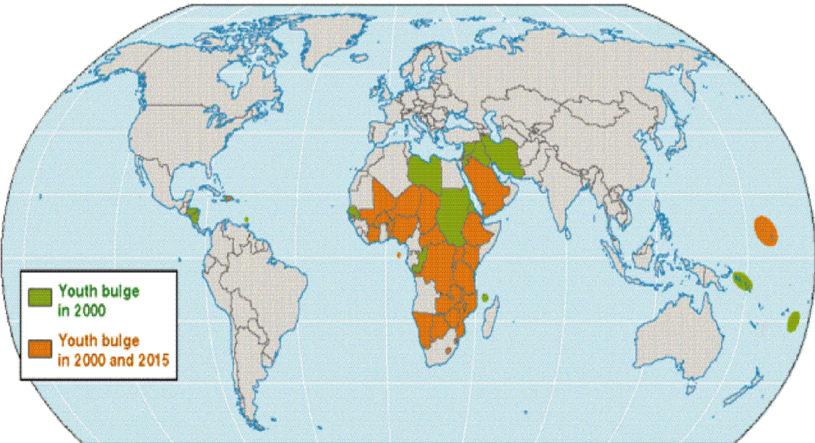
Figure 1-5: Youth Bulge

Source: Central Intelligence Agency, *Global Trends 2015: A Dialogue About the Future with Non-Governmental Experts* Washington D.C.: National Foreign Intelligence Council, December 2000, 33.

An aging West confronts its own demographic challenges. In Canada and elsewhere, demographers increasingly warn that declining populations threaten a significant reduction in tax revenues at the same time that demands for key social services will be rising.[9] The impacts, both for domestic and foreign policy, are

likely to be profound. Dwindling populations may well generate greater reliance on technology as a substitute for manpower, with efforts toward automation becoming especially prominent. Pressures to liberalize immigration and refugee policy may also increase as the need for able-bodied workers and an expanded tax base rises. However, concerns for national identity and security may also work to temper openness—generating greater efforts to provide foreign aid as a means of checking immigration flows and/or greater internal policing and surveillance of those admitted into receiving nations.

Resource Scarcities

Environmental scarcities will also create stress in various regions.[10] Developing nations in Sub-Saharan Africa, the Middle East, and South Asia will be especially hard hit with societies in each region facing crucial deficits in renewable resources (e.g. cropland, timber, and fresh water).

Such scarcities contribute to state weakness, economic decline, and societal instability. They may even help fuel, albeit indirectly, the onset of armed conflict either in the form of clashes between key societal groups contesting access to scarce resources, or through direct challenges to regime authority.
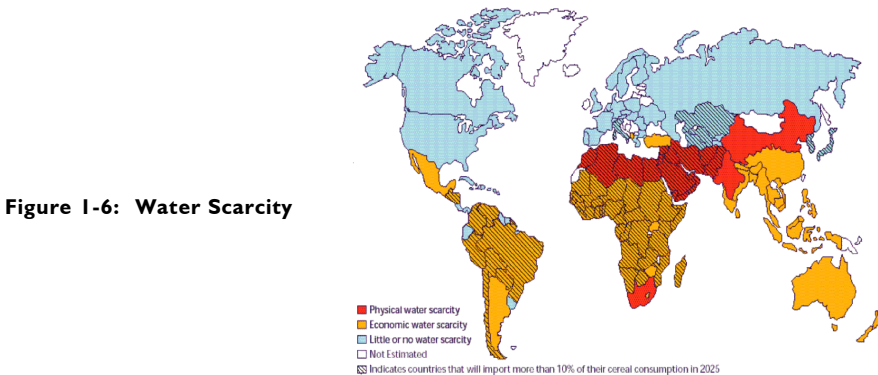
Figure 1-6: Water Scarcity

- ■ Physical water scarcity
- ■ Economic water scarcity
- ■ Little or no water scarcity
- □ Not Estimated
- ▨ Indicates countries that will import more than 10% of their cereal consumption in 2025

Source: Joint Doctrine and Concepts Centre, Ministry of Defence, United Kingdom, *Strategic Trends—The Physical Dimension* United Kingdom: Joint Doctrine and Concepts Centre; March 2003, 37.

Water scarcity represents an area of particular concern (Figure 1-6). By 2025, it is estimated that approximately 40 percent of the world's population will live in countries experiencing chronic water shortages.[11] And in areas such as the Middle East, Central Asia, and in parts of Africa and South America, the capacity to control access to this strategic resource may not only offer a key source of power—but a basis for future conflict.[12]

Developed countries will generally be less vulnerable to such challenges—particularly in the case of renewable resources. Nonetheless, decline in the

developing world will likely have indirect impacts, either in the form of increased regional conflict and refugee migration from ecologically stressed regions, or in growing demands for humanitarian aid and development assistance. Resource rich nations such as Canada may become especially attractive destinations for ecological migrants, either as a permanent home or as a stepping stone from which to gain entry into the United States. And demands for Canadian participation in Peace Support Operations (PSOs), as well as calls on Ottawa for increases in foreign aid budgets, may well grow. So too may the rationale for an expeditionary army. At the same time, rising political sensitivities to the fragility of ecosystems may generate growing pressure for constraints on Western military deployments and activities within regions at risk.
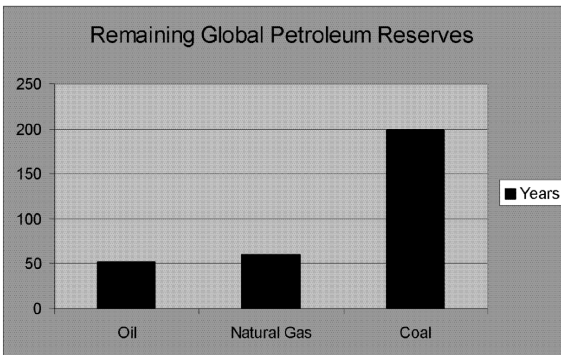
Figure 1-7: Estimated Resource Limits

Source: Joint Doctrine and Concepts Centre, Ministry of Defence, United Kingdom, *Strategic Trends—The Physical Dimension* United Kingdom: Joint Doctrine and Concepts Centre; March 2003, 7

Shortfalls in non-renewable resources may nevertheless prove more consequential (Figure 1-7). For instance, as global demand for oil and gas increases in years to come, issues of control and access may pose a growing source of tension between developed and developing nations, as well as within the developing world itself. Admittedly, demand may be somewhat tempered by the development of alternative energy sources. Commercial opportunities for resource rich countries such as Canada may also increase. Yet, the ability to fully satisfy growing demand is unlikely, particularly as developing nations industrialize. Accordingly, Middle Eastern oil, and other sources of supply in West Asia, Russia, the Gulf of Guinea and North Africa may not only breed growing state interaction, but ultimately, new dangers for turmoil and ultimately for armed conflict.

Weak and Failed States

The presence of failed and failing states throughout the international system not only persists, but in some regions, will likely increase in the years ahead (e.g. Africa, Middle East). Particularly in the developing world, the problem

of state failure will endure as widespread corruption and concerns such as infectious disease (e.g. HIV-AIDS, tuberculosis, Severe Acute Respiratory Syndrome), resource scarcity, famine, and economic stagnation continue to tax societies and strain already limited state resources.[13]

The inability, or unwillingness, of such regimes to govern their societies effectively poses a range of security threats. Generally prone to lawlessness, anarchy and rebellion, such states are prime candidates for humanitarian disaster and the many destabilizing forces that accompany it (e.g. epidemics, uncontrollable refugee flow). They may offer safe havens and bases of support for trans-national organized crime, arms dealers and terrorist groups. And, their precarious existence can render their militaries and the armaments they possess vulnerable to takeover and appropriation by rogue elements within a government, or by private organizations. To the extent that such states occupy key strategic locations (e.g. Pakistan in the war on terror), or possess crucial resources (e.g. oil in Iraq and Venezuela; or nuclear weapons in Pakistan) the dangers they pose, both regionally and globally, are heightened.

Growing Significance of Non-state Actors

States continue to represent the key actors in international affairs. However, non-state actors compete increasingly as significant players on the global stage. Such actors range from non-governmental organizations(NGO) engaged in monitoring governmental performance and policy advocacy, to multinational corporations seeking greater profit, to humanitarian organizations engaged in the provision of humanitarian aid and assistance to societies in need. They also include organized crime syndicates engaged in trafficking of armaments and dangerous substances, as well as armed irregulars, insurgents, warlords and trans-national terrorist groups intent on undertaking violent action to overturn the status quo (see Figure 1-8).

Figure 1-8: Threatening Non State Actors

| Sectarian	Obsessionalists	Militarists	Profiteers	Proliferators
Tribalists	Vigilantes	Mercenaries	Cartels	Of Information
Religious denominations	Single issue movements	Extreme right paramilitaries	Criminals	Of Technology
Nationalists	Cults	Private military companies	Opportunists	Of Weapons
Insurgents	Sects		Pirates	
Revolutionists	Radicals			
Warlords	Mentally unstable individuals			
Dissidents	Anarchists			
Militants	Dissidents			
Gangs	Militants			
	Instigators			

Source: Joint Doctrine and Concepts Centre, Ministry of Defence, United Kingdom, *Strategic Trends—The Military Dimension* United Kingdom: Joint Doctrine and Concepts Centre; March 2003, 5.

The latter possibilities are particularly unsettling. The terror bombings of the World Trade Centre and the Pentagon on 11 September 2001 by al-Qaeda operatives dramatically demonstrated the potential capability of relatively small organizations to conduct operations that can inflict massive destruction on modern societies.

Over the near-term, possibilities for similar incidents may seemingly recede due to heightened vigilance by potential target states and an aggressive US-led international campaign against terrorism. The threat, however, over the longer-term may rise again. Ongoing globalization and technological change, exacerbated by the proliferation of readily accessible and relatively cheap technology is substantially increasing the ability of such groups to organize, function and infiltrate target societies. It also heightens their access to a range of means that enable them to conduct devastating attacks (e.g. high explosives, weapons of mass destruction).[14] Meanwhile, rogue nations and weak states offer safe havens and bases from which such groups can operate. Furthermore, the relative anonymity that such groups enjoy makes decisive retaliation against them exceedingly difficult.[15]

Defence against the threats posed by such groups will be increasingly complex and burdensome, especially in open societies such as the United States and Canada. Indeed, with targets ranging from ordinary civilians, to critical infrastructure, to key ports and transportation nodes, demands for heightened security will proliferate. And, so too will the economic costs of providing it.

Ultimately, the death and physical destruction that such groups may inflict can have more sweeping implications. Ironically, the need to protect a free society from such attacks may necessitate action that is counter to our culture. Recent efforts in both the US and Canada to tighten borders and to adopt strong domestic legislation aimed at preventing such dangers have already raised such fears and have generated considerable protest—a reaction which in Canada's case has prompted some retreat from initially proposed legislation (i.e. Bill c-36, Bill c-42). However, continuing deadly terrorist strikes could generate pressures for greater restrictions on civil liberties.

Prominence of Identity-Based Conflict

The causes of global strife continue to vary. Yet conflicts grounded in issues of identity, ethnicity, culture and belief appear increasingly prominent.[16] In addition to the ongoing and global confrontation between Western secularism and radical Islam, the past decade has witnessed a range of identity-driven clashes such as the Serb hostilities against Kosovar Albanians (i.e. Kosovo); Muslim-Hindu clashes in South Asia (i.e. Kashmir); Hutu-Tutsi

strife in Africa (i.e. Rwanda, the Congo); and Christian-Muslim confrontations in Russia (e.g. Chechnya), Western China (i.e. Xinjiang), and Central Asia (i.e. Uzbekistan).

Such clashes have tended to be persistent and highly destructive. In fact, recent experience suggests that parties driven by ethno-nationalist, religious and/or quasi-religious beliefs and causes may undertake and prosecute conflict with a degree of purpose and intensity that confounds material-based and generally Western notions of rational action.[17] One result is a tendency on the part of such groups to ignore generally accepted international norms governing the use of force in pursuit of their goals (e.g. ethnic cleansing). Yet another is a degree of immunity their actions appear to have to the standard Western strategies of deterrence (i.e. how does one effectively respond to suicide bombings?).

Dangers are likely to endure, if not grow, as the impacts of globalization and technological development extend further. In fact, not only might such processes work to fuel identity based conflict itself, but also the ability of such groups to pursue their goals through ever-more destructive means.

Figure 1-9

FUTURE POSSIBILITIES

The consequences of many of the trends identified are already being felt throughout the international system. Indeed, events such as the dramatic terrorist bombings of 11 September 2001 (9/11) have underlined their darker side, dramatically illustrating the dangers posed by rapid and uneven globalization, trans-national terrorism, identity-based international conflict, and asymmetric warfare. They also highlight the regional and global dangers posed by failed states and the vulnerability of open and highly urbanized societies to major disruption.[18]

Ongoing trends may also generate other impacts. Depending on the extent of their presence and the character of their interaction, a number of alternative security environments are possible. In fact, four possible scenarios, ranging from a relatively benign future to one that is highly

confrontational and unstable, are particularly noteworthy:[19]

Scenario 1—Rough Status Quo

Existing power realities ensure that Western states continue to dominate the international system and that the US continues to fill the role of global hegemony. Globalization and technological innovation

continue, but their chief benefits remain highly concentrated in the developed world with Western governments and multinationals exerting tight control over operations. Accordingly, Western prosperity increases and integration of developed societies grows.

Elsewhere, conditions are less favourable. While processes of globalization continue to make headway in the developing world, societal benefits are less forthcoming. Many developing countries continue to experience political, economic and demographic stresses. They also remain the focus of the majority of armed conflicts.

Western wealth and global presence elicit some resentment and backlash. Rogue states continue to seek weapons of mass destruction in defiance of Western preferences. Moreover, sub-state actors such as terrorist groups continue to engage in acts of violence against the status quo. Such actions result in some degree of societal dislocation in the West and prompt the adoption of policies allowing greater scrutiny of citizens by affected states, leading to an increase in the concerns and debate over the erosion of civil liberties. Nonetheless, a preponderance of economic and military might ensures that rivals are unable to pose significant threats to Western dominance. But increased sensitivity to civilian casualties imposes constraints on Western military responses. In general, however, technological innovation ensures that Western military action is able to minimize dangers to non-combatants.

Overall, intra rather than inter-state violence accounts for the lion's share of armed conflict worldwide and occurs primarily in the developing world. Moreover, conflict is largely asymmetric in character (e.g. attacks against civilians, infrastructure and key industries by terrorist organizations; operations against government forces by armed irregulars; violence between rival ethnic and religious groups).

Scenario 2—Western Decline and the Emergence of Competing Power Blocs

The US-led West finds its predominance increasingly challenged by the emergence of rising powers and power blocs in coming decades. While processes of globalization and technological innovation remain most mature

in the West, an inability to effectively control such processes leads to an increasing diffusion of information, technology, and ultimately, power to various regions of the globe.

Gradually, regional powers emerge and cooperate increasingly to offset, and at times, contest the military and technological supremacy and influence of the US and the West. Such coalitions harness globalization processes to integrate and gain access to advanced military technologies. In turn, Western presence and influence abroad becomes more tenuous and circumscribed.

Neither the West, nor its competitors, possesses the military power, unifying ideology, or political culture required to achieve global leadership. Accordingly, no one state or bloc is fully dominant.

Exclusion of many developing nations from the benefits of globalization and economic and technological progress continues. Problems of over-population, resource scarcity, civil unrest and state failure also persist. Yet, bloc rivalries allow many states to jockey for advantage as competing blocs vie for their support and resources. Threats from non-state actors continue to surface; yet, targets of attack are increasingly domestic or regional in nature. Both inter and intra-state conflict occurs and is both symmetric and asymmetric in character—with the latter remaining most prominent. Notably however, a lack of clear military superiority within any one bloc heightens prospects for inter-bloc war and works to increase the dangers of miscalculation and inadvertent escalation when such conflict occurs.

Scenario 3—An Emerging Global Community

The international system is characterized increasingly by a convergence toward a "liberal democratic" future under Western stewardship. Forces of globalization and technological innovation spread beyond the developing world and work both to democratize and homogenize the international system. States and societies across the globe become more tightly integrated, increasingly homogenous and more open.

Throughout, Western nations and elites actively work to ensure equitable access to the benefits of globalization processes. Furthermore, international institutions and the rule of law gain greater power and authority (e.g. a strengthened United Nations, and the creation of an International Court).

Better access to the benefits of technological advances and globalization work to reduce distributional disparities within and between states. For instance, heightened access to education in the developing world increases. And this, along with the increased availability of genetically

engineered food products helps to mute the destabilizing societal impacts of population growth. Meanwhile, technological innovation substantially improves military capacities to detect and defend (e.g. enhancements in monitoring systems, strategic and theatre missile defences). Armed conflicts, humanitarian crises, and complex emergencies continue to arise. However, as the incentives for resorting to war and acquiring the means through which to prosecute it wane, armed violence is less frequent and intense in character. Cases of symmetric warfare are rare. And, while the use of armed violence by non-state actors continues to occur, it is increasingly sporadic.

Scenario 4—Increasing Fragmentation of the International System and its Component Parts

Globalization and the march of technology lead to a steady erosion of state power and authority throughout the international system. Slowly, economic, political and military power becomes increasingly diffused and fragmented. Rapid developments in communication and information technology, biotechnology and nanotechnology coalesce to generate growing pressures for new forms of social, economic, military and political organization.[20]

Despite considerable resistance on the part of states, non-state entities such as cities, distinct regions, and even key industries ultimately emerge as the main centres of influence and power. Increasingly, sub-state rather than state units conduct international affairs. Global politics come to resemble a technologically sophisticated version of the middle ages. Conflict, and the potential to wage it, is conducted primarily by loose alliances of sub-state units for a range of purposes (e.g. economic and political gain, ethno-cultural predominance).

Military organizations are generally small, but the social fragmentation generated by the combined impact of various scientific and technological revolutions ensures that they are numerous and diverse in character (e.g. professional, mercenary). Furthermore, they are highly sophisticated in character and possess capabilities that are exceedingly lethal.

IMPLICATIONS FOR WESTERN MILITARIES

Clearly, future worlds may diverge considerably—with long term possibilities ranging from a modest variation of the current status quo to a world barely recognizable from that of today. Consequently, implications for Western militaries are difficult to draw with any precision. Still, a number of similarities do exist in terms of the challenges likely to materialize in any future world.

Most notably, and regardless of wide variation in the character of those possibilities presented, none is likely to escape the dangers of armed conflict. Indeed, while the frequency and intensity of such conflicts will vary from case to case, conflict itself will represent an enduring feature of international politics—and so too, will the need for armed forces capable of addressing it.

Threats and Challenges

Overall, the vast majority of conflicts and crises will continue to arise in the developing world. These conflicts will largely be intra as opposed to inter-state in character (see figure 1-8). Civil wars, revolutionary insurgencies, and internal rebellions will represent the majority of future strife.

Symmetric, "View 1" engagements between regular armies will also remain a possibility (e.g. India-Pakistan over Kashmir; PRC-ROC over Taiwan; US-North Korea).[21] In general, such conflicts will feature high-tempo conventional battle utilizing relatively complex technologies between national entities. However, while possible, such incidents will become less and less prevalent. Indeed, as the cost and risk of such engagements continues to rise, inclinations to engage in such action will correspondingly decline.[22]

Meanwhile, "View 2" or asymmetric threats, often initiated by non-state actors, will grow more prevalent.[23] Such acts of aggression would avoid direct engagement of regular forces and instead focus on exploiting societal vulnerabilities and disrupting the course of everyday life in an attempt to undermine the authority of state adversaries. Accordingly, key industrial and commercial facilities and / or symbols of state power will represent prime targets for attack (e.g. financial institutions, power grids).

Assaults could involve weapons of mass destruction and even exotic weaponry—particularly as technology cascades throughout the state system. The acquisition and use of chemical and biological agents by state and non-state actors is especially unsettling. In the near-term, however, acts of sabotage featuring relatively low cost, yet highly accessible conventional arms (e.g. light weaponry, high explosives) are far more likely. So too are attacks aimed at disrupting critical information systems and key databases (i.e. information operations).[24]

Regardless of the means employed, the character of conflict will increasingly diverge from past experience as large, set-piece battles between rival armed forces increasingly give way to more fluid, non-linear engagements in which aggression could emanate from a multiplicity of sources, using a wide range of tactics against innumerable, and often non-military targets.[25]

Meanwhile, problems of state failure, resource scarcity, and demographic pressure will continue to generate humanitarian crises and complex emergencies—especially in the developing world. Furthermore, the challenges associated with restoring order and stability to those nations and regions affected will similarly continue—if not increase.

Throughout, urban growth combined with strategies and tactics explicitly aimed at overcoming Western technological advantages will ensure a future in which military operations will be increasingly urban-based. Accordingly, conflict will increasingly involve close contact between adversaries and between combatants and civilian populations.

Beyond this, challenges will occur in an environment in which opposition to Western, and most notably American, global influence and presence are on the rise, and sensitivity to casualties is acute—both in Western nations, and elsewhere.

Western Military Responses

The implications for Western militaries are likely to be profound and at times somewhat conflicting. For instance, rising dangers of asymmetric attack will likely ensure greater emphasis on homeland defence and security. In some cases, this may generate an insular stance whereby governments and their militaries focus attention on the home front and de-emphasize international missions and engagements. Yet in others, asymmetric threats may work to reduce the perceived value of traditional methods of deterrence and increase interest in preventative and pre-emptive action abroad, thus, raising possibilities for proactive and more outward looking military postures.[26] Similarly, while growing sensitivity to civilian and military casualties may reduce, if not deter, Western military involvement in some conflicts, evidence of human suffering abroad may also increase the willingness of publics to support military intervention in others.

Notably, the character of emerging threats suggests that responses may have less to do with traditional military power than with intelligence gathering, assessment and surveillance, civilian policing, and emergency preparedness. Accordingly, a more holistic approach to security incorporating both domestic and foreign policy assets is likely to become increasingly essential, with domestic law enforcement and immigration and refugee policy gaining a standing equal to that of armed forces in future security thought and practice. In turn, the need for effective coordination between such assets will increase.

To the extent that Western military capabilities are required, emerging threats and challenges indicate that Western forces and the strategies and

tactics governing them will possess a number of characteristics. Specifically:

· Flexibility and adaptability will be increasingly central components of national military capabilities.

· Employment of Western military power will be increasingly governed by principles of proportionality and non-combatant immunity.

· Future threats and challenges abroad will increasingly demand coalition rather than unilateral military action. And while such responses may involve traditional alliances, they will often demand more ad hoc, often regional groupings and / or coalitions of the willing.

· Concern over casualties may lead policy-makers to focus greater attention on the use of air and naval power than ground troops when contemplating participation in foreign military interventions. However, the character of future international expeditionary operations will nonetheless ensure a continuing and highly important role for ground forces in meeting future contingencies (e.g. ground combat, peace support operations, humanitarian aid).

· Trends indicate the growing importance of light, more mobile, rapid reaction and special operations force capabilities (e.g. flexibility, multi-mission platforms). Moreover, capabilities designed to ensure rapid response and effective power projection will be essential.

· Both the diffusion of power and Western influence indicate some decline in the capacity of Western militaries to be assured reliable and secure forward basing and thus suggest an increased need to develop viable alternatives (e.g. mobile off-shore basing).

· More lethal environments and a growing dependence on information-based systems and strategies will demand increased emphasis on the active defence of key military assets (i.e. emphasis on mobile missile defences).

· Highly uncertain, fluid battlespace environments will increase the degree to which timely intelligence and sensing capacities will be crucial to meeting the security challenges (i.e. reliance on space-based sensors and platforms).

· The spread of advanced military technologies will necessitate continued Western efforts to monitor developments and adjust

strategies, tactics and capabilities accordingly.

· The character of future threats, prospects of an aging Western population, and economic realities will ensure continued efforts on the part of Western militaries to substitute technology for manpower in years to come.

· Technological diffusion, along with the intensifying urban character of the future, conflict will threaten to reduce certain advantages likely to accrue to technologically sophisticated forces (e.g. ability to attain accurate situational awareness; ability to effectively exploit airpower in all situations; and ability to avoid non-combatants).

IMPLICATIONS FOR CANADIAN POLICY

Much like other Western nations, Canada finds itself increasingly affected by many of the trends and forces detailed above. Globalization and technological innovation have already fully integrated Canada culturally and economically with the rest of the world. They have also facilitated greater intellectual and cultural diversity within the nation itself. Moreover, the close association with the US and North American commercial and economic integration continues to yield a range of economic and security dividends.

Yet, dangers also exist. Despite its benefits, the interdependence bred by globalization produces economic and military vulnerabilities. While direct threats to Canadian territory currently remain minimal, industrial espionage, terrorist infiltration and / or information operations now hold increasing potential to disrupt Canadian society and harm security. So too does the prospect of economic downturns in key economies (i.e. the US) and the scourge of disease.

Armed conflict and turmoil abroad pose additional challenges that threaten to disrupt the international peace and stability required for the promotion of Canadian values and interests. To the extent that foreign conflicts result in immigration to Canada, such turmoil may even be imported into the domestic social fabric via immigrants either seeking to renew hostilities in their new homeland or through the conduct of activities aimed at providing political and financial support to armed struggles abroad.

Efforts to address such threats are ongoing and have generally been sound. Since the Cold War's end, Canada has gradually moved to respond to the demands of a world characterized increasingly by state failure, civil war and humanitarian disaster. For instance, it has gone beyond participation in the

"classic" peacekeeping practice of juxtaposing forces between belligerents willing to accept a third party presence, to more ambitious operations aimed at peace enforcement in which stability in terms of security, governance, and humanitarian assistance is superimposed for the benefit of a range of peoples in a variety of regions. Beyond this, and in light of ongoing shifts in the international threat environment, Canadian policy-makers and planners have increasingly recognized the "two-view" conception of the nature of future conflict—with both symmetric and asymmetric threats now demanding attention.

Nevertheless, recent events and the potential future worlds that may arise from the interaction of ongoing trends suggest that still more shifts will be required in the manner in which security must be addressed in the years ahead. Certainly, emerging realities along with the character of Canada's interests and goals will demand that Canada retain a global focus. Given likely security challenges, such a focus will continue to involve active Canadian participation in both North American security, and more generally, in international peace support and security operations.

 More than ever before, however, Canada will require an approach to security that features and effectively integrates both non-military and military capabilities—particularly in light of the growing dangers posed by asymmetric threats. Faced with the emergence of sub-state or non-state actors interested in infiltrating the West and attacking from within, skilful diplomacy, strengthened intelligence and domestic law enforcement capabilities may well have an importance equal to, if not greater than, military forces in effectively addressing the dangers of the future.

That said, recent and potential future threats will demand that governments place somewhat greater emphasis on "hard power"—military capabilities in particular—as a means of achieving foreign policy and security goals than has been evident in the recent past.[27] In the case of terrorism for instance, eradication of immediate threats may well require an ability to participate in international operations aimed at confronting the threat at its source rather than simply preventing its emergence on the home front. The need for the use of "hard power" may also arise domestically as a response to future cases of asymmetric attack. In fact, without sufficient hard power assets, dangers emanating from such attacks may not only rise but also governmental credibility may well decline—both at home and abroad.

Such resources must include both adequate manpower and effective military equipment. The prospect of an aging population also suggests that greater emphasis on technology and automation will be required in future defence planning.

Beyond this, political, economic and security considerations indicate the need to increase the relative importance of homeland and North American defence within the Canadian security calculus. As the American planning for national missile defence, its tightening of homeland security in the wake of 9/11, and the development of the North American Command proceed, issues of an appropriate Canadian response will rise. Such a response must balance the continuing importance of Canada's bilateral relationship with the US on the one hand, against the longstanding domestic concerns regarding Canadian sovereignty and independence on the other. Yet, whatever its precise character, it must be coherent and "joint"— integrating both Canadian and US institutions and organizations in a manner which maximizes their capability to ensure the future security and well-being of both countries.

IMPLICATIONS FOR THE CANADIAN FORCES

Current defence policy calls upon the CF to ensure that domestic security and sovereignty contribute to continental defence, and support initiatives aimed at enhancing international peace and security. It also calls for such demands to be met through the retention of a balanced, flexible and combat-capable force.[28] Such guidance remains relevant in addressing the emerging security environment. However, the character of many of the threats and challenges likely to arise suggests that certain capabilities and requirements must be emphasized. In this regard, Canada should take heed of virtually all of the suggestions outlined for Western militaries more generally. Yet, additional practices should also be considered, particularly in light of Canada's particular circumstances. Specifically:

· Trends continue to support the development of a flexible, balanced military force, although one more capable of swift adaptation to changing circumstances and with improved levels of overall capability. Indeed, capabilities must be rapidly deployable and sustainable.

· Growing concerns over potential asymmetric attacks against North America will require that greater emphasis be devoted to homeland defence and North American defence commitments.

· Future Canadian participation in multinational peace support operations will demand continued efforts to ensure the interoperability of Canadian forces (i.e. particularly, although not exclusively, with US forces).

· While the majority of missions abroad will continue to involve peace support and humanitarian assistance, current trends in the nature of

conflict reinforce the need for a robust combat capability.

· Continued, if not greater, emphasis on the development of doctrine and capabilities for operating in complex terrain (e.g. jungles, urban environments) is essential.

· A greater likelihood of asymmetric conflict, perhaps involving WMD, will demand forces capable of operating in chemical, biological and nuclear environments. It will also reinforce the need for smaller, lighter, more rapidly deployable and mobile capabilities (e.g. lighter equipment; shift from tracked to wheeled vehicles; increased capacities for air and sea-lift).

· A highly fluid and volatile threat environment will place a premium on enhanced sensing capabilities, as well as on means dedicated to their protection (i.e. *Shield* capabilities).

· Greater public sensitivity to casualties will demand more intense exploration of means to ensure discrimination in military responses (i.e. precision-guided munitions (PGMs), non-lethal weaponry) and greater emphasis on effective defences both for the CF and support personnel. In fact, ongoing technological innovations may offer increased opportunities to create a smaller yet more effective force at less overall cost. At the same time, limited resources, along with the cost of technology itself will ensure that its application to the CF must continue to be highly selective with rigorous examination of relative "value added" a must. Accordingly, highly fluid and unpredictable environments combined with limited resources will demand that efforts be focused on acquiring technologies promising the widest possible application within the CF (e.g. advanced command, control, computers, communications and intelligence (C4I) systems; intelligence, surveillance, target acquisition and reconnaissance (ISTAR) capabilities; unmanned aerial vehicles (UAVs); improvements in strategic lift; and continued acquisition of lighter, more mobile forces).

· Effective development of the CF will continue to require a number of changes in the acquisition process (i.e. continued improvements in concept development; increased use of experimentation; a more flexible, staged and technologically informed approach to the purchasing of equipment).

· Growing international and domestic awareness of international events, and sensitivity to the conduct of war will demand greater emphasis on explaining military missions and operations to

domestic audiences.

· Given demographic trends strategies capable of appealing to a more ethnically diverse population will be increasingly essential for encouraging future CF recruitment.

· The growing prevalence of technologically sophisticated systems will require that the CF place greater emphasis on attracting, and retaining, highly skilled recruits.

CONCLUSION

Whether Canada and other Western nations will be capable of successfully adapting their militaries to the challenges outlined above remains to be seen. While recognition of ongoing trends and challenges offers some guidelines for determining what is needed to cope with the future security environment, continuing uncertainties ensure that observations must be general. In fact, trends themselves often point in varied directions. For instance, while both security and alliance considerations may well support greater interoperability of forces, domestic political logic may favour moves in the opposite direction, especially if increased military integration is seen as compromising national autonomy, or as reducing freedom of action by a general public increasingly sensitive to questions of sovereignty.[29]

Economic and fiscal realities are likely to impose additional constraints on change. In light of finite resources and the range of demands that confront governments domestically and on the international stage, the ability to undertake increased and sustained commitments to security and defence cannot be assured.

The identification of such dilemmas is not meant to suggest that establishing guidelines is unwarranted. While uncertainties doubtless exist, it is clear that the future environment will demand new approaches, capabilities and forces. Not only will old challenges remain, but new ones will emerge. And, all will demand forces that be combat-capable, rapidly deployable and sustainable, and at the same time, lighter, more mobile and more agile than ever before. Most importantly, these challenges will demand that militaries be "smarter"—possessing the capacity to acquire and leverage information, and ultimately knowledge, effectively and efficiently so as to achieve total situational awareness wherever and whenever they may be engaged.

Consequently, development of a plausible game plan is essential, generally for Western nations and in particular for Canada. In its absence, threats may come to fruition and security could be compromised.

ENDNOTES TO CHAPTER 1

1   Martin Van Creveld, *The Transformation of War* (New York: The Free Press, 1991), 198.

2   Insightful discussions of globalization and its impacts can be found in Thomas L. Friedman, *The Lexus and the Olive Tree* (New York: Anchor Books, 2000), David Held, Anthony McGraw, David Goldbatt and Jonathan Perraton, *Global Transformations: Politics, Economics and Culture* (Stanford: Stanford University Press, 1999), Robert Keohane and Joseph S. Nye, "Globalization: What's New, What's Not (and So What?)," *Foreign Policy*, Spring 2000, 104-119, and Martin Wolf, "Will the Nation-State Survive Globalization?" *Foreign Affairs*, January/February, 2002, 178-191.

3   Obviously, the benefits promised may be highly dependent on intent. For instance, while innovations in robotics may be employed as a means of accomplishing military missions while preserving life, growing access to such technology could offer new and relatively inexpensive means of destroying it. Indeed, the hands of terrorist groups, such devices could eventually reduce the need for suicide bombers.

4   Indeed, recombinant DNA technologies (i.e. "gene cloning") are already raising the theoretical prospect of weapons capable of wiping out specific ethnic and racial groups. As such, genocidal possibilities cannot be discounted. For critical assessments of such threats, see Raymond Zilinskas (ed.), *Biological Warfare: Modern Offense and Defense* (Boulder: Lynne Rienner Publishers, 2001) and Joshua Lederberg, (ed.), *Biological Weapons: Limiting the Threat*, (Cambridge: The MIT Press, 1999).

5   Notably, such innovations are already raising fears concerning an extension of military competition to cyber-space and outer space.

6   Some analysts contend that one of the key features of the emerging international system is the growing importance which moral principle occupies in relations between states. See for instance, Philip Zelikow, "The Transformation of National Security: Five Redefinitions," *The National Interest*, Spring 2003, 20–23 and Leslie H. Gelb and Justine A. Rosenthal, "The Rise of Ethics in Foreign Policy: Reaching a Values Consensus," *Foreign Affairs*, May–June, 2003.   .

7   See, Central Intelligence Agency, *Long-term Global Demographic Trends: Reshaping the Geopolitical Landscape* (Washington D.C.: Central Intelligence Agency, July 2001); and Brian Nichiporuk, *The Security Dynamics of Demographic Factors* (Santa Monica CA: RAND, 2000).

8   In the future, states in the Middle East and Africa may be especially vulnerable to demographically induced instabilities. Both regions are experiencing rapid urban growth. And in the future, both are expected to exhibit a significant "youth cohort" (i.e. percentage of population between 15–29 years of age)—a segment of the population which generally demands greater opportunities for employment and access to resources than others.

9   Detailed examination of the implications of aging on the international system can be found in Peter G. Peterson, "Grey Dawn: The Global Aging Crisis"; *Foreign Affairs*, January/February 1999, 42–55.

10 Such scarcities may be supply induced-owing to declining availability of the resource itself; demand induced—stemming from rising resource consumption; or structurally induced—a result of unequal access to the resource itself. Most often, however, they arise as result of a complex interaction featuring all three processes. For a systematic examination of the links between environmental scarcity and conflict, see Thomas Homer-Dixon, *Environment, Scarcity and Violence*, (New Jersey: Princeton University Press; 1999), and Thomas Homer-Dixon, *Ecoviolence: Links Among Environment, Population and Security* (New York: Rowman and Littlefield, 1998).

11 As reported in, Directorate of Land Strategic Concepts, *The Future Security Environment* (Kingston: DLSC, 1999), 11. For a more detailed assessment see, Central Intelligence Agency, *Long-term Global Demographic Trends: Reshaping the Geopolitical Landscape* (Washington D.C.: Central Intelligence Agency, July 2001).

12 For a detailed study of such possibilities, see Michael T. Klare, *Resource Wars: The New Landscape of Global Conflict* (New York: Metropolitan Books, 2001)

13 Instances of failed and failing states are numerous and span a number of regions. Current examples include the Palestinian Authority, Afghanistan, (Middle East), Columbia, Venezuela (Latin America), Cote d'Ívoire, Liberia, (Africa), Pakistan, Sri Lanka, (South Asia) and Turkmenistan, Uzbekistan, (Central Asia)

14 For an insightful discussion of the possibilities, see Thomas Homer-Dixon, "The Rise of Complex Terrorism," *Foreign Policy*, January–February, 2002, 52–62.

15 In part, such strife represents an ongoing reassertion of historic ethno-national, and religious rivalries long

suppressed by decades of East-West ideological rivalry. Yet local reaction to the homogenizing effects of globalization and perceived inequities in the distribution of societal benefits among groups involved are also at work. In fact, it is likely that globalization itself serves to both heighten such equalities and at the same time increase awareness of deprivation among those affected—a process that generates a heightened sense of grievance, and ultimately—armed violence.

16 For an insightful, although highly controversial, examination of this phenomenon, see Samuel P. Huntington, *The Clash of Civilizations and the Remaking of the World Order* (New York: Simon and Schuster, 1997).

17 See Neil J. Kressel, *Mass Hate: The Global Rise of Genocide and Terrorism* (Boulder, CO: Westview Press, 2002), Bruce Hoffman, *Inside Terrorism* (Great Britain: Orion Publishing, 1998), and Hoffmann, "The Logic of Suicide Terrorism," *The Atlantic Monthly*, June 2003, 40, 42–47.

18 In this regard, it can be argued that recent years have witnessed less an alteration in the types of trends and forces at play in the global arena than in the degree and intensity at which they are operating.

19 Efforts to extrapolate the possible worlds which could emerge as a result of current trends are growing. For some recent examples, see Jacquelyn K. Davis and Michael J. Sweeney, Strategic Paradigms 2025: U.S. Security Planning for a New Era (Washington, DC: Institute for Foreign Policy Analysis, 1999) and Central Intelligence Agency, *Global Trends 2015:.A Dialogue about the Future With Non-Governmental Experts* (Washington, D.C.: Central Intelligence Agency, December, 2000).

20 For an argument along similar lines, see Thomas K. Adams, "Radical Destabilizing Effects of New Technologies," *Parameters*, Autumn, 1998, 99–111.

21 See Canada, *Future Army Capabilities* (Kingston: Directorate of Land Strategic Concepts, 2001), 2.

22 Michael T. Klare, "Waging Post-Industrial Warfare on the Global Battlefield," *Current History*, December 2001, 434.

23 As commonly defined, the "View 2" conflict envisions nation states opposed by armed bodies that are not necessarily armed forces, directed by social entities that are not necessarily states, fought by people who are not necessarily soldiers. See, Canada, *Future Army Capabilities*, 2.

24 An excellent collection of essays examining the various possibilities is offered in Robert J. Bunker, ed., *Non-State Threats and Future Wars* (Portland, OR: Frank Cass Publishers, 2002).

25 Studies examining the future character of conflict and its implications for military strategy are plentiful. Particularly insightful works include: Martin Van Creveld, *The Transformation of War* (New York: The Free Press, 1991); Chris Hables Gray, *Postmodern War: The New Politics of Conflict* (London: The Guilford Press, 1997); Marc Cerasini, *The Future of War: The Face of 21st Century Warfare* (Indiana: Alpha Press, 2002); Christopher J. Bowie, Robert P. Haffa Jr. and Robert E. Mullins, *Future War: What Trends in America's Post-Cold War Military Conflicts Tell Us about Early 21st Century Warfare* (Washington D.C.: Northrop Grumman, January 2003); Michael Evans, "From Kadesh to Kandahar: Military Theory and the Future of War," *Naval War College Review*, Summer 2003, 132-150; and Michael T. Klare, "Waging Post-Industrial Warfare on the Global Battlefield," *Current History*, December 2001, 433–437.

26 The articulation of a new US national security strategy following the terror attacks of 11 September 2001 offers the most explicit example to date of the degree to which such threats have generated more explicit pre-emptive (and preventative) tendencies in security policy. Termed the Bush doctrine, the document officially advocates greater emphasis on pre-emption to address future threats emanating from terrorist groups and the proliferation of weapons of mass destruction. See, White House, *The National Security of the United States of America* (Washington, D.C.: U.S. Government Printing Office, September, 2002), especially chapter 5.

27 "Hard Power" generally refers to tangible military and economic assets and their use as means of coercion. In contrast, "soft power" involves the use of assets such as culture, political institutions and ideas in ways that influence and persuade in more subtle fashion. For an extended discussion see Joseph S. Nye, Jr., *The Paradox of American Power: Why the World's Only Superpower Can't Go it Alone* (Oxford: Oxford University Press, 2002).

28 Canada, *1994 Defence White Paper* (Ottawa: Department of National Defence, 1994), 13.

29 On a broader note, while future worlds may well underline the continued need for balanced armed forces capable of addressing a range of contingencies both at home and abroad, an absence of clarity and precision regarding missions and roles may obstruct the ability to determine what such capabilities should be. With reference to the CF for instance, greater thought must be given to its precise role in North American as well as territorial defence, and the missions and capabilities that this entails. While growing concerns over asymmetric threats to North America are clearly on the rise, and while future trends suggest that such dangers will persist and perhaps even grow, the CF's contribution in meeting them on domestic soil remains somewhat underdeveloped in the context of new strategic realities.

CHAPTER 2
EMERGING TECHNOLOGY AND GROWTH AREAS

The best way to predict the future is to invent it.

Alan Kay[1]

INTRODUCTION

The Canadian Army of the future, like armies past and present, will be enabled or constrained by the characteristics of the technology at its disposal. Few would contend that we are not in the midst of a dramatic period of technological innovation; therefore, new technology will play an ever-growing role, not only within the defence community, but also within society at large.

While it is futile to attempt to predict the future, it is prudent to reflect upon the realm of the possibilities so that they can be selectively pursued and developed, or guarded against. It is critical to identify the revolutionary technologies and inventions that are emerging from current innovations, assess where they may lead in the next 25 years, and consider their potential impact on future military forces and operations. Only through this process of projecting what can plausibly be expected in the years ahead can we understand what our options could be, and therefore, set reasonable goals and develop effective strategies that will contribute to the achievement of an advantageous future, while avoiding negative consequences or indeed irrelevance.

RATE OF PROGRESS

Leading industry experts and futurists suggest that the last decade of the 20th century witnessed more technological progress than during all of the preceding 90 years.[2] At this pace, these same experts predict that the first decade of the 21st century will experience the same level of technological development as that experienced during the entire 20th century. Indeed, detailed historical analysis of the rate of progress of many domains in science and technology reveals that each has experienced exponential growth since their inception.[3] Given the nature of this explosive growth, however, a technology that may have existed for decades can seemingly erupt overnight. The evolution of the Internet is an example of this phenomenon (see Figure 2-1).

Internet Hosts - Linear Scale

Data from Hobbes' Internet Timeline v6.0, http://www.zakon.org/robert/internet/timeline/#Sources
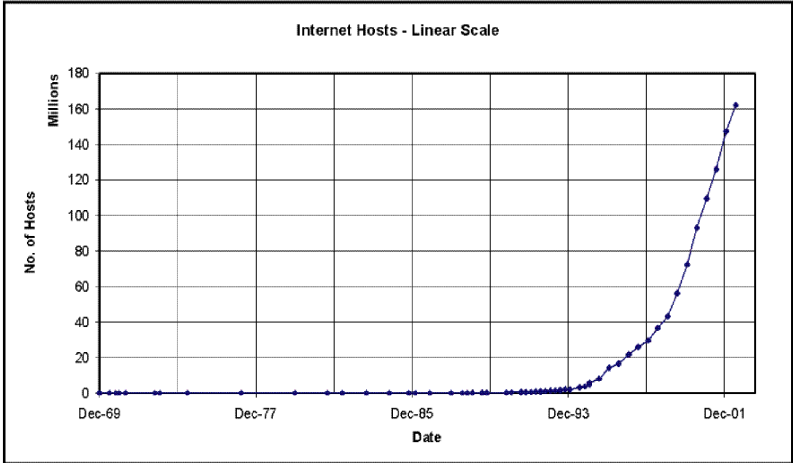
Figure 2-1: Internet host growth chart on linear scale

Although the Internet has existed since the late 1960s, it remained relatively unnoticed until the early 1990s when it seemed to burst into view. Charting its growth, however, on a more suitable logarithmic scale, reveals a predictable exponential growth trend that, on average, has doubled every eighteen months (see Figure 2-2). Internet enabled wireless devices will likely permit this trend to continue. At this rate, the number of Internet hosts (i.e. devices with a unique address on the Internet), will exceed people within the next ten years, bringing new meaning to the term globalization.[4]

Internet Hosts - Logarithmic Scale

Data from Hobbes' Internet Timeline v6.0, http://www.zakon.org/robert/internet/timeline/#Sources
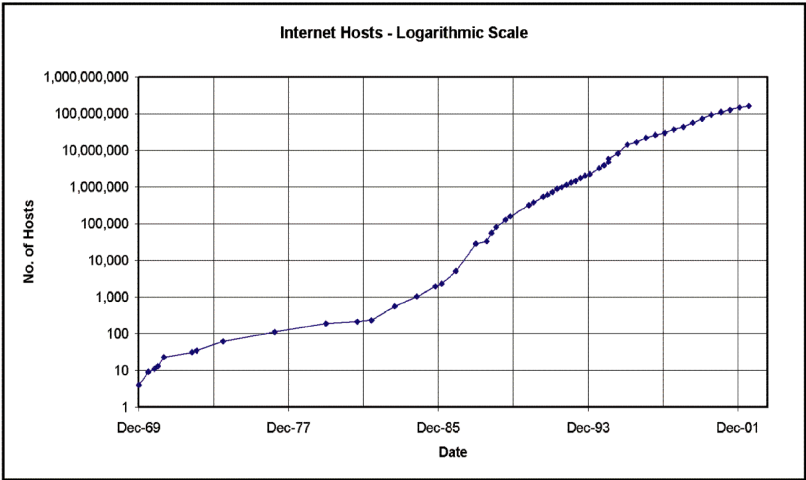
Figure 2-2: Internet host growth chart on logarithmic scale

Historical analysis has revealed similar exponential trends for a number of other key technological areas.[5] These include:

· Computer processing power (doubles every 18 months).

· Magnetic data storage capacity (doubles every 15 months).

· Random access memory capacity (doubles every 18 months).

· Internet service provider cost-performance ratio (halves every 12 months).

· Modem cost-performance ratio (halves every 12 months).

· Internet backbone bandwidth (doubles every 12 months).

· Fastest possible data transmission speed (doubles every 12 months).

· Price-performance ratio of wireless data devices (halves every 36 months).

· DNA sequencing cost per base pair (halves every 12 months).

· Human genes mapped per year (doubles every 18 months).

· Genomes sequenced per year (doubles every 12 months).

· Resolution of non-invasive brain scanning devices (doubles every 12 months).[6]

· Brain scanning speed (doubles every 26 months).

· Brain scanning image reconstruction time (halves every 18 months).

Coinciding with the exponential growth in the areas noted above is an equivalent trend towards technological integration and miniaturization of computers and mechanical devices. While it is impossible to state categorically that these trends will continue indefinitely, history is replete with examples of the self sustaining nature of technological growth, whereby ever more advanced technology is created using tools from earlier innovations. In addition, Internet-enabled recording and dissemination of technical and scientific knowledge has never been greater. Furthermore, new and novel techniques inevitably appear and take over whenever a particular technology nears the limits of its potential. An unprecedented number of rapidly maturing technologies exist, which are poised to drive future innovations. In 2025, these innovations will be as inconceivable to us

today, as the likelihood of an "integrated, shirt-pocket-sized-cell-phone-wireless-internet-PC-PDA-high-resolution-digital-video-camera-global-positioning-system-music-playing-game-console, complete with a quarter Gigabyte of electronic digital memory," would have seemed in 1980.

Figure 2-3: Soon to be released cell phone from Motorola

Expected to be available for purchase in late 2003, the model A835 combines a phone, Personal Computer (PC), still and video cameras, arcade, digital music recording and playback, Global Positioning System (GPS) and Personal Digital Assistant (PDA) capabilities in one device, providing a fast, "always-on" Internet connection. Integrated video-phone capabilities allow communication with phone or PC users using voice and body language. Bluetooth™ technology allows wireless connection to compatible accessories and devices such as printers.
http://commerce.motorola.com/consumer/QWhtml/m_a835.html

The ostensible eruption of technologies, characteristic of exponential growth situations, is difficult to react to, in fact, it is often disruptive, particularly for large organizations that tend to have substantial institutional inertia, such as the Department of National Defence (DND). This is not unique to the military, as recently evidenced by the turmoil within the music recording industry due to peer-to-peer (P2P) file sharing enabled by Napster and subsequently Kazaa and others. The challenge for today's Army, therefore, will be to continuously modernize itself by conceptualizing the future in order to prepare for, and harness, the derivative and entirely new capabilities that will result from this technological explosion.

Relying upon 20th century combat development and procurement processes will be a recipe for certain technological irrelevance. Consider that a major procurement initiative requiring 15 years from initial capability deficiency identification to fielding of initial operational capability will witness ten doubling periods pass in the case of computer processing speed and memory capacity. This 15-year period represents a forecasted 1000 fold increase in computation speed and digital storage capacity. Equally, consider that at its current pace of development, computing speed and memory capacity will experience roughly 16 doubling cycles during the 25-year timeframe represented by this report. It is expected, therefore, that a typical consumer computer will have over 65,000 times the processing power of its equivalent counterpart today, currently a desktop personal

computer (PC) with an Intel microprocessor running at a clock speed of just over three GHz. This level of performance equates to twice as many computations per second as today's fastest supercomputer.[7] Equivalently, today's one Gigabyte (GB) memory stick will be able to store over 65,000 GBs (i.e. 65 terabytes (TB)) of data. Clearly, combat development and procurement cycle times must be reduced, or equipment will be antiquated before it is issued.

TECHNOLOGICAL FOUNDATION

At present, and not withstanding some difference of opinion among industry and academic experts, four broad domains of science and technology are beginning to lay the foundation for future revolutionary innovations. These four domains are: (1) nano-science and nanotechnology; (2) biotechnology and biomedicine, including genetic engineering; (3) information technology, including advanced computing and communications; and (4) cognitive science.[8]   Based upon the unity of all matter at the nano-scale and on technological integration from that scale, these four key disciplines are rapidly converging. Collectively, these convergent technologies are often referred to as NBIC technologies.[9] This convergence is summarized well by W.A. Wallace who observed, "If the *Cognitive Scientists* can think it, the *Nano* people can build it, the *Bio* people can implement it, and the *IT* people can monitor and control it."[10]

Being highly interdependent, each domain is currently experiencing stages of stagnation followed by exponential growth periods, as breakthroughs in one area feed into the others. Viewed over short periods, a particular technology may appear stationary, but over the long term, exponential growth trends are clearly evident.[11] Care must be taken, therefore, not to conclude that a particular technology will no longer develop exponentially simply because it is experiencing a plateau in its growth. Indeed, new developments and breakthroughs in one or more of the foundation technologies are announced on a daily basis, shortening the periods of technological stagnation while contributing to rapid growth.

Although these NBIC domains are expected to continue to converge on their own, due to market driven research, a concerted defence research and development (R&D) strategy is required to realize the military potential these areas will offer within the next 25 years. This coordinated strategy will lead to revolutionary developments for defence purposes in such areas as: data linkage and threat anticipation; fully autonomous air and ground uninhabited combat vehicles; efficient and effective distributed war fighter education and training; responses to chemical, biological, radiological and explosive threats; increasingly lethal war fighter systems; non-drug treatments to enhance soldier performance; and revolutionary human-machine interfaces and integration.[12]

Figure 2-4: Potential NBIC technology enabled adaptive camouflage

Revolutionary advances at the interfaces between these previously separate fields of science and technology are rapidly approaching the point where key transforming tools are possible. For the first time, these NBIC building blocks are allowing the scientific community to understand the natural world, human society, and scientific research as closely coupled complex, hierarchical systems.[13] Building upon this foundation, the scientific and technological developments over the next 25 years have the potential to be truly revolutionary and indeed they are already spawning entirely new fields of study or re-energizing existing fields.[14] Many of these fields have the potential to drive revolutionary innovations, not only for enhancing military capabilities, but also for improving society in general. If used carelessly or maliciously, however, there exists an equal risk of technologically induced devastation. Indeed, it is not inconceivable that a nano-engineered biological pathogen could be developed within this timeframe, which could target a specific race or environment while leaving another unharmed.

Accordingly, a US Nanotechnology Bill has recently been tabled to the 108th Congress, 1st session, which includes a section that requires that societal and ethical concerns be addressed as the technology is developed.[15] In his testimony to the US House of Representatives Committee on Science, Ray Kurzweil, information technology entrepreneur and author, summarized this situation as a precarious balancing act between deeply intertwined promise and peril due to our increasing ability to manipulate matter and energy at ever-smaller scales (see Figure 2-5). This ability will stimulate transformation in virtually every sector of society, including health and medicine, manufacturing, electronics and computers, energy, travel, and defence.

Future transformation will be achieved through a variety of scientific and technological innovations enabled by the increasing overlap between nanotechnology and other technologies of influence such as biotechnology and artificial intelligence. The following is a comprehensive, albeit not exhaustive, list of the fields of study that, through breakthroughs in the NBIC technological domains, have the potential to drive future civil / commercial and military revolutionary innovations out to 2025.[16]
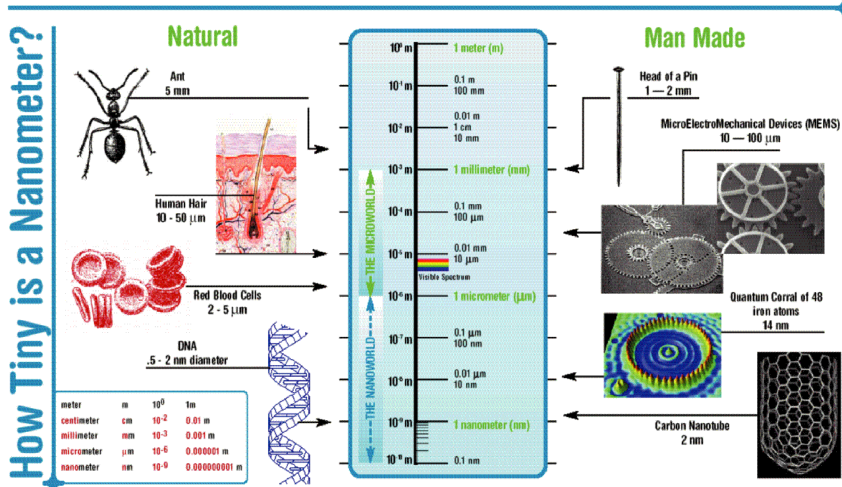
Source: J. Wolfe, *Nanotech Report—Nano 101*. Published jointly by Forbes Inc. and Angstrom Publishing LLC.

Figure 2-5: Nano scale

· Wireless Sensor Networks

· Superconductivity

· Smart Personal Objects Technology

· Glycomics

· Molecular Imaging

· Wearable Computing Devices

· Tele-immersion

· Bio-mimicry and Robotics

· Biosensors and Nano-biotechnology

· Cognitronics

· Bio-fuels

· Bionics

· Nano-weapons of mass destruction (WMD)

· Quantum Nucleonics and Cryptography

· Power Generation and Power Sources

· Injectable Tissue Engineering

· Parasitic Grids & Grid Computing

· Mechatronics

· Neurotechnology

· Molecular Materials Manufacturing

· Genotyping

· Combinatorial Science

· Swarming technology

· Biometric ID Systems

· 4th Generation Communications

· Adaptive camouflage

33

SCIENCE AND TECHNOLOGY TRENDS

Following an intensive study aimed at developing a coherent view of how the world might develop over the next thirty-year period (out to 2030), the United Kingdom Joint Doctrine and Concepts Centre (UK JDCC) produced a series of documents that identified strategic trends in several defence significant dimensions including science and technology. The following list of trends, modified where required to place them within a Canadian context, were extracted from various issues of the JDCC series, "Strategic Trends— The Science and Technology Dimension":[17]

· Developed nations, led primarily by the US, Japan, and the European Union (EU), will continue to dominate scientific and technological innovation by capitalizing upon their educational systems, commercial infrastructure, and existing technical competence.

· The US will lead technological innovation as long as it continues to be the world's largest market, allowing it to generate enormous amounts of research funding through commercial enterprises, and also through continued governmental policy of direct research investment and commercial incentives.

· US investment in defence R&D will continue to considerably exceed that of its allies (and undoubtedly potential adversaries), leading to an increasingly significant military technological gap between them.

· China and India will continue to grow in niche areas of biotechnology and information technology respectively, given their current prowess in these areas coupled with rapidly growing economies.

· Threat of leakage of technological information to states and non-state actors, or the development of high-threat technologies such as new weapons of mass destruction by states, and potentially individuals, operating under ethical standards that are contrary to western ideals, will continue to grow. Although corporate commercial self-interest will continue to safeguard intellectual property and thus minimize the leakage of technological information that could threaten national security or undermine commercial advantage, the need for scientific and technological regulatory control will rise due to the increasing volume of research, the general rise in the ease of information sharing, and the more interconnected and less tightly-controlled manners in which research is distributed.

· Cyber-terrorism will continue to threaten both the civil and military communities due to their growing dependence on network infrastructure.[18]

· Non-nuclear, high power electromagnetic pulse (EMP) generation techniques and high power microwave technology will become technically feasible and available, not only to the current leaders in these areas, the US and China, but to any nation with even a moderate technological base.[19] Unshielded communications and computing infrastructure will become increasingly vulnerable as these devices and techniques proliferate, and become a preferred weapon given their potential ability to cripple the underpinning information technology of today's developed nations while avoiding politically hazardous loss of life.

· A comprehensive national critical technological advantage will be difficult to maintain due to increased pace of innovation, global markets, trans-national corporations, collaborative public research programmes, and technological leakage.

· Multi-partner R&D alliances, involving strategic high-technology alliances and collaboration between governments or enterprises pursuing dual-use (military and civil) technology, will continue to increase in importance. Since the consumer market will drive, to a large extent, the financing and development of new technological innovations, the military will need to leverage the commercial sector in order to militarize those advanced technologies that can best augment military capabilities.[20] Directly funded public research will remain important in those areas where there is little, or no civil counterpart or market, demand for purely military technology such as explosives, protection systems, weapons guidance, and sensors.

· The level of commercial market-driven investment in technological development, and hence commercial innovation, will continue to dwarf any publicly funded investments, effectively reversing the Cold War trend that saw innovation flow from the defence and security sector to the commercial sector.

· Market-led research will continue to focus on near-term consumer demand, which inevitably leads to technical evolution rather than the revolution that is possible from longer-term, high-risk pure science. Militarily significant high-risk, but high-payoff science and technology will inevitably require public investment to establish the commercial viability of unproven areas before

commercial industry will invest their research funds. The US Defense Advanced Research Projects Agency (DARPA)[21] exemplifies the success of this methodology.

· The time between scientific discovery and technical feasibility will shorten, as will that between technical feasibility and commercial application, due in large part to the profit-oriented goals of the research, wider global markets, and sales innovations such as on-line storefronts.

· Maintaining a technical advantage, and backwards compatibility between old and newer systems and components, will become increasingly difficult due to shortening development cycles, mandating defence procurement flexibility and capacity to manage "graceful obsolescence".

· Synergistic or converging technological applications that successfully combine technical innovations from several fields are expected to deliver the most significant, or revolutionary capability improvements (see Figure 2-6).

THE 3D GADGET PRINTER

How to print a remote control all in one go

Ink-jet cartridges containing different types of electroactive polymer print moving parts as well as electronics

Electronics are embedded within the polymer casing itself, rather than being soldered separately on a printed circuit board

Remote control is "printed" layer by layer
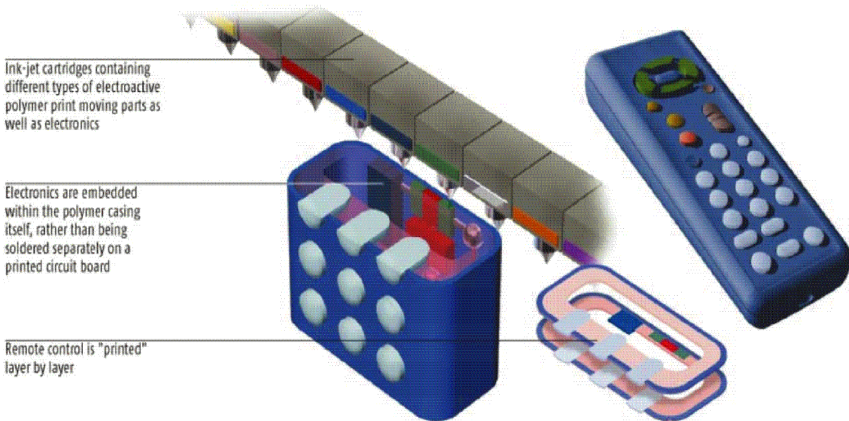
Research at the University of California in Berkeley will allow fully assembled electric and electronic gadgets to be printed in one step. When the technique is perfected, devices such as light bulbs, radios, remote controls and mobile phones will be 'printed' as individual fully functional systems without the need for expensive and labour-intensive production assembly lines. http://www.newscientist.com/news/news.jsp?id=ns99993238

Figure 2-6: 3D gadget printer

· Volumetric weapons with enhanced blast characteristics such as thermobaric and fuel-air explosives are likely to continue to proliferate, making it increasingly difficult to effectively shield soldiers and vehicle crews from blast, and also fragmentation and penetration weapons.

· Fully autonomous weapons systems with independent tactical decision-making capabilities (i.e. without a human-in-the-loop) are expected to become technically possible by 2015—though there will likely be continued legal and ethical challenges to their employment.

· Autonomous military systems will continue to mature and proliferate, due largely to Western society's casualty aversion coupled with the continued digitization of the battlespace. Contributing to this trend will be the rising costs, and difficulty, associated with developing manned platforms able to shield the crew and survive in the increasingly lethal future battlespace.

· Individual privacy will continue to erode due to increased government-initiated surveillance initiatives, such as the Terrorism Information Awareness (TIA) System and other unofficial surveillance capabilities enabled by sensor miniaturization and wireless connectivity.[22]

· The technological gap between developed and developing nations is unlikely to narrow significantly despite the developing world's ability to "leap-frog" certain technologies by importing mature systems rather than developing them locally as many have done.[23]

· Diagnosis and treatment of human disease with genomic and other techniques will contribute to the gradual increase in life expectancy, particularly for the wealthy, thus, contributing to the aging population of developed Western societies (see Figure 2-7).
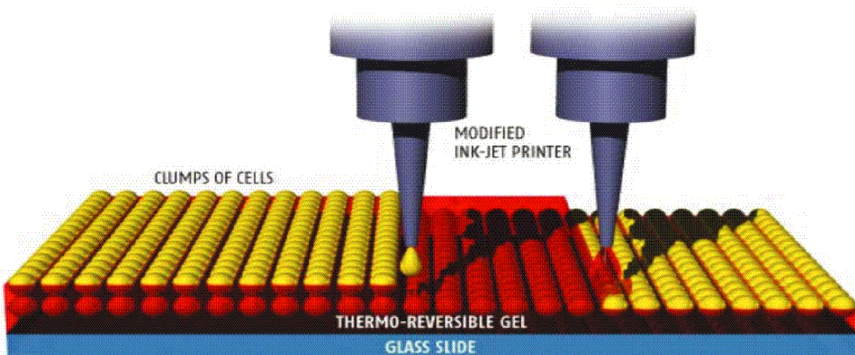
Three-dimensional tubes of living tissue have been printed using modified desktop printers filled with suspensions of cells instead of ink. The work is a first step towards printing complex tissues or even entire organs.
http://www.newscientist.com/news/news.jsp?id=ns99993292

Figure 2-7: Cell printing technology

· Cloning, stem cell research and genetic engineering will offer the potential to not only de-select harmful characteristics for one's progeny, but rather to select desirable ones, raising the spectre of a new form of class system, differentiated by the ability to enhance one's self and offspring versus the lack of means, or desire, to do so.

· Space technology and commercial access to low-earth orbit will mature, opening up this frontier to an even wider segment of the population. The immense financial and material resources of a select few wealthy countries will no longer be needed to secure access to space. The current, near-monopoly position enjoyed by the US and its allies within the space-based surveillance and precision targeting domain will begin to erode. The US will likely continue development of space-based weapons systems, perhaps igniting an arms race in this frontier. Initially, potential adversaries are likely to develop anti-satellite capabilities to counter superior US space weapon capabilities.

· An active "technology watch" programme that aims to avoid "technology surprise" by monitoring highly innovative markets such as healthcare, information technology and the entertainment sectors, for potential military applications will become increasingly important as the pace of innovation continues to escalate.

FUTURE POSSIBILITIES

Given the scientific and technical advances that are emerging today, coupled with the exponential pace of innovation and discovery, the following outcomes are all within the realm of the possible provided that focused public / private investments are undertaken:

· Smart agents that scan the current common operating picture (COP) for any contingency that is likely to require further attention by staff.

· Knowledge management systems that autonomously integrate new information into existing information repositories, preserving and validating the information quality with respect to its age and "truth" using databases, which autonomously communicate with each other.

· Image analysis performed by artificial intelligence (AI) systems, freeing human resources for vital human intelligence (HUMINT) functions.

· AI systems that incorporate equivalent human-level common-

sense knowledge, planning and reasoning abilities, permitting fully autonomous tactical decision-making by unmanned land, sea and air weapons systems within complex mission environments.

· Replicators that can produce any material or substance, including food and water on demand.

· TB[24] data storage devices occupying one cubic centimetre, or less space, coupled with palm-sized and priced supercomputers and electronic paper provide access to global high-resolution geographic data for every soldier.

· Biotechnology (synonymous with bioengineering) perfects the use of living organisms for commercial or medical purposes.

· Ability to fully control and manipulate the genetics of humans, animals and agricultural plants.

· Embedded micro circuitry that improves human cognition and communication.

· Instantaneous wireless broadband digital networks that provide access to needed information anywhere in the world.

· Comfortable, wearable sensors and computers together with smart materials will enable uniforms to respond to weather, interface with distributed information systems, monitor vital signs, deliver medicines, and automatically protect wounds.

· Distributed intelligent autonomous sensor networks that can monitor and analyse their surroundings, sending their observations and findings on command or upon trigger conditions.

· Enhanced human body, that is more durable, healthy, energetic, easier to repair, and resistant to many kinds of stress, biological threats and the aging process.[25]

· Ability to learn new knowledge and skills, more reliably and quickly and without skill fade, with the use of embedded neural prosthetics.[26]

· Fast broadband interfaces, directly between the human brain and machines that remove the rigid syntax required by today's information technology.

· Virtual environments for training, design and task performance that are unlimited by distance or the physical scale at which it is performed.

· Robots and software agents with human-like goals, awareness and personality.

· Ability for individuals and teams to communicate and cooperate across barriers of culture, language, distance, and professional specialization, using universal translation applications.

· Revolutionary materials that are 100 times the strength of steel, yet only 1/6th the weight.

· Materials that instantly heal themselves when punctured, surfaces that can "feel" the forces pressing on them, wires and electronics as tiny as molecules, structural materials that also generate and store electricity, and liquids that can instantly switch to solid and back again at will.[27]

· Engineered materials with exactly the desired properties, including the ability to adapt to changing situations, high-energy efficiency, and environmental friendliness enabling lighter, stronger and more reliable equipment.[28]

· New power generation technologies, lightweight and high-strength materials, high performance communications and computing, all enabled by nano-scale science will provide unprecedented capabilities to the individual soldier.[29]

· Cheap access to space using small satellites that provide space-based surveillance, targeting and communications abilities, down to the tactical level.[30]
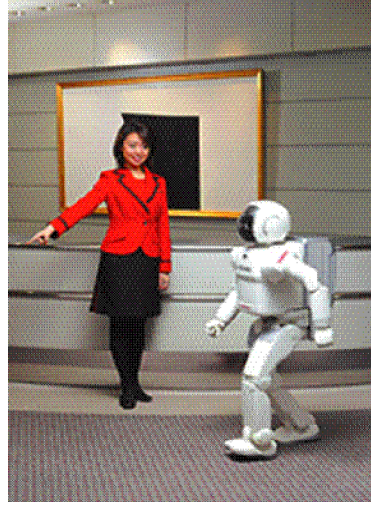
Tokyo, 5 December 2002—Honda Motor Co., Ltd. has released a new model of its intelligent humanoid robot ASIMO that is capable of interpreting the postures and gestures of humans and moving independently in response. ASIMO can greet approaching people, follow them, and move in the direction they indicate, and even recognize their faces and address them by name. Further, utilizing networks such as the Internet, ASIMO can provide information while executing tasks such as reception duties. ASIMO is the world's first humanoid robot to exhibit such a broad range of intelligent capabilities. http://world.honda.com/news/2002/c021205.html

Figure 2-8: Honda robot

TECHNOLOGY PARADOX

A fine balance exists between the technological innovations required for progress and the institutional responses resulting from these innovations. In general, the purpose of technological progress is the betterment of society, whereas for military technology it is the strengthening of total military effectiveness. To illustrate this precarious balance, consider that the recently decoded human, mosquito and malaria parasite genomes could lead to the eradication of malaria, however, the same tools and knowledge could be used to create entirely new and more lethal pathogens.[31] Technological

innovations, therefore, must not be pursued merely for the sake of enhanced performance. Rather, they must be deliberately crafted to produce the desired outcome for the Army while satisfying the social, political and economic needs of the nation.[32]

It is unlikely that authorities around the world will be able to stop the spread of disruptive technology information amongst terrorists, just as they have been unable to stop the spread of pirated music files, despite successful litigation against the file sharing program developers.[33] This possibility defines a new threat for governments and militaries worldwide, requiring them to develop responses to these potential "knowledge-enabled" attacks. In this new era, the possession of knowledge itself, by belligerents or adversaries, poses a fundamental threat.

As such, defence systems must be addressed as complex interdependent entities involving people, organizations, equipment, training, support, command and control, and numerous other aspects that must be viewed as a whole. These entities exist within wider systems comprising such areas as strategy, doctrine, and existing views on weapons systems and types. Systems integration will therefore be the greatest challenge, as the context in which the developed system will be placed is often well defined.[34]

For instance, "sensors track physical things and activities that have electromagnetic and other signatures. Sensors cannot identify human motives, measure human emotions, quantify the coherence of human organizations, or assess the importance of the data they gather."[35] Agent-based computer artificial intelligence will require concerted development before they will have the ability to assimilate and interpret sensor-based input in this fashion.

Moreover, significant research and development will be required for safeguarding against network and information attack. This will not only be difficult, it will become critical as the battlespace, and indeed societies of the future, become more and more reliant upon network connectedness. Quantum cryptography may become practical within the timelines considered in this report, but this will undoubtedly raise additional implications for security[36].

However, the technological advancements require corollary changes in culture and doctrine. Restricting a network-enabled organization to existing hierarchical chains of command will defeat the benefits of the network. Soldiers and crews enabled in the future with advanced situational awareness capabilities, comparable or superior to that of their commanders, will likely mandate a change in traditional command relationships. Today for

example, soldiers, crews, and perhaps entire units, are often unaware of the total tactical view the commander has of the battlespace. When empowered with superior SA (situational awareness), however, these entities can contribute directly to an assigned objective, becoming self-organizing as they act and react to the changing situation with greater autonomy, while allowing them to monitor and safeguard their resources.[37] The commander's control is not lost, however, as he is still able to monitor the unfolding situation and adjust the objectives accordingly.

Despite the pace of development and the open-minded manner in which western societies approach technology, long held personal, social, religious, or indeed scientific beliefs, are difficult to overcome and can stifle innovation. For example, the conclusion within the scientific community that only highly evolved organisms have the ability to act collectively has proven to be a stubborn prejudice to overcome.[38] Fostering an open, innovation-culture will therefore be required if maximum benefit is to be achieved from new discoveries.[39]

CONCLUSION

We are in the midst of a period of unprecedented technological achievement and progress that is delivering exponential technological improvement across a broad spectrum of military and commercial applications, led primarily by advancements within the four NBIC foundational domains of technology. Given this pace of development, soon it may no longer be necessary to ask our science and technology experts "if" something can be done, but rather "should" it be done at all? Moral and ethical considerations may well continue to govern Western technological developments, but the same is unlikely to hold true the world over. In our rush towards ever more sophisticated technology, will we open Pandora's Box, or will we achieve the means to solve humanity's greatest perils? Although an analysis of current trends clearly highlights the growing significance that new technology will play, not only within the defence community, but also within the larger global community, it is impossible to provide a suitable answer to this question.

Shrinking defence budgets will not allow militaries of the future to be the dominant source of technological innovation that they once were. Today's fundamental technological progress is aimed at general consumer markets rather than the military. Canadian society and its institutions will change, in unimaginable ways, in concert with ever advancing technology. If the Army wishes to remain relevant, it too must adapt and change along with the society that it is charged with safeguarding. Since the consumer market is to a large extent financing new technological innovations, the military will need to leverage the commercial sector in order to militarize those advanced

technologies that can best augment military capabilities. At the same time, the Army must pursue defences against advanced technology developed by adversaries that could potentially be used as weapons of mass destruction, such as biological or nano-engineered organisms. Only by maintaining world-class expertise and visibility into science and technology across all domains will the Army be able to measure and understand the potential benefits and threats posed by evolving technology.

Technology must be designed and integrated consciously to be resistant to countermeasures and to avoid weakness that could be exploited asymmetrically. Future technologies will undoubtedly be more effective and lethal, however, our experience with nuclear weapons technology has shown that while an advanced technology can be designed to deploy offensively, it is nearly impossible to defend against. Consequently, the present state of deterrence through mutually assured destruction is a precarious position, yet it seems that the world will remain in this predicament for the foreseeable future.

The Army's continuous modernization must respond to change by enhancing the overall ability of the force to perform its assigned missions through the integration of new innovations into all aspects of military effectiveness: doctrine; training; leadership; organization; and technology.[40] Traditional military command hierarchies, however, do not lend themselves well to this type of continuous change. In the future, self-organizing systems and institutions that defy centralized management are expected to be the only bodies able to routinely produce new and enhanced technological processes and products by combining components and knowledge in synergistic ways.[41]

In addition, the Army must find ways to streamline its major equipment procurement programme, which is currently characterized by cycles that are measured in decades—clearly an archaic paradigm that is obsolete in an era where technological innovations proliferate at ever increasing rates. Therefore, programme managers must find ways to mirror commercial developmental cycles that are measured in weeks, months, or just a few years, if continuous modernization is to be a reality.

Furthermore, innovations and changes to military capabilities cannot be pursued in isolation; rather, they must be implemented in order to satisfy particular capability deficiencies that are, in many cases, responses to superior opposing force capabilities. The future force that is able to capitalize on new innovations early will achieve significant, albeit potentially short-lived, military superiority. However, early adoption of technology is not characteristically accomplished within the defence community today.

Thus, the exponential pace of technological development will require this to change. As such, an open-minded and visionary combat development approach that fosters innovation in all aspects of defence, focused upon leveraging the foundation NBIC technological developments, will be needed for effective force modernization beyond 2010.

ENDNOTES TO CHAPTER 2

1 Alan Kay is one of the inventors of the "Smalltalk" programming language; one of the fathers of the idea of "Object Oriented Programming"; conceiver of the laptop computer and the architect of the modern windowing GUI (graphical user interface).

2 R. Kurzweil, "The Law of Accelerating Returns," Internet, http://www.kurzweilai.net/articles/art0134.html accessed 3 February 2003.

3 Ibid.

4 This suggests that every person could have several internet enabled devices, which to a certain extent is beginning to be realized in developed countries as cell phones, PDAs (personal digital assistants) and computers are connected to the web.

5 R. Kurzweil, "The Law of Accelerating Returns," Internet, http://www.kurzweilai.net/articles/art0134.html accessed 3 February 2003. Values in parenthesis represent the average doubling / halving times (e.g. in 18 months computers will have twice the processing power as they have today) as reported by Kurzweil.

6 While the significance and importance of improved communication and computation is clear within the context of a future digitized battlefield, genetic and brain scanning advancements may be less so, however, they have the potential to revolutionize medicine and artificial intelligence among many other disciplines. For example, forecasted medical advancements could potentially reduce or eliminate disease or the risk of bio-terrorism, whereas improved brain-scanning techniques could lead to a full understanding of the function of the human brain, leading ultimately to human level artificial intelligence.

7 Japan's recently announced Earth Simulator supercomputer performs 35.6 trillion calculations per second, and as the fastest supercomputer in the world, is almost five times faster than the next best one and as fast as the top 5 US supercomputers combined. It is so large that it is housed in a building the size of an aircraft hangar and cost $350 million to develop. Internet, http://wired.com/news/technology/0,1282,56893,00.html accessed 13 May 2002.

8 Robotics technology is sometimes included as a foundation technology.

9 Editors, M.C. Roco and W.S. Bainbridge, *National Science Foundation/Department of Commerce Sponsored Report*, "Converging Technologies for improving Human Performance—Nanotechnology, Biotechnology, Information Technology and Cognitive Science," Arlington, Virginia, June 2002.

10 W.A. Wallace participated at The National Science Foundation (NSF) and the Department of Commerce (DOC) workshop on Converging Technologies for Improving Human Performance, 3–4 December 2001.

11 These feast and famine cycles produce growth patterns that are characteristically referred to as S-shaped growth curves. For an in depth review of this phenomenon see: J.L. Casti, *Complexification: Explaining a Paradoxical World through the Science of Surprise* (New York: HarperCollijns, 1994).

12 Editors, M.C. Roco and W.S. Bainbridge, *National Science Foundation / Department of Commerce Sponsored Report*, "Converging Technologies for improving Human Performance—Nanotechnology, Biotechnology, Information Technology and Cognitive Science," Arlington, Virginia, June 2002.

13 Ibid.

14 This revolution will be powered by the nature of technological exponential growth. In the case of communications bandwidth, 25 years equates to 25 doubling periods at the current rate of development, representing a potential 33 million fold increase over today's performance levels; the potential for unlimited bandwidth is clearly within sight.

15 *Nanotechnology Research and Development Act of 2003*. This Bill proposes the allocation of over $2 billion for nanotechnology research and development, split between five departments and agencies between now and 2006. (http://www.house.gov/science/press/108/HR766.pdf accessed February 10, 2003)

16 While it is beyond the scope of this work to provide a detailed analysis and description of each of these evolving technology areas, interested readers can find detailed definitions to these and other terms from many online science glossaries including: Cambridge Healthtech Institute—http://www.genomicglossaries.com/; Whatis.com—http://whatis.techtarget.com/whome/0,289825,sid9,00.html; and the Glossarist—http://www.glossarist.com/. The potential impact that science and technology, in general, is likely to have upon the Army in the future, vis-à-vis concepts and future innovations, is addressed in following sections, but with the caveat that suitable investment and focus in these areas must be initiated now and maintained.

17 Compiled from "Strategic Trends—The Science and Technology Dimension," UK Joint Doctrine and Concepts Centre, March 2003.

18 White House cyber-security chief, Howard Schmidt, in a recent *Wired Magazine* interview refers to cyber-

attacks as "Weapons of Mass Disruption." Internet http://www.wired.com/wired/archive/11.05/schmidt.html

19 The JDCC (UK Joint Doctrine and Concepts Centre) has concluded that due to the relative simplicity of the technology required to assemble an EMP device, also known as an E-bomb, any nation with even a 1940's technology base could have the ability to manufacture them.

20 As an example, in 2001, nearly 75 percent of the UK Defence Evaluation and Research Agency (DERA) became a private sector company (QinetiQ), which is allowing it to achieve full commercial potential that would have been impossible within the public sector. Internet http://www.qinetiq.com/about_qinetiq/history.html accessed 15 January 2003.

21 Internet http://www.darpa.mil/index.html accessed 20 January 2003.

22 The TIA System is a US DARPA program (http://www.darpa.mil/iao/TIASystems.htm). Civil liberties groups will likely expand in numbers and increase in significance, perhaps leading to amplified tensions between the electorate and their governments.

23 For example, by installing wireless communications facilities, several underdeveloped countries have completely bypassed the "wired" phase of land-based communications.

24 One TB (terabyte) represents 240 = 1,099,511,627,776 bytes of digital information. It would require 1571 standard digital compact disks to contain a TB of data. An area of one thousand square kilometres, imaged with a resolution of one metre and a colour depth of 256, would require approximately a TB of data storage.

25 J. Randerson, *New Scientist.com*. "Working Kidney Grown In Mouse." Complete working kidneys have been grown in mice using stem cells derived from human and pig fetuses. If this feat can be repeated in humans, it will allow doctors to replace damaged organs without the need for a donor. Internet http://www.newscientist.com/hottopics/tech/article.jsp?id=99993216&sub=Medical accessed 7 May 2003.

26 *New Scientist.com* special report 10:02 24 March 03. "Synapse chip taps into brain chemistry." A microchip that uses chemicals instead of pulses of electricity to stimulate neurons has been created. It could open the way to implants that interact with our nervous system in a far more subtle way than is possible now. Internet http://www.newscientist.com/news/news.jsp?id=ns99993523 accessed 5 Feburary 2003.

27 Ian Sample, *New Scientist.com*. "Self-healing plastic unveiled." Researcher at the Exotic Materials Institute at the University of California in Los Angeles, has developed a material that can mend itself as many times as it's broken. Internet http://www.newscientist.com/hottopics/tech/article.jsp?id=23332800&sub=Extra accessed 30 March 2003.

28 *Nanotech Report—Nano 101*. Published jointly by Forbes Inc. and Angstrom Publishing LLC. Internet www.forbesnanotech.com accessed 18 May 2003.

29 US Army News Release, #R-02-011 March 13, 2002. "Army Teams With Massachusetts Institute of Technology (MIT) To Establish Institute For Soldier Nanotechnology" Internet http://www.dtic.mil/armylink/news/Mar2002/r20020313r-02-011.html accessed 23 July 2002.

30 Nano-satellites of 1 to 10 kilograms are expected to be operational within five to ten years, and furthermore, the US DARPA has already completed trials of miniature satellite swarms in low earth orbit.

31 B.A. Maher, *The Scientist*, News, "NEWS - Closing In on the Malaria Genome," Internet http://www.the-scientist.com/yr2002/mar/maher_p28_020318.html accessed 3 February 2003.

32 Kip P. Nygren, "Emerging Technologies and Exponential Change: Implications for Army Transformation," *Parameters*, US Army War College Quarterly, Summer 2002.

33 *New Scientist.com* special report 09:15 18 January 03. "Recipes for Bioterror: Censoring Science." Several months before 11 September, Australian scientists published a paper describing how they had unintentionally created a "super-virus" that, instead of sterilizing mice as intended, killed every last one. Could this information help someone to create a human super-virus in the same way? Internet http://www.newscientist.com/news/news.jsp?id=ns99993266 accessed 4 February 2003.

34 Recently, this idea of tightly integrated systems and components has been referred to as a "system-of-systems."

35 J.A. Gentry, "Doomed to Fail: America's Blind Faith in Military Technology," *Parameters*, Winter 2002-03, 91.

36 Quantum encryption will potentially be unbreakable. While adversaries will be unable to decipher friendly information, neither will friendly forces be able to decipher that of adversaries, potentially rendering cyber surveillance of little use.

37 See *Self-Organization, Autopsies, and Enterprises* by R. Whitaker, http://www.acm.org/sigois/auto/Main.html, accessed 5 February 2003.

38 http://www.wired.com/wired/archive/11.04/quorum.html?pg=1&topic=&topic_set "bacterial communication"

39 See T. Homer-Dixon, *The Ingenuity Gap*, which looks at how ingenuity can be fostered within governments.

40 K.P. Nygren, "Emerging Technologies and Exponential Change: Implications for Army Transformation," *Parameters*, US Army War College Quarterly, Summer 2002.

41 R.W. Rycroft and D.E. Kash, *The Complexity Challenge: Technological Innovation for the 21st Century* (London: Pinter, 1999).

CHAPTER 3
ALLIED DEVELOPMENTS

*Adherence to dogma has destroyed more armies
and lost more battles and lives than anything else in war.*

Major-General J.F.C. Fuller

INTRODUCTION

Developments in the defence policies of a number of Allies indicate that efforts are currently underway to fashion defence establishments and militaries to address emerging military threats and challenges more effectively. Programmes in the US, the UK, and Australia (AS) are particularly noteworthy.

These nations are generally considered to be at the forefront of military modernization and transformation. As longstanding Allies, they represent likely coalition partners in future military operations involving the Canadian Forces (CF). A survey of the military policies, practices and ongoing programmes of these three nations offers insight not only into their particular attempts to meet future challenges, but also into future policy direction that Canada should consider in charting its own road to security as the 21st century continues to unfold.

UNITED STATES

Background

The defence policy of the US continues to be guided by the 2001 Quadrennial Defence Review (QDR). The 2001 QDR called for the transformation of US forces from their Cold War structure into a more flexible and responsive instrument through which to cope with the threats and challenges of the 21st century.[1]

Recent guidance from US Secretary of Defence, Mr. Donald Rumsfeld, outlines six key goals for the American military: protect the US homeland and defeat weapons of mass destruction (WMD); project and sustain power overseas; deny sanctuary to enemies through the use of new surveillance techniques; provide war fighters with the most advanced information technologies available; protect information systems; and maintain unhindered access to outer space and protect US space assets from attack.

Such guidelines are reinforced in the first comprehensive foreign policy blueprint of the George W. Bush administration—"National Security of the United States of America."[2]   Released in September 2002, the document advances a strategic vision that represents a clear departure from Cold War policies of deterrence and containment. It argues instead for the maintenance of American military pre-eminence and for recourse, when necessary, to unilateral and pre-emptive military action. It postulates that in a post 11 September 2001 (9/11) environment, US military power must be prepared to take a more proactive approach to security.

Not surprisingly, recent years have witnessed considerable effort to maintain a military second to none, yet one that is significantly different from its Cold War predecessor. While it was downsized considerably in the 1990s, it is still indisputably the pre-eminent military in the world. Moreover, the Americans have focused on ensuring that it is fully and increasingly integrated, joint, and that it possesses increasingly greater sustainability, agility, and swiftness than in the past.

Organizationally, this has involved the creation of a Unified Command Plan (UCP) aimed at realigning and streamlining US defence to better address emerging threats. Toward this end, the UCP has delineated geographic responsibilities and missions to commanders and has assigned responsibilities for regional security cooperation and coordination. Specific changes include the establishment of a fifth regional command for North American Continental Defence (NORTHCOM) and the merging of US Space Command (SPACECOM) and US Strategic Command (STRATCOM) to better enable the US to defend against missile attack.

As for the services (environments) themselves, developments are numerous.[3]   Yet, the trend is similarly toward greater flexibility and responsiveness to changing conditions. And, while progress towards stated transformational goals is somewhat uneven, evidence of change is clear.

Navy

The Navy continues to shift away from a blue water fleet toward a strategy emphasizing land warfare and, increasingly, joint operations. Indeed, supporting programmes are underway. The Future Surface Combat programme—an initiative that will feature a multi-mission, highly automated land-attack focused ship capable of significantly reducing manning requirements—has replaced the Land Attack Destroyer programme. The programme also includes a cruiser for missile and air defence missions, and a Littoral Combat Ship (LCS) to engage small enemy boats, submarines, and mines close to shore.

Other major equipment projects include the construction of seven new ships—one SSN-774 attack submarine, three Arleigh Burke class Aegis guided missile destroyers, one San Antonio class landing ship, and two Lewis and Clarke class combat logistics replenishment ships. Conversion of two additional ballistic missile submarines (SSBNs) into guided missile submarines (SSGNs), one Aegis cruiser, and the acquisition of 100 new aircraft, is also planned. Meanwhile, nine aging legacy ships, and fifty different types of systems and aircraft will be eliminated.[4]

The guided missile boats will combine covert conventional strike capability (150 Tomahawk cruise missiles) with the capacity to deploy up to 100 Special Operations Force (SOF) personnel. Meanwhile, the SSN-774 will incorporate new capabilities, including an array of unmanned vehicles and the ability to support special warfare forces. Furthermore, combat logistics replenishment ships—a total of twelve will be delivered by fiscal year (FY) 2009—will assist in maintaining a forward presence. Each can carry approximately 50 tanks and 900 heavy vehicles, and is capable of travel at a speed of twenty-four knots. Other projects include a new aircraft carrier, the CVN-21, and the San Antonio class landing ship, a vessel that can transport 770 Marines as well as their equipment.

Meanwhile, the need to conserve aircraft procurement and increase "jointness" has resulted in a Navy-Marine Corps agreement to combine all F/A-18 Hornet aircraft into a single force. Moreover, there is a planned reduction in the purchase number of F-35 Joint Strike Fighters (JSF) and F/A-18s. Integration of the aircraft used by the two branches will save $975 million through 2009, and the elimination of 497 F/A-18E/F Super Hornets will generate an additional $35 billion in cost savings through 2025.

As for the Marines, emphasis continues to be placed on the development of improved strategic agility, operational reach and tactical flexibility. Toward these ends, the United States Marine Corps (USMC) has implemented the concept of "Expeditionary Maneuver Warfare," and has engaged in a number of modernization efforts aimed at enhancing firepower and deployment capability (e.g. MV Osprey tilt-rotor aircraft, Advanced Amphibious Assault Vehicle, LW155 lightweight howitzer).

Army

Army planners continue to move toward a force characterized by greater responsiveness, lethality, mobility, versatility, and interoperability. Indeed, while the inherent uncertainties of the emerging security environment demand that current forces (e.g. heavy tanks), in some degree, be maintained in the future,[5] the main thrust of the army transformation is to

restructure the bulk of its forces into medium-weight units that are lethal, survivable, and rapidly deployable—with the ultimate goal of creating a fully operational Objective Force (OF) by 2010.

The OF is intended to transform the US Army into an unequalled 21st century land combat force, capable of executing a decisive role in joint and combined military operations across the full spectrum of conflict, and against an expanding range of threats.[6] Designed to contribute to sustained combat power in the form of dominant manoeuvre to future joint operations, the force would be capable of participating in all phases of the joint campaign, in all environments, weather and terrain.

The force would ensure the army's long-term relevance to adaptive, sophisticated threats and to the changing, often unexpected, requirements of both the geopolitical and operational environments. Highly knowledge-based, it would be designed to fully exploit the power of information technology and knowledge-building enhancements—featuring layered multiple information paths and flexible operational procedures (e.g. "system of systems"). And, it would possess enhanced ability for operational manoeuvre through coherent, balanced and self-sufficient fighting forces. The force would feature full dimensional protection, robust and highly improved sustainment, and be capable of simultaneous engagement in operations distributed across the battlefield.[7]

Key capabilities would include: advanced command, control, computers and communications (C4); future combat systems (FCS); integrated intelligence, surveillance and reconnaissance (ISR); RAH-66 Comanche attack / reconnaissance helicopters; and expanded capabilities for manoeuvre and standoff precision fires, robotics, improved methods of reducing sustainment demands (e.g. increased equipment commonality, greater airlift, higher fuel efficiency); and strategic or intra- theatre and fast sea lift means, such as the Theatre Support Vessel or advanced vertical lift.[9]

TENETS OF THE OBJECTIVE FORCE

- **The Future Environment**
- **Full Spectrum Dominance**
- **Knowledge Based**
- **Strategically Responsive**
- **Simultaneous Engagement and Distributed Operations**
- **Force Protection**
- **Force Sustainment**

Figure 3-1[8]

Progress toward the OF vision is increasingly evident. Efforts are currently underway to develop a capability to move an armoured brigade combat team (BCT) of 3,500 soldiers—the basic unit of action (UA) for the force—

anywhere in the world within 96 hours, with additional augmentation up to a warfighting division (the basic unit of employment (UE)), to follow within 120 hours, and up to five divisions within 30 days. The plan involves a de-emphasis of heavy tanks (70-ton M1A Abrams) in favour of the much lighter (19-ton) Stryker interim armoured vehicle (IAV). Two variants of Stryker—a mobile gun system with a 105 mm cannon, and an eleven-soldier troop carrier—will be fielded for this rapidly mobile force.
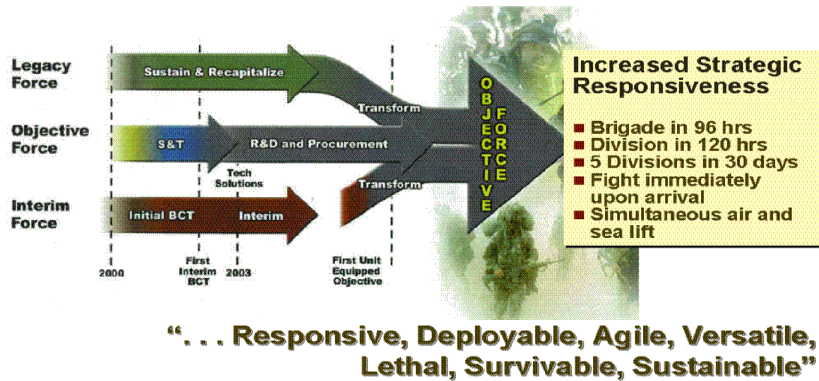
Source: United States. *Trends for the Objective Force Concept Development*, (US TRADOC Publication TRAC-F-TR-02-003, March 2002)

Figure 3-2: The Army vision—TRADOC

Two prototype BCTs with a mandate to deploy in 96 hours are already operational.[10] An Interim Force—which will take advantage of available technology to reconfigure and re-equip brigade-size units to meet the medium-weight goals of greater deployability, survivability and power—will follow. The plan for OF calls for its initial units to be operational by 2008.

Funds earmarked for priority transformation of the Army currently total $22 billion. This includes allocations for precision munitions, sensors and communications, and missiles and air defence. Funds for future weapons systems include: $1.1 billion for the RAH-66 Comanche helicopter; $1 billion for the purchase of 301 Stryker IAVs; and $776 million for the Patriot Advanced Capability (PAC) 3 missile system. Meanwhile, $1.8 billion will be spent in FY 2004 on the Future Combat System (FCS)—an effort that incorporates the latest technologies for mobility, lethality, sensor platforms and survivability.

Air Force

The Air force is also moving toward a more flexible force. Toward this end, planners have developed ten Aerospace Expeditionary Forces (AEFs)—a construct that mixes various types of aircraft in an effort to provide optimum flexibility and effectiveness in a single package. To ensure responsiveness, steps have been taken to ensure that the Air Force is able to deploy an AEF within 48 hours and up to five AEFs in 15 days.

Recent expenditures on weapons systems and platforms include $5.2 billion for the F/A-22 Raptor stealth fighter programme, which will replace the F-15 Eagle. Purchase of 22 Raptors is expected by end 2004. In addition, the F-35 JSF programme will receive $4.4 billion in the 2004 budget, with its initial operating capability planned for 2011.

Efforts to augment strategic lift are being emphasized as well, with an additional $3.7 billion allocated in 2004 for purchase of an additional eleven C-17 Globemaster IIIs. The wide-bodied aircraft will allow transport of outsized and oversized payloads over intercontinental distances without in-flight refuelling.

Other major initiatives include: Space-Based and Transformational Communications programmes; and increased emphasis on the development and deployment of Global Hawk and Predator unmanned aerial vehicle (UAV) programmes—with the sum of $885 million set aside for both.

Moves toward transformation notwithstanding, shortfalls continue to exist in areas such as strategic lift—a necessity for required mobility. Some observe that emphasis on new, modern weapon systems has yet to be matched by corresponding doctrinal and organizational change, particularly in the Army. Fundamental change also remains a distant prospect. Most transformational programmes will not bear fruit for another 10–15 years, and some may eventually prove more costly than expected.

Overall, however, commitment to and evidence of change has increased throughout the American military, particularly since 9/11 and the events that have followed.

UNITED KINGDOM

Background

British defence policy remains based upon the Strategic Defence Review (SDR-98) that called for an extensive, long-term reorganization and

modernization of the armed forces with emphasis on force projection, deployable command and control, sustainability, and joint operations.[11] Since then, the document has been supplemented by a number of annual updates. Nonetheless, conclusions remained fairly consistent with the original review.

However, 9/11 attacks prompted a re-examination of UK defence posture and plans. Issued as a "New Chapter" or addendum to the SDR, the document concluded that while the Armed Forces would continue to have a role in homeland defence against terrorism, their chief role would be to "take the fight to the terrorists, deterring, disrupting, and destroying threats before they reach the UK." It also stressed the need for enhanced deployment capability, and it advanced the concept of network centric capabilities[12] as a key objective for British forces.[13] Such pronouncements are in line with the Defence Ministry's longer-term goal of acquiring an international crisis response capability.

Force structure development continues to focus on extensive force replacement, modernization programmes, improved weapons, and the creation of deployable support units. Moreover, force projection, deployable command and control, sustainability, and joint operations, are emphasized throughout the services.

Navy

Naval programmes reflects a shift away from large-scale maritime warfare and open-ocean operations to littoral warfare and force projection in support of land operations. Toward this end, planners are in the process of enhancing sealift. Construction of two new aircraft carriers under the Future Aircraft Carrier programme is moving forward. In January 2003, BAE Systems was named prime contractor and Thales UK, the "key supplier for ship design." The demonstration and manufacture contract will be signed in 2004.

The vessels will be able to accommodate up to forty aircraft, including combat / strike fighters, airborne early warning aircraft, and anti-submarine helicopters. As such, they will provide a capability to deploy a powerful combat force to potential trouble spots throughout the world.

The ability to apply precision force will be bolstered further by acquisition with satellite-guided Tomahawk cruise missiles for the Royal Navy's nuclear submarine fleet and, possibly, it's warships.

The navy has also taken delivery of the first three of a planned six roll-on / roll-off container vessels. Capable of transporting heavy equipment to any

port, even where sophisticated facilities are unavailable, the ships will significantly increase the Army's rapid deployment capability. Indeed, each vessel can carry 25 main battle tanks and 24 armoured vehicles.[14]

The launching of a new class of Landing Platform Dock (LPD) assault ships will further augment the capacity to deploy. Indeed, they have the capacity to transport about 300 troops as well as equipment, supplies and vehicles, on hostile shores using helicopters and landing craft. They will also be used to coordinate amphibious operations through integrated command, control and communications systems. The vessels will begin to enter service in 2003.

Efforts are also underway to modernize the Maritime Air Component. Toward this end, Sea Harriers have been fitted recently with advanced radar, as well as medium range air-to-air missiles. They are also scheduled for further upgrades to operate short-range air-to-air missiles. A fleet of 44 new Merlin anti-surface warfare helicopters will soon replace 92 Sea King and some Lynx helicopters. Finally, replacement of current maritime patrol aircraft with eighteen upgraded Nimrod 4 aircraft is planned for the period 2004–2008.[15]

Army

Recent developments in the Army have focused on improvements in rapid deployment capability and the restructure of units into more flexible, mobile brigades. In this vein, sustainment capability has been increased through the reorganization of the army's eight regiments into six larger mobile brigades. In addition, armoured regiments are becoming more strategically mobile through the reduction in the number of main battle tanks.

Intentions to replace remaining tanks with a variant of the Future Rapid Effect System (FRES) family of vehicles will result in still greater enhancement of such capability. Indeed, not only will the version chosen incorporate plastic armour and stealth technology, but will also be capable of moving roughly twice as fast as the Challenger 2.[16]

Army digitization is also underway with the award of the $2.4 billion Bowman communication programme to General Dynamics UK. The project aims at linking all British ground forces in a digital command, control and information web. Delivery of approximately 50,000 communications components is expected in 2004. Meanwhile, plans for the demonstration of a state-of-the-art battlefield information system are in progress.

Delivery of 67 WAH-64 Mk1 Apache attack helicopters is underway, a move that could result in re-assignment of 125 Lynx helicopters to command and

control, reconnaissance, and utility functions. Upgrades to Lynx, including provision of a new avionics suite, an advanced self-protection system and a more powerful engine, are anticipated in the near future.

Other programmes aim to improve battlefield surveillance through the acquisition of an electronic support measures system, and to concentrate operational UAVs into a single regiment. The army is also moving towards acquiring simulator-training equipment for dismounted close combat under its Future Integrated Soldier Technology (FIST) programme. Approval is scheduled for September 2006, with a contract for approximately 30,000 sets valued at £500 million to follow.[17]

Air Force

The Royal Air Force (RAF) is currently contemplating its strike capability requirements under the Future Offensive Air System Project (FOAS). In light of the changing security environment, planners are aiming toward a "mix" of weapons systems, including manned fighters, unmanned combat air vehicles, and conventional air and sea-launched cruise missiles linked by a sophisticated command and control network.

The planned acquisition of 150 JSFs by the air force and the navy, slotted to begin in 2012, will address a large portion of FOAS needs.[18] In the interim, however, long-range strike capabilities will be bolstered by the delivery of Storm Shadow cruise missiles, and their use with the Tornado GR4 bomber fleet—a platform which itself is undergoing upgrades to accommodate a precision-guided missile capability. Programmes to enhance aircraft reconnaissance are also underway, with installation of new reconnaissance pods for the Tornado and Jaguar aircraft to be completed by the end of 2003.

Finally, strategic lift capabilities have been augmented by the recent delivery of four Globemaster III aircraft. Discussion on the acquisition of up to seven more C-17s is underway.

Central to the government's overall defence strategy has been the creation of a Joint Rapid Reaction Force. Up and running since 2001, this pool of versatile and powerful units drawn from the three services will become fully operational in 2003. It will be complemented by: Joint Helicopter Command (under Land Command); Joint Force Harrier Command (under RAF Strike Command); the JDCC; a Joint NBC regiment; and a Joint Force Headquarters, able to command two small-scale operations in theatre. The Chief of Joint Operations at the Permanent Joint Headquarters has assumed responsibility for joint training.

In addition, the armed forces have established a Defence Logistics Organization that brings together the three single-service logistics chains.

In sum, similar to the other Allies, the commitments described above have been accompanied by calls for increases to the overall defence budget. In fact, funding is planned to increase an average of three percent annually from 2003 to 2006. Additionally, a new Defence White paper is scheduled for release in late 2003.

AUSTRALIA

Background

The December 2000 White Paper entitled *Defence 2000: Our Future Defence* noted a significant deterioration in Australia's strategic environment. Developments in Indonesia, East Timor and the Southwest Pacific represented an arc of growing instability, and rising nationalism. Expanding military capabilities within a number of regional states exacerbated this situation. These realities, compounded by proliferation issues, all indicated a need for action.

Accordingly, the White Paper outlined five strategic objectives for Australia's security: to defend Australia and its direct approaches; to foster security of the country's immediate region in the Southwest Pacific; to work with the Association of South-east Asian Nations (ASEAN) member states to promote stability and cooperation in South East Asia; to contribute more generally to the maintenance of stability in the Asia Pacific area; and to support efforts of the international community to uphold global security.[19]

The events on, and following 9/11, including the October 2002 terrorist bombings in Bali, have heightened Australia's threat perceptions. According to the government's February 2003 Defence Update,[20] the strategic environment is in fact being shaped by the twin global threats of terrorism and the proliferation of WMD, threats from which Australia's geographic isolation offers little protection. As such, Australian Defence Forces (ADF) will likely be involved in coalition operations further projected than in the past. Such realities have resulted in movement of the ADF toward a more joint, integrated and a more "expeditionary" force structure—a trend reflected in recent modernization and acquisition projects.

The establishment of Special Operations Command in December 2002, and its ongoing expansion, is noteworthy. This joint command is responsible for counterterrorism operations, as well as surveillance and reconnaissance roles traditionally associated with special forces. Currently, the Special Air Service (SAS) regiment and the Sydney-based 4th Battalion Royal Australian

Regiment (RAR) are being expanded to provide a tactical assault group in eastern Australia. A combat service support team—focusing on counterterrorism operations at home—is also being formed out of the battalion. Meanwhile, 4 RAR is receiving dedicated funding for training, weapons and other specialized equipment. In addition, a dedicated squadron of troop-lift helicopters will be made available to the battalion to expand the army's helicopter transport capabilities.

Navy

The Royal Australian Navy (RAN) continues to balance between the retention of capabilities suited to open-ocean warfare and those needed to engage more fully in littoral operations. Accordingly, recent years have seen efforts to upgrade in both areas.

In the former case, the RAN is fully upgrading its Collins-Class submarines; with recent efforts focused on the provision of better acoustic performance, and a new combat system. Intentions are to fit the submarines with heavyweight torpedoes by 2006. As for the latter, plans are afoot to replace the Navy's three amphibious ships between 2010 and 2015, as well as its fleet of heavy landing craft. Indications are that naval planners are presently considering significantly larger amphibious ships (e.g. helicopter dock landing ships) capable of deploying in excess of twelve helicopters each. Programmes are supported by a general commitment to increases in defence spending on the order of three percent per annum in real terms over the next decade.

Whether such movement can be maintained over the longer term is less clear, particularly in light of the fact that the tempo of international operations is likely to remain high in the foreseeable future. Furthermore, it should be noted that historically no Australian government has successfully sustained long-standing increases in defence spending. That said, current commitments to transformational objectives and programmes geared to their realization appear strong.

Army

The Australian Army has emphasized the development of a professional, well-trained and equipped force capable of rapid deployment and sustainment over extended periods. Forces are organized in three brigades, each consisting of two infantry battalions and a range of combat and combat support units. A large proportion of the personnel are held at 30 days notice to move. The key goal is to establish and maintain the capability to sustain a brigade on operations for an extended period, while at the same time, preparing and deploying a battalion group elsewhere.

Ongoing modernization efforts continue to emphasize firepower, protection and mobility. Equipment acquisitions include the order of approximately 300 Bushmaster infantry mobility vehicles, as well as augmentation of its current fleet of 111 LAVs by an additional 150 ASLAV (LAV 25). Twenty new ASLAV-mounted 120 mm mortar systems are planned for acquisition by 2006. In addition, 350 Armoured Operational Carriers are now receiving major upgrades. And, the first of 22 ("Aussie") Tiger armed reconnaissance helicopters are scheduled to be in-service by December 2004.

Efforts to augment airlift capability are also underway. The Minister for Defence ordered the acceleration of the programme to purchase a fleet of troop-airlift helicopters as soon as possible. Current plans call for 12 maritime helicopters to bolster the army's amphibious and counterterrorism capabilities. Army planners also hope to gain funding approval for the acquisition of a family of tactical UAVs to provide airborne surveillance and reconnaissance for brigade-size formations.

Air Force

RAAF (Royal Australian Air Force) planners continue to emphasize a combination of combat and precision-strike capabilities with aircraft, presently performing these missions, to receive upgrades. This includes the F/A-18A/B Hornet (air-combat) and the F-111C/G Aardvark (strike) aircrafts. All F/A-18s will receive new radars, advanced medium-range air-to-air missiles (AMRAAM) and airframe improvements beginning in 2004 with a termination date of 2007. The F-111s are scheduled to receive further additional electronic warfare self-protection systems, as well as new types of long-range standoff weapons.

Replacement of current systems was scheduled to commence in 2012; however, the June 2002 decision to join the development phase of the JSF programme is clear indication that the F-35 is the most likely aircraft to replace current systems.

Airlift capacity has also been strengthened with the delivery of twelve C-130J-30 Hercules transport aircraft, and serious consideration is being given to enhance heavy strategic lift capability (e.g. C-17 Globemaster III, or Airbus A400M). As for surveillance, upgrades to Australia's fleet of 19 P-3C Orion maritime patrol aircraft and its three electronic intelligence specialist P-3s is continuing, to include new sensors and lightweight torpedoes. The government has also announced plans to acquire four Global Hawk long-range surveillance UAVs later in the decade.

Beyond this, the government has signed a contract for the acquisition of four Boeing 737-300 airborne early warning and control (AEW&C) aircraft with an option for another three later in the decade. The move represents a key

step in overall efforts to deliver a viable and integrated command, control, communications, and intelligence (C3I) capability to the ADF for operations in the future battlespace.

CONCLUSION

Notwithstanding variations in the specific developments in each of the three countries examined, efforts to significantly upgrade existing military capabilities are evident throughout. Indeed, virtually all have reversed the spending cuts that characterized the early post Cold War period in favour of renewed commitments to military reform and modernization.

These commitments generally involve greater emphasis on the enhancement of force projection capabilities relevant for undertaking multinational missions ranging from peace support operations to war. Moreover, each nation's defence establishment consistently cites qualities, such as deployability, flexibility, interoperability, and jointness as the characteristics essential to future military effectiveness.

The overall result is a steady shift toward smaller defence establishments and lighter organizational structures, as well as lighter, more deployable and interoperable units, modern standardized equipment, enhanced communications and data systems, precision-guided munitions, and increased emphasis on strategic lift.

ENDNOTES TO CHAPTER 3

1 U.S. Department of Defense, *Quadrennial Defense Review*, (QDR, 2001), available at http://www.defenselink.mil/pubs/qdr2001.pdf.

2 See, The White House, *National Security Strategy of the United States of America*. (Washington, DC: September, 2002) available at http://www.whitehouse.gov.nsc.html.

3 Developments discussed in this annex focus on conventional as opposed to nuclear forces. Discussion of recent developments on the nuclear front can be found in John Bryson, ed., *Western Defence Policies, Budgets, Force Structures and Procurements: A Project Report 2003/04*. (Ottawa: Directorate of Strategic Analysis, Policy Planning Division; April 2003), and International Institute of Strategic Studies, T*he Military Balance 2002-2003*. (London: Oxford University Press, 2002).

4 John Bryson, ed., *Western Defence Policies, Budgets, Force Structures and Procurements: A Project Report 2003/04*. (Ottawa: Directorate of Strategic Analysis, Policy Planning Division, April 2003), 11.

5 As such, current forces, such as the M1A Abrams Tank fleet and the M2/3 Bradley Fighting Vehicles will undergo some modernization and re-capitalization.

6 Louis G. Bornman Jr., Michael C. Ingram and Saundra K. McLarney, *Trends for Objective Force Concept Development* (Fort Leavenworth, Kansas: TRADOC Analysis Center, 2002), B-6.

7 Ibid., B7-B11.

8 Ibid., B6.

9 Other projects currently underway include: the M109A6 Paladin and Excalibur precision-guided extended range munitions; the XM777 lightweight towed howitzer; the High Mobility Artillery Rocket System; the Future Combat Systems non-line of sight platform; a NATO-standard integrated fuze to improve the precision of artillery munitions; and a Guided Multiple-Launch Rocket System.

10 The Brigades are designed to provide an early combat force as part of a coalition force, or alone, capable of operating in urban and complex terrain where weak logistical and transportation infrastructure exists. BCTs are not intended to take over forced entry missions (which will remain purview of airborne, light infantry and special operations forces).

11 Ministry of Defence, *Strategic Defence Review* (London: Ministry of Defence, July, 1998), available at http://www.mod.uk/issues/sdr/wp/contents_htm.

12 As defined in the New Chapter, a network-centric capability is an intelligence, communications and response link-up that under the slogan "detect, decide, destroy" would provide a real-time, comprehensive view of potential targets. As reported in John Bryson (ed.), *Western Defence Policies, Budgets, Force Structures and Procurements: A Project Report 2003/04* (Ottawa: Directorate of Strategic Analysis, Policy Planning Division, April 2003), 90.

13 Ministry of Defence, *The Strategic Defence Review: A New Chapter* (London: Ministry of Defence, July 2002), available at http://www.mod.uk/issues/sdr/newchapter.htm

14 See Elinor C. Sloan, *The Revolution in Military Affairs: Implications for Canada and NATO* (Montreal and Kingston: McGill-Queens University Press, 2002), 59.

15 John Bryson, ed., "Western Defence Policies, Budgets, Force Structures and Procurements: A Project Report 2003/04," 96.

16 Elinor Sloan, *The Revolution in Military Affairs*, 52

17 As reported Bryson, 94.

18 In fact, such plans have raised doubts concerning the need for a replacement for the Tornado bomber. Reported in Bryson, 97.

19 See, Department of Defence, *Defence 2000: Our Future Defence Force* (Canberra: Defence Publishing Service, 2000).

20 Department of Defence, *Australia's National Security: A Defence Update* (Canberra: Defence Publishing Service, 2003), available at http://www.defence.gov.au/ans2003/htm

CHAPTER 4
THE FUTURE BATTLESPACE

*We have to put aside the comfortable ways
of thinking and planning, take risks and try new things
so that we can "prepare our forces to deter and
defeat adversaries that have not yet emerged to challenge us.*

Donald Rumsfeld, US Secretary of Defense[1]

BACKGROUND

The military institution is perpetually criticized for preparing to fight the last war. In many ways this is understandable. Undoubtedly, some of this is a function of its conservative manner and abhorrence to change; however, there is also a certain degree of comfort, if not logic, in maintaining or emulating doctrine, equipment, and tactics, techniques and procedures (TTPs) that have proven successful in the realm of combat or operations. Conversely, to change, evolve or leap to new concepts, methods or technologies, involves an enormous degree of risk, particularly in a field where failure carries such cataclysmic consequences.[2] After all, "if the vision and the concepts are wrong," warned Major-General Robert Scales, "adding resources simply compounds the error."[3]

Nevertheless, few if any competent military or political decision makers would argue that the status quo is acceptable. In the wake of the Cold War, the vacuum that was created has been filled with instability, conflict, and seemingly continual change. The Canadian Army, like its allied counterparts throughout the world, must evolve if it is to remain a relevant institution.

But, to what end? What will be the future battlespace? To say that militaries must be prepared for full spectrum conflict may be accurate, but it is hardly helpful. Likewise, to attempt a definitive description would also be foolhardy. "Today's world is without precedent," cautioned French military analyst Phillippe Delmas, "it is as different from the Cold War as it is from the Middle Ages so the past offers no basis for comparison."[4] Clearly, there is no crystal ball. As quickly as belligerents develop determinate methods of fighting, their opponents create a countermeasure. It is important for commanders and strategists to always remember that potential antagonists are equally clever and constantly strive to find a weakness to exploit. And,

as the 11 September 2001 (9/11) terrorist attacks in New York and Washington so clearly indicated, the successful attack will be the one that no-one thought possible.

Figure 4-1: Spectrum of conflict
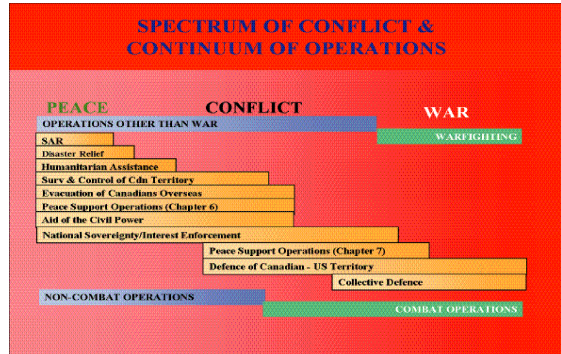
Therefore, although impractical to describe a given scenario with precision and detail, it is possible to paint a description of likely characteristics that will shape the future battlespace and our ability to operate within it.[5] By understanding current trends and the possibilities that the future may hold, political and military decision makers will be able to choose the appropriate path that will allow desired outcomes to be realized, and conversely, prevent those undesired possibilities from effecting our national security. Moreover, a comprehension of the likely attributes of the future battlespace will allow commanders, planners, and scientists to develop the necessary doctrine, training regimes, and equipments to assist the Army, specifically its soldiers, to prepare themselves to meet the challenges of the next millennium.

INCREASED COMPLEXITY

To state that the battlespace of the future, that is to say the realm (i.e. land, air, sea, space and electromagnetic spectrum) where armed conflict will be conducted within its entirety (i.e. within its cultural, economic, ecological, environmental, political, social and technological context), will be dramatically different from that of today is to repeat the strikingly obvious. "Future war," prophesied Former US Marine Corps (USMC) Commandant General Charles Krulak, "is most likely not the son of Desert Storm; rather it will be the stepchild of Somalia and Chechnya."[6]

Undeniably, it will be increasingly complex. Gone is the reassurance and safety of a well-known, predictable and easily templated enemy. The elaborate battle and contingency plans for the defence of Europe and the Western world are now largely irrelevant. So too are the doctrine and training programmes designed to combat the symmetrical Warsaw Pact

forces. Canada and its allies have been plunged into a chaotic and turbulent new era that is more ambiguous, uncertain and volatile.

The battlespace is similarly predisposed. Its complexity will increase exponentially due to such factors as the asymmetric nature of the threat, the antagonists' choice of urban terrain, blurred operations, the dimensional expansion of the battlespace, the technological / humanistic interface, and the challenge of real-time media coverage.

The Asymmetric Threat

The asymmetric nature of future conflict will have a dramatic effect on how we fight. "Asymmetry," according to American strategist Steven Metz, "is acting, organizing, and thinking differently than opponents in order to maximize one's own advantages, exploit an opponent's weaknesses, attain the initiative, or gain greater freedom of action." He adds that "It can entail different methods, technologies, values, organizations, time perspectives, or some combination of these … [and it] can have both psychological and physical dimensions."[7] Doctrinally, an asymmetric threat is a concept "used to describe attempts to circumvent or undermine an opponent's strengths while exploiting his weaknesses, using methods that differ significantly from the opponent's usual mode of operations."[8]

At its core, asymmetry is not designed to win battlespace victories. Rather, its aim is to disrupt, distract and disconnect—in short, to weaken a normally superior opponent. "Difficult to respond to in a discriminate and proportionate manner," explained strategist Colin Gray, "it is of the nature of asymmetric threats that they are apt to pose a level of response dilemma to the victim. The military response readily available tends to be unduly heavy-handed, if not plainly irrelevant, while the policy hunt for the carefully measured and precisely targeted reply all too easily can be ensnared in a lengthy political process which inhibits any real action."[9]

Gray also points out that the asymmetric threat makes coercive threats less credible and even poses difficulties in going to war, as was recently demonstrated in the war against terrorism and with the lack of international support for the American war against Iraq. Moreover, asymmetric threats make the achievement of operational and tactical goals difficult. As Gray pondered, what defines success? Displacing Osama Bin Laden? Ousting Saddam Hussein? Furthermore, it is not enough for responses "to asymmetric threats to be effective; in addition, they must be politically and morally tolerable."[10]

Herein lies the difficulty for the practitioner. Commanders will be required to operate in, and be comfortable with, ambiguous and

uncertain surroundings. Their options for the type of, if not the use of, force will often be restricted. Moreover, of necessity, they will require the capability of adapting physically and theoretically to changes not only in their immediate operational area, but also in the larger international security environment. It will demand that individuals, units and formations be agile, flexible, and capable of responding to the unforeseen and expected.

Complexity will emanate from the nature of the enemy that is spawned by asymmetric warfare and the evolving Western way of war. As military superiority increases so too does the resiliency of the opponents. The enemy will work increasingly in complex networks composed of small organizations made from a number of dispersed individuals that communicate, coordinate, and conduct campaigns in a networked manner. These associations will be diverse, robust and redundant, thus, making it difficult to bring superior effects to bear. There will be multiple nodes, most likely with no centralized command to attack. Therefore, the question arises how do you defeat it?[11]

As well, state and non-state actors will increasingly have access to advanced communication and weapons technology that will make them more effective, by giving them global reach for planning, staging and striking. It will also provide opponents with a means to interfere with friendly communications, command and control networks. Central to future operations in the battlespace will be the threat of "cyber-shock" that can inflict paralysis, annihilation and exhaustion on a belligerent's network, with the net result of total destruction of his ability to maintain a coherent command and control ability.[12] The Assistant Deputy Minister, Office of Critical Infrastructure Protection and Emergency Preparedness for Canada's Department of National Defence (DND), reported that malicious attacks on systems and networks increased by 430 percent from 1999 to 2000, and will probably increase by another 525 percent by 2001.[13] In 1995, the US Department of Defense experienced approximately 250,000 attacks.[14] During the crisis in Kosovo in 1999, Yugoslavian President Slobodan Milosevic organized a systematic "ping bombardment" of the North Atlantic treaty Organization (NATO) server that went on for ten days and totally incapacitated it with a virus.[15] Finally, during the first week of conflict in Iraq in 2003, over 20,000 website attacks were recorded on pro and anti-Iraqi war sites alone, in many cases rendering it impossible for sites to re-establish themselves due to repeated attacks.[16]

Complex Terrain

Complexity will also derive from the terrain on which an opponent will choose to do battle.[17]   Once again, the element of asymmetry and the enemy's desire to avoid the superior firepower, organizational and technological advantages of the US and its allies, will drive them to seek means of levelling the playing field. One obvious method will be to operate in an environment that negates the Western technological advantage— namely urban centres.

Figure 4-2: Future soldier in urban terrain

Consistent through history, and without near-term relief, cities have and will continue to pose a Herculean challenge for armies. The compression of space and proximity of belligerents, as well as non-combatants, shapes the environment. Small, distributed targets, primarily people, are densely located in a high clutter, masked environment. The design of cities with their abundance of varied infrastructure limit and restrict current military capabilities, such as stealth, mobility, command and control (C2), intelligence, surveillance, target acquisition and reconnaissance (ISTAR), and global positioning system (GPS) navigation and target designation. Moreover, fighting in built-up areas is not a traditional core competency of the army. This is further exacerbated by the inability, due to failure to train and practice, of soldiers and commanders to think in a three dimensional manner.

These challenges and limitations provide a levelling effect. In addition, cities also provide physical cover for the enemy. As noted, an urban centre by its very nature tends to neutralize technology, especially long-range weapons. As a result, it relegates action to close combat— normally a very slow, resource and casualty intensive process. Moreover, the clutter and dense nature of cities allows for maximum innovativeness of camouflage, concealment, deception, and surprise strikes. The most recent conflict, Iraq in 2003, demonstrated that an opponent will hide combatants, equipment and weapons in churches, community centres, hospitals and schools, as well as shedding uniforms and deploying soldiers in civilian dress mixed in with the population in an attempt to achieve success. One unofficial after action report

revealed the enemy to be: "Smart, flexible. Utilizing all means at their disposal. They have moved ammo in civilian trucks, held weapons to their own people's heads, and pretended to be doctors with asthmatic children. Pretend to surrender then open fire."[18]   Not surprisingly, two Chinese strategists have warned: "There is no means which cannot be used in war [in the future] and there is no territory or method which can not be used in combination."[19]

This movement to unrestricted warfare on the part of some antagonists severely increases the complexity for commanders and their soldiers. Regardless of the heinous nature of the circumstances that caused the conflict, or the moral bankruptcy of the organizations fighting it, the militaries of western industrialized democracies will be expected to uphold the principles and values that are fundamental to their societies. Future pressures due to the political context and constraints, such as societal tolerance to friendly casualties, timelines, collateral damage, and demand for increasing precision engagements, will make fighting exponentially more complex in the future.[20]   When military force is authorized, the resultant action should be executed with minimal risk, ensuring the slightest number of casualties and collateral damage, and be accomplished in the quickest possible timeframe.

Therein lies an inherent paradox. Commanders are often left with the quandary of using sufficient force to win, but risking criticism if there is excessive death and destruction (e.g. 2003 war against Iraq when the media consistently stressed imagery of wounded Iraqi civilians despite American restraint); or using too little force and risking failure, or at a minimum, becoming the target of criticism for a stalled, ineffectual strategy, campaign and / or performance (e.g. initial stages of the Kosovo, Afghanistan and Iraq campaigns in 1999, 2001, 2003 respectively).

This realization provides opponents with another valuable reason to use urban settings—political cover. The risk of heavy casualties, specifically civilians; the danger of collateral damage; and the likelihood of a subsequent humanitarian crisis in the aftermath of a prolonged struggle in an urban area, compounded by the scrutiny of the media, assist in levelling the battlefield, and, in some ways, provides an advantage to the enemy. Consequently, political constraints (e.g. restrictive rules of engagement (ROE)), compounded by obligations to invest heavily in humanitarian efforts, or at times, public affairs efforts to counterbalance adverse press, can potentially distract from the primary mission and sap momentum. It will also have the effect of prolonging the conflict, which to an impatient public is untenable.

Media Scrutiny and the Reality of the Strategic Corporal

Due to such enumerated issues as those cited above, leaders and their subordinates will operate in a politically sensitive environment where the actions of a soldier at a roadblock, or in any tactical setting, can have strategic ramifications. Operating in a context that is under the constant glare of the news camera will exacerbate the complexity faced by leaders and their subordinates. "The Power of CNN" is no longer an idle network boast. The CNN effect of instantaneous worldwide imaging will exponentially magnify the concept of the "strategic corporal" where a tactical decision / error can become a strategic issue as it is beamed across the globe in real-time. In fact, it may greatly add to the volatility of the political security environment. In this regard, the media's global connectivity and instant reporting can create unwarranted threats based upon viewers' reaction (and generated perceived beliefs) to news reports (e.g. collateral damage, unjust military action). A recent example was the USMC soldier who, upon clearing a stronghold in Iraq, raised the American flag. Although lowered almost immediately, the fleeting image of that action unleashed a barrage of controversy and debate in that the act portrayed America as an occupying power instead of a liberating force. "A wrong decision in the glare of the media," warns Colonel Paul Maillet, a former DND Director of Defence Ethics, "can have far reaching consequences that can affect peacekeeping mandates and strategic and national policies and aims."[21]

The CNN effect also feeds what has become an unrealistic impatience by both the public and the media. War, arguably the most multifarious of human endeavours, even when conducted in some of the most distant and hostile environments known, is expected by restless media and their audience to be completed within days, at best weeks. In a medium where only 90–100 seconds are allocated per issue on an average news story and where the concept "if it bleeds it leads" exists, there is a need for news to be dramatic, if not sensational. This has inordinate potential to cause consequential problems for the military. News reports can be fleeting and without context. "Television as a medium has no past and no future," explained NATO spokesman Jamie Shea, "It is always the eternal present. What BBC's [British Broadcasting Corporation] Nik Gowing has called the 'tyranny of real-time,' with no causality, no connection to what came before or what goes next. So everything is immediately important and a few moments later completely unimportant, contrary to our experience of real life."[22]

A single act can become the defining image of a battle, campaign or operation. Failure or errors on any scale carries the potential of being catastrophic. Recent examples have shown that shocking images of combat

can sway public opinion in an open democratic society and create intense political pressure to cease hostilities.[23]

And, there will be no respite. In Bosnia in 1995, there were 3000 journalists on the ground throughout the NATO air campaign. "They were faster than NATO soldiers or NATO satellites," conceded Shea, "Certainly faster than our intelligence community."[24] For example, the infamous tractor-bombing incident caused NATO to lose public support in Germany by 20 percentage points after images were transmitted over the world.[25] In the recent 2003 war against Iraq, there were 700 embedded reporters within the coalition, as well as thousands of others covering the conflict from the battlefields and other strategic locations throughout the globe.[26] This has led to a universally accepted popular notion that "it isn't real unless it's on television." To conduct operations in such an environment magnifies the complexity of an already complicated profession.

Information Operations

As a result, operations in the future battlespace at all levels will be more dependent on information operations (info ops), which include computer network attack (CNA), efforts to counter propaganda, deception, electronic warfare (EW), destruction of enemy info ops targets, security of friendly information and infrastructure, as well as related activities such as civil-military cooperation (CIMIC) and public affairs (PAff). One immediate requirement will be the need to disseminate information quickly to military personnel and the civilian population within the theatre of operations, as well as the domestic and international audience. This will entail the swift devolution of information; that is, tactical operators will need to explain events at the scene. This carries a degree of risk and adds to the complexity of the task. However, a RAND (an independent, non-profit research institution, whose name is a contraction of the term research and development) study concluded, "the marginal return from leveraging an information factor—such as the media—may be greater than the marginal return of applying more firepower."[27] In the end, time becomes the critical factor—often the centre of gravity.

This will have dramatic implications on those conducting operations. Firstly, it will require a greater concentration on info ops and a comprehension of the people / cultures of the theatre of operations. It will also necessitate great effort to counter propaganda and informing the media, affected population, domestic audience, and the international community of the "proper and righteous" manner in which operations are being conducted.

Blurred Operations

The constant media scrutiny and instantaneous global coverage of events as they happen in real-time will further blur operations. It will no longer be plausible in fact to conduct branches or sequels choreographed following a carefully laid out schedule. Public indignation and consequential political pressure emanating from negative images portraying humanitarian crises will compel concurrent and parallel operations. Best described by former USMC Commandant, General Charles Krulak as the "three block war," soldiers will be expected to provide humanitarian assistance in part of the city, conduct peacekeeping operations in another, and fight a lethal mid-intensity battle in a third part of the urban setting.[28] During Operation Iraqi Freedom, Lieutenant-Colonel William Wallace revealed "One day our troops are kicking down doors, and the next they're passing out band-aids." He added, "In some cases, they're kicking down doors without really knowing if they are going to have to pull a trigger or pass out a band-aid on the other side."[29] In the end, victory will not be assured just because the shooting stops. Winning the peace, as has been popularly coined, will become essential.

This reality, as well as the proclivity of opponents to use civilian infrastructure and populations to shield their actions, will result in a larger use of, if not reliance on, non-lethal weapons (NLW) to allow friendly forces to conduct missions safely without inflicting large amounts of civilian casualties or collateral damage. By incapacitating large crowds or physical areas, soldiers can attempt to identify potential foes from "friendlies" or neutrals without putting themselves or others at greater risk. Although increasingly complex, the alternatives become untenable.

As a result, commanders and soldiers will be expected to transition quickly from warfighting to peace support, to humanitarian or aid to the civil power operations, or any combination thereof. They will be expected to conduct complex and dangerous combat in urban settings against a wily, elusive enemy. This will require excellent tactical skills such as marksmanship, house clearing and demolitions; yet one moment later, softer expertise such as negotiation, mediation and assistance to civilian authorities. Each is diametrically opposed, demanding a totally different suite of skills and ability. In essence, the complex new battlespace will require that soldiers become warrior diplomats.

The implication for the warrior of the future battlespace is simple; to be a highly trained combat soldier is not enough. The traditional emphasis on training—"a predictable response to a predictable situation"—will have to be better balanced with education, defined by Professor Ron Haycock as the "reasoned response to an unpredictable situation—critical thinking in the face of the unknown."[30] To operate in this multi-faceted environment,

soldiers will also have to be highly educated. "Time dedicated to understanding the higher orders of conflict inculcates mental agility and the ability to be creative as well as technically competent," explains Major-General Scales. "A well-read and educated leader," he adds, "will be better prepared to deal with the uncertainty and chaos of combat."[31] Decentralized decision-making power, and enlightened low-level leaders capable of making reasoned, timely decisions under pressure, will determine success or failure.

EXPANDED BATTLESPACE

The expanded nature of operations will be another characteristic of the future battlespace. Operations will be conducted simultaneously, with direct effect on all participants, on land, sea, air, and space, as well as in the electromagnetic domain. Moreover, operations will be non-contiguous and non-linear. That is to say, operations will be distributed throughout the entire battlespace without the historical linear approach where the frontages and flanks of opposing forces delineated the actual battlefield, and where boundaries, report lines and axis of advance defined the scope of manoeuvre of a commander, unit or formation.

Continual technological advancements will enable land forces to manoeuvre, acquire and engage targets at greater ranges, faster and with more precise effects than ever before. The ability to identify targets, accurately assess their capabilities, and mass effects to engage them in a timely manner will drive force structure towards smaller, more agile, networked units, with a smaller logistical footprint, capable of greater lethality, and dispersal over larger distances. This diffusion of force, protected through connectivity to real-time information and effects, rather than the historical emphasis on mass and firepower, will allow for simultaneity of operations throughout the battlespace. This will deprive an opponent of any respite as their physical forces, infrastructure, command and control, as well as their psychological resiliency (i.e. morale and will) are disrupted, displaced and destroyed.

This will lead to a battlespace with numerous parallel and simultaneous operations, spanning the entire spectrum of conflict, being conducted by diverse, yet interconnected and interdependent forces, dispersed throughout a battlespace that is less dense and with no defined boundaries. Manoeuvre, tied to situational awareness (SA) and access to lethal effects, will become dominant. The size of forces will become less relevant. However, their ability to access precision effects and provide accurate target designation will be essential. In the future, precision will be another key to operational and strategic success.
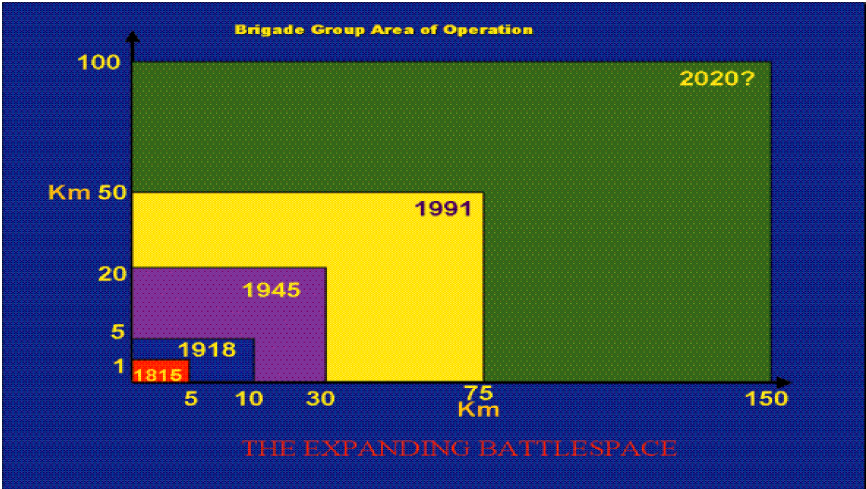
Figure 4-3: Expanded battlespace

Higher commanders will be required to deal with wide-scale dispersion and the challenge of span of control. Real-time threat assessments, realistic tasks, and the precise allocation of effects and sustainment, will require careful management and control. Lower commanders will increasingly find themselves with seemingly independent commands at great distances from friendly forces. They will progressively rely on agility, speed, manoeuvre, and accurate and timely information and massed effects coordinated through connectivity, to avoid defeat.
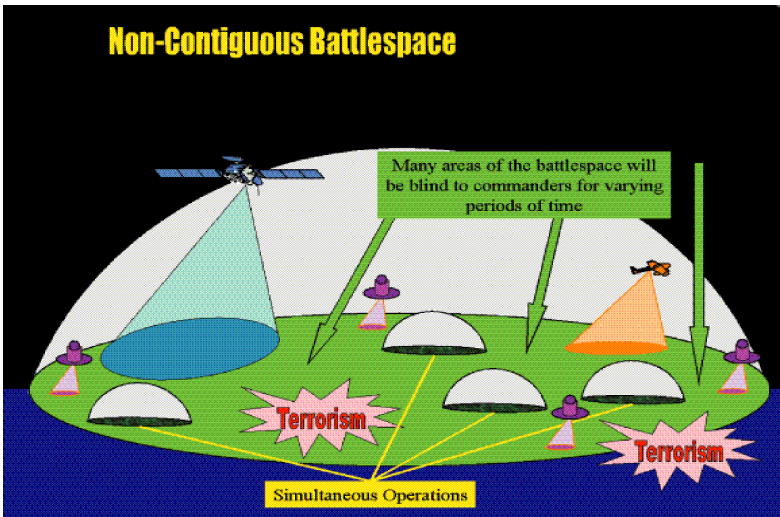
Figure 4-4: Non-contiguous battlespace

INCREASED CONTINUAL HIGH TEMPO OF OPERATIONS

Another characteristic of the future battlespace will be the continuous battle. Technological advancements such as all-condition, all-weather, day / night vision enhancement will permit non-stop operations. This will allow the concept of tempo to be used as a deliberate tactic; that is, the sustenance of an intensity of operations with which the enemy cannot cope. Single spikes in intensity rarely break the will of an opponent. Rather, a consistent, concentrated, simultaneous effort is required over an extended period of time. By endlessly overwhelming the enemy's decision cycle, its ability to react and offer coherent resistance will be diminished.

Tempo will also be augmented as a result of the compression of time from "sensor to shooter" and the ability to influence the entire battlespace. Technology will enable advances in early and distant detection of enemy forces. The desire, combined with the ability, to destroy enemy forces before they disperse, disappear or engage friendly forces, as well as the need to maintain constant unrelenting pressure on the enemy to ensure the quickest possible successful outcome, will drive belligerents to conduct non-stop persistent operations until one side is exhausted and / or destroyed.

In addition, the political pressure for rapid resolution will also drive a relentless tempo. The cost of war to modern societies is such that leaders will hesitate to engage in military campaigns unless the result can be quick and decisive. This will become more so with globalization as the world becomes more economically integrated. Furthermore, as already discussed, the public, fed by an insatiable implacable media, will compel governmental decision-makers, as well as military commanders, to push for instant results.

ENHANCED LETHALITY

Yet another characteristic of the future battlespace will be its increased lethality. Technological advancements will continue to enhance the range and precision of weapon and target acquisition systems. As the sense and act operational functions become more advanced, survival within the battlespace will become progressively more difficult. Dispersion, rapid mobility, stealth, quick response and force protection will be primordial, as long-range precision engagements by a myriad of weapon systems (e.g. kinetic, laser, sound, light, pulse) become the norm. The future battlespace will focus on simultaneous attack by interdependent air-ground-sea-space forces that have situational awareness; that is, have a current and accurate view of the battlespace via computer and satellite. These forces will be networked from "sensor to shooter" (i.e. surveillance systems are electronically connected to all effects (strike) platforms), which will ensure the capability for swift, massed effects.

Clearly, a key to success will be timely intelligence, coupled with flexible, swift and lethal military response. The technology is already proving both capable and lethal. For example, During Operation Enduring Freedom in 2001, key terrorist commanders were killed by an unmanned remotely controlled Predator drone, armed with hellfire missiles, while they were travelling in a secluded area. Less than two years later, an American B2 Bomber hit a building in a residential area, believed to house Iraqi strongman Saddam Hussein, with a precision bomb within 45 minutes of receiving the information. Increasingly, the premise "if you are seen you are dead" will prevail.

However, the proliferation of inexpensive weapons and information technology will also permit antagonists to establish a lethal capability relatively easily and cheaply. To counter this threat, smaller, agile units must be capable of controlling ever-expanding areas and have access to accurate timely targeting data and precision effects; of necessity, they will need to be dispersed, highly mobile and robust to avoid and withstand enemy precision effects.

WAR	TARGET RANGE (enemy tank)	NUMBER OF ROUNDS FOR A KILL
WWII	800 yards	18
1973 Arab-Israeli War	1,200 yards	2
War Against Iraq, 2003	2,400 yards	1

Figure 4-5: The Growing Precision of Direct Fire Weapons[32]

WAR	# 2000 lbs BOMBS (missiles) to hit a 60' by 100' target	# AIRCRAFT (from medium height)	CIRCULAR ERROR OF PROBABILITY
WW II	9,070	3,024	3,300 ft
Korea	1,100	550	1,000
Vietnam	176	44	400
1991 Gulf War	30	8	200
War Against Iraq, 2003	(1)	1 (B2)	10

Figure 4-6: The Growing Precision of Aerial Weapons[33]

73

TECHNOLOGICALLY DEPENDENT BATTLE

The need for accurate, instantaneous SA, intelligence and target acquisition, coupled with long-range precision effects will make the battlespace of the future technologically dependent. "Our goal," explained Pennsylvanian Representative Curt Weldon of the House Subcommittee on Procurement on the issue of the unmanned bomber / unmanned combat aerial vehicle, "[is to ensure that] within 10 years, one-third of our tactical strike aircraft will be unmanned."[34] US Air Force Lieutenant-Colonel David Branham concurred. "Its possible," he commented that in our lifetime we will be able to run a conflict without ever leaving the United States."[35] Former serving officer, strategist and futurist Major-General Robert Scales explained that "the task of destroying the enemy now [and in the future] belongs to firepower, not maneuver systems."[36]

However, in the shorter time frame, the conundrum will be the balance between technology and manpower. How much redundancy (legacy system back-up) is required? More importantly will be the increased complexity that the transition to an enhanced technologically dependent battlespace will create. The interface / integration of technology (e.g. equipment, surveillance systems, soldier systems, robotics, weapon systems) and humans will provide an exponential increase in capability and a more technologically proficient and aware military. However, it will also develop dependencies and increased training requirements (whether practical or simulation).

In addition, increased information technology, sensor capabilities and output, as well as full spectrum connectivity, will provide an abundance (potentially an overload) of information that will need to be filtered and processed in a timely manner. This may well become the greatest challenge of future commanders—to cull the critical modules of information from the massive waves of clutter that will continually flood recipients.

Of significant note, however, the rise of technology will not negate human ingenuity. In this regard, it would be foolhardy to assume that an enemy that lacks similar technology or weapon systems is incapable of causing destruction or mayhem. The threat of asymmetric attack will always be present, and commanders must never underestimate an opponent merely because of his limited technology.

INTERDEPENDENT OPERATIONS

The expanded, more lethal, technologically dependent battlespace creates the final characteristic of the future realm of conflict—interdependent operations. Currently, the pursuit of joint operations, defined as operations

involving two or more environments (services) of a single country, are the goal. In sum, this entails the ability to plan and conduct operations in a seamless manner including such issues as an integrated command structure, interoperable communication and information systems, common doctrine, formats, and procedures.[37]

Responsibly, however, militaries will have to move beyond joint to interdependent operations. The need for swift response to fleeting opportunities within the battlespace will require adaptability and flexibility, and commanders at all levels, joint and multi-national, will need authorized access to appropriate shared capabilities and effects. It will require the ability to designate effects platforms, regardless of service, to react instantly in support of another element anywhere in the battlespace. As such, capabilities and effects in operations must be embedded in one command. Ponderous chains of command and unwieldy targeting protocols will be tantamount to failure. Equally, the inability to ensure connectivity and the accurate SA of all friendly forces will be wholly negligent.
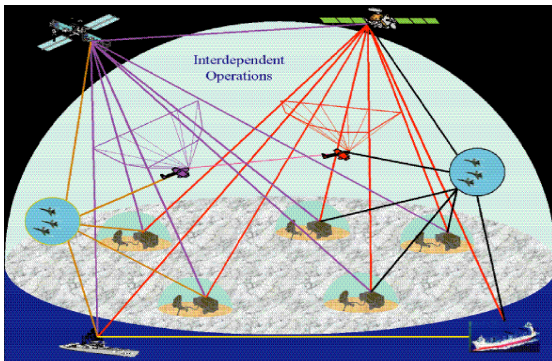
Figure 4-7: Independent operations

As well, blurred operations, media scrutiny and political pressure will ensure that the battlespace necessitates the cooperation and interaction of not only all three environments (services), but also governmental agencies and non-governmental organizations. Increasingly, interdependent operations encompassing a myriad of military and non-military forces working together simultaneously in operational areas will be the key to achieving the desired outcomes.

CONCLUSION

The future battlespace will be volatile, uncertain, constantly changing, and ambiguous. There will be increased emphasis on info ops, SA, and small, agile, dispersed units required to operate in a non-linear environment supported by instantaneous precision effects. Operations will be conducted simultaneously

on land, sea, air, and space, as well as in the electromagnetic spectrum. Conflict will become increasingly complex due to the asymmetric nature of the threat, the use of urban terrain, blurred operations and the expansion of the battlespace. Technological advancements will ensure that the battlespace becomes even more lethal leading to the catechism, "if you are seen you are dead." Furthermore, operations will be multi-dimensional requiring not only the close integration of all environments, but also that of governmental and non-governmental agencies to achieve desired outcomes. Finally, all activity will be conducted under the unrelenting scrutiny and glare of the national and international media that will beam events across the world in real-time.

To operate in this daunting environment will require a reorientation of how we presently think and operate within the battlespace. It will require commanders to develop the situation out of contact, engage targets with long-range standoff precision effects and overmatch the enemy (i.e. engage with consistently superior effects). The American conceptualization of "See First—Understand First—Act First—Finish Decisively" provides appropriate guidance. Enhanced SA as a result of global C2 and ISTAR will achieve this. It will also be the result of networked interdependent environments (services) capable of conducting simultaneous operations in a non-contiguous battlespace, as well as responding instantly to calls for precision massed effects.

The American solution, in accordance with the White Paper Concept for the future "Objective Force" issued by the US Army Chief of Staff, is defined as operations "characterized by developing situations out of contact; manoeuvring to positions of advantage; engaging enemy forces beyond the range of their weapons; destroying them with precision fires and when necessary, by tactical assault at times and places of our choosing."[38] In essence, the need will be for adaptable (highly trained and educated), highly mobile, well-equipped forces capable of rapid deployment on complex multi-dimensional coalition operations, and able to conduct missions across the entire spectrum of conflict.

ENDNOTES TO CHAPTER 4

1   Speech given at the National Defense University, Washington D.C. 31 January 2002, http://defenselink.mil/speeches/2002/s20020131-seedef.html.

2   This is why the American military maintains a ratio of 15 percent of its forces in a state of change, while the other 85 percent remains constant and forms the baseline combat capability. David Hughes, "The Future of Joint Warfighting," *Aviation Week & Space Technology*, 26 May 2003, 76.

3   Major-General Robert H. Scales, Jr., *Yellow Smoke. The Future of Land Warfare for America's Military* (New York: Rowman & Littlefield Pubishers, Inc., 2003), 19.

4   Phillippe Delmas, *The Rosy Future of War* (New York: Free Press, 1995), 213.

5   This projection is based on trends analysis which is based on the systematic collection of data on what is actually occurring in the world at present in regards to such things as technology, economic performance, military spending, environmental degradation, etc. The analysis of this data normally indicates a specific direction, or trend for a given area. From this, a rough order of magnitude forecast can be made.

6   Robert Holzer, "Krulak Warns of Over-Reliance on Technology," *Defence News*, 7–13 October 1996, 4.

7   Steven Metz and Douglas V. Johnson II, "Asymmetry and US military Strategy: Definition, Background, and Strategic Concepts," *US Army War College*, Strategic Studies Institute, January 2001, 5–6.

8   Colonel W.J. Fulton, *DNBCD*, "Capabilities Required of DND, Asymmetric Threats and Weapons of Mass Destruction," Fourth Draft, 18 March 01, 2/22.

9   Colin Gray, "Thinking Asymmetrically in Times of Terror," *Parameters*, Vol 32, No. 1, Spring 2002, 6.

10 Ibid., 9.

11 Mohammed Aideed in Somalia is one example. He used runners, burning tires and other primitive means of communication and was able to elude capture and destruction of his power base.

12 See James J. Schnieder, "Black Lights: Chaos, Complexity and the Promise of Information Warfare," Joint Forces Quarterly, Spring 1997, 21-28.

13 The Standing Senate Committee on National Security and Defence, Canadian Security and Military Preparedness, February 2002, Part I, Item 15.

14 Edmund M. Glabus, "Metaphors and Modern Threats: Biological, Computer and Cognitive Viruses," in Lloyd J. Matthews, ed., *Challenging the United States Symmetrically and Asymmetrically: Can America be Defeated?* (Carlisle: US Army War College, 1998), 203.

15 Dr. Jamie Shea, "Modern Conflicts, the media and public opinion. The Kosovo Example," *Militaire Spectator*, JRG 169, 8-2000, 411.

16 Reuters, "War Hack Attacks Tit For Tat," http://www.wired.com/news/conflict/0,2100,58275,00.html?tw=wn_ascii, accessed 1 April 2003.

17 The term "complex terrain" refers to terrain features that impact on line-of-sight, restrict manoeuvre and separate the soldier from his vehicle (e.g. jungle, mountain or urban environments).

18 "3–7 CAV Lessons Learned," posted on Companycommand.com, 1 April 2003.

19 Qiao Liang and Wang Xiangsui, *Unrestricted Warfare* (Beijing: PLA Literature and Arts Publishing House, February 1999), 199.

20 See Jeffrey Record, "Collapsed Countries, Casualty Dread, and the New American Way of War," *Parameters*, Vol 32, No. 2, Summer 2002, 4–23.

21 Colonel J.P.M. Maillet, "Defence Ethics Program Ethics and Operationsl Project," memorandum, 20 June 2000.

22 Dr. Jamie Shea, "Modern Conflicts, the media and public opinion. The Kosovo Example," *Militaire Spectator*, JRG 169, 8-2000, 409.

23 See Sean J. A. Edwards, *Mars Unmasked* (Santa Monica: RAND Arroyo Center, 2000), 67.

24 Shea, 410.

25 Ibid., 411.

26 CNN televised report, 9 April 2003.

27 Sean J. A. Edwards, *Mars Unmasked* (Santa Monica: RAND Arroyo Center, 2000), xiv.

28 Robert Leitch, "The Three Block War: Urban Conflict," *US Medicine Information Central*,

http://www.usmedicine.com/column.cfm?columnID=37&isseID=23, accessed 27 March 2003.

29 Michael Noonan, "The Military Lessons of Operation Iraqi Freedom," *Foreign Policy Research Institute (FPRI)* E-Notes, 1 May 2003.

30 Dr. Ron Haycock, "Clio and Mars in Canada: The Need for Military Education," presentation to the Canadian Club, Kingston, Ontario, 11 November 1999.

31 Scales, 13.

32 Scales, 65.

33 Source: George and Meredith Friedman, *The Future of War* (New York: St. Martin's Griffin, 1996), 262; CNN televised report, 10 April 2003.

34 Matthew Brzezinski, *New York Times Magazine*—Online edition, 20 April 2003.

35 Ibid.

36 Scales, 157.

37 Canada. *Joint Doctrine for Canadian Forces. Joint and Combined Operations* B-GG-005-004/AF-000 (Ottawa: DND, 1995), 1–11.

38 Steven Metz, the Director of Research and Chairman of the Regional Strategy and Planning Department at the Strategic Studies Institute, has articulated six decisive characteristics for the future battlespace: strategic speed; full scale decisiveness; broad band precision; success in protracted, asymmetric, ambiguous, and complex conflicts; ability to operate in coalition; and rapid conceptual and organizational adaptation.

CHAPTER 5
ENDURING FACTORS AND THE HUMAN DIMENSION

The starting point for the understanding of war is the understanding of human nature.

S.L.A. Marshall[1]

BACKGROUND

Despite ongoing advances in military technology and the improvements in combat effectiveness that it promises, armed conflict ultimately remains a human endeavour. Quite simply, it is the physical manifestation of a "clash of human will(s)." While a host of factors influence the character or means involved in this struggle, its cognitive and physical manifestations actually create and drive conflict.

Simply put, there are enduring human dimensions of armed conflict, as well as a number of other factors that are constants in its nature. Notwithstanding inevitable changes that are occurring in the conduct of armed conflict, the human dimension remains paramount. People are the focal point at which all other considerations converge and become relevant to success and failure in warfare.

THE HUMAN DIMENSION

Ultimately, military operations involve the threat of, or use of, force in pursuit of national objectives. Much like diplomacy, such actions are undertaken in an effort to influence human will and action. War and armed conflict are in themselves essentially efforts to control and direct human activity.[2]

The conduct of war and conflict has both cognitive and physical dimensions.[3] The cognitive, or non-physical aspect, of armed conflict involves the psychological or mental processes whereby beliefs, motives, ideas and emotions coalesce to establish resolve.[4] Often this involves intangibles. It may even feature cognitive processes that are not necessarily logical or rational. Such cognitive activity is essential for subsequent physical action to occur.

In contrast, the physical plane consists of those activities and material realities that relate to the laws of physics or nature (i.e. physical actions such

as the application of force by soldiers, weapons and equipment, including cyber and electromagnetic activity). Generally, the physical action required to partake in armed conflict is the most salient. Physical action is the reality that must be confronted and in fact employed to defend or impose one's will on an adversary. Yet, it is the cognitive aspect of armed conflict that truly fuels and propels the conflict. The cognitive plane is in fact the nexus of armed conflict—filtering both the physical and psychological effects that the conflict environment imposes to determine the capacity of soldiers, and those that they represent, to conduct combat.[5]

Ensuring a proper mind-set for the conduct of armed conflict is essential to an army's military effectiveness. On the physical plane, it demands adequate food, water, rest, hygiene, and physical fitness for those charged with the task of fighting. Psychologically, it calls for the building of trust, comradeship, esprit de corps and discipline among troops in the field. The fact that such requirements must be met in extraordinary circumstances and often while facing extreme conditions makes the challenge all the more difficult. Nevertheless, while many forces cannot be anticipated in advance, others endure.

THE "FACE OF BATTLE"—ENDURING FACTORS

At the battlefield level, it is clear that conflict often involves a seemingly infinite number of factors. Indeed, while broad generalizations may be possible, interaction of a wide range of forces ensures that each situation is ultimately unique. In addition, the methods and means of conflict are dynamic and continue to change.

At a human level, however, even complexity generates a number of enduring challenges. Regardless of the case considered or the political, economic and military-technological forces involved, virtually all armed conflicts are to some degree characterized by:

· Violence and Risk.

· Chance, Uncertainty, and Chaos.

· Friction.

· Continual Adaptation.

· Constraints of Time, Geography and Climate.

· The missions and tasks attending conduct of military operations.

· The demands imposed by military ethos and culture.

Violence and Risk

While the ultimate ends of armed conflict can vary widely, its conduct is inherently violent and risk-prone. For instance, in the last century, approximately 35 million people were killed as a direct consequence of war.[6] Such carnage underlines the fact that armed conflict is a deadly enterprise. In fact, the threat of violence and the risk that attends it may well serve to heighten vigilance and help trigger the mental and physical qualities essential to the successful conduct of military operations. Yet, they may also work to instil a degree of fear and anxiety in soldiers that can seriously impede their ability to effectively function on the battlefield.

Indeed, to the extent that fear is not properly channelled and controlled, risk management becomes ever more difficult as probabilities of inaction, or alternatively, rash action, increase. As risk management deteriorates, threats from violence may rise.[7] The end results can well include the destruction of unit cohesion and discipline, rising casualties, and ultimately political and military disaster.

Figure 5-1

Chance, Uncertainty and Chaos: The "Fog of War"

No set pattern of cause and effect exists in human affairs. Uncertainty and chance are endemic in life. As a result, confusion and chaos are often the results. Coping with such realities represents a constant challenge in human existence. But, the challenge of coping with chance and uncertainty is magnified in combat, as soldiers struggle with the knowledge that chance events and occurrences could well determine not only the course of battle but also their very existence.

Simply put, the stakes inherent in armed conflict serve to immeasurably heighten the potential dangers that the unknown can hold, as well as the mental and physical stress that those engaged in armed conflict must endure. The results, both for individual soldiers and for the missions of which they are a part, can be profound. Fatigue, inertia and panic, the collapse of unit cohesion, and ultimately mission failure, are just some of the possibilities.

Coping with such unknowns is an essential component of military success. Toward this end, soldiers and their commanders must plan for the unexpected, nurture a culture of initiative, and occasionally take risks. While such techniques can lead to more effective management of uncertainty, they can never eliminate it entirely. Ultimately, soldiers must learn to successfully compete in an environment that is inherently uncertain.

Friction

According to the military philosopher and strategist, Karl Von Clausewitz, friction is "the force that makes the apparently easy so difficult." Indeed, it is the force that resists all action—making the simple difficult and the difficult seemingly impossible.[8]

In essence, anything that impedes the capacity of military organizations to function harmoniously and seamlessly may be said to generate "friction." Its roots lie in the rigorous physical demands, the lack of clear information and the inherent danger found in conflict. All these factors work to cloud judgement and reason, slowing progress, increasing opportunities for mishap, and confounding even ostensibly routine plans.[9] At its root, friction is the result of human frailty.

Opportunities for the creation of friction in combat abound. On the cognitive plane it can arise in the form of personality clashes among leaders, or in the indecisiveness of commanders. Yet, it may also stem from the physical realities of conflict. In this regard, the source may be seemingly minor incidents such as vehicular breakdown, loss of communication, navigational error, difficult terrain and/or poor weather.[10]

When the interplay and hostile actions of a determined opponent are combined with such mishaps, the possibilities for friction are magnified
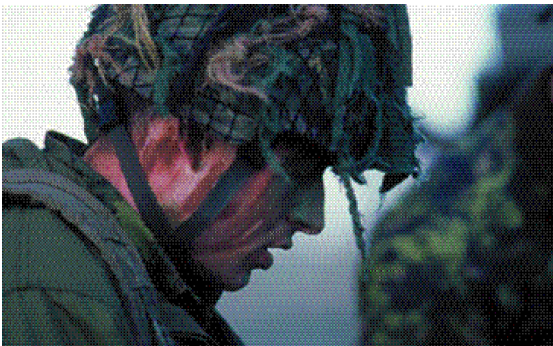
further, increasing both the complexities and difficulties inherent in the conduct of military operations. Often the results are fear, fatigue, miscommunication, misunderstanding and sub-standard decision making—all of which can combine to derail progress toward key military objectives.

Figure 5-2

Continual Adaptation to Changing Circumstances

Soldiering demands continual adaptation to constantly changing conditions and circumstances (i.e. to new threats, to new military doctrine, to advances in technology, to societal developments, and quite simply, to an evolving world). In a rapidly changing environment, excessive faith in past practice could breed disaster. However, the necessary adaptation requires considerable intellectual flexibility and continuous reflection on past experience. It also demands careful and constant consideration of the needs of the present and future. Only then is it possible to understand and employ new ways and means of conducting armed conflict efficiently and effectively.

Unfortunately, impediments to change and adaptation are often legion. This is particularly so in organizations heavily steeped in tradition and strongly wedded to time-tested doctrinal beliefs and standard operating procedures. The existence of well-established and/or highly successful doctrines and procedures often ensures that effective change is incredibly difficult, since experiential baggage and past successes combine with vested interests in status quo practice to impede innovation and limit effective analysis and assessment. In such cases, nothing may be as dangerous, or fail as completely, as past success.

Time, Geography and Climate

Notwithstanding ongoing strides in military science and technology, time, geography and climatic conditions remain significant factors in the conduct of military operations—often working to broaden or limit the potential courses of action that may be available to military planners.[11]

In fact, history bears strong testimony to the key role that time, geography and climactic conditions can play in military success and failure. The devastating effects of cyclones on Kublai Khan's 13th century efforts to cross the Korean Strait to invade Japan, as well as the punishing effects of cruel Russian winters on both Napoleon's forces and later those of Hitler attest to the fact that leaders and military planners ignore the elements at their peril.

The relationship between such forces is generally symbiotic—with the realities of weather, climate and terrain combining to either expedite or slow military progress. Often, their effects are capricious. Yet, their importance cannot be ignored.

Physical and temporal factors continue to constrain military operations today. Notwithstanding decisive US military superiority and eventual success, the realities of climate and terrain clearly influenced both the timing and character of military operations in the Gulf. Similar forces were at work in Kosovo, significantly influencing the duration of the air campaign.

Figure 5-3

Accordingly, careful consideration of such factors poses an enduring and unavoidable challenge in any military campaign.

Missions and Tasks

Armed conflict entails the control of physical action. Toward this end, militaries must execute a range of missions and tasks including: defeating the enemy; neutralizing enemy weapons, equipment, infrastructure and troops; and seizing, holding and controlling territory and resources.

A range of technological, social, political and economic forces shapes such missions and tasks. Still, the essence of the tasks themselves, and the physical and psychological demands often associated with their execution, endures.

Ethos, Culture, Values

While military missions and tasks vary, attributes such as integrity, discipline, duty and honour serve as unchanging, core values to which those responsible for the conduct of combat must aspire. A shared set of values and beliefs, along with a strict moral code of conduct provides the framework within which soldiers perform their duties.

Such an ethos or "code" offers a guide in both war and peace and acts as a crucial enabler that permits soldiers to perform the difficult tasks that are demanded in military operations including, if necessary, the taking of human life. As the Army's capstone manual states, …the military ethos enables the soldier to differentiate between right and wrong, between what is necessary and what is criminal."[12] Beyond this, it works to instil personal fulfilment, as well as cohesion within the organization itself. Moreover, it provides those that internalize it with the satisfaction of knowing that they belong to

something which is fundamentally good, noble and greater than one's self.[13] Instilling such values among military personnel and ensuring that they are faithfully observed during the prosecution of combat is a crucial and never-ending task for professional militaries.

PERSPECTIVE ON THE FUTURE

Undisputedly, change in the conduct of armed conflict is inevitable. Given scientific and technological innovation, it is likely that the future will witness fundamental, if not revolutionary, shifts in the character of battle. In fact, as developments in such areas progress, the future battlespace may well consist of a variety of complex, autonomous machines performing many of the combat tasks once reserved exclusively for humans.

Such advances may minimize some of the challenges posed by the various enduring factors endemic to armed conflict. For instance, ongoing strides in information technology and information systems are working to enable troops to obtain a degree of battlespace awareness (and control) that promises to significantly reduce the uncertainty, risk and even friction that are a normal and longstanding part of war. Nonetheless, blind faith in the capacity of technology to adequately address the "constants" of war is best avoided. While innovation may reduce such problems, they are unlikely to eliminate them entirely.

Figure 5-4

Scientific and technological advantages over potential adversaries rarely, if ever, endure. While applications of technology may work to overcome some problems, they may actually generate new vulnerabilities. And, little in the area of technological or even organizational innovation will remove the fact that warfare will remain in essence a profoundly human enterprise, involving at its core, a clash of wills between humans. In fact, if history is any guide, the capacity to endure and overcome physical and mental hardship, to bear the costs associated with battle and to sacrifice for the greater good, may make up for a wealth of material and technological shortfalls.[14]

With no "silver bullet" capable of removing the key challenges that armed conflict poses on the horizon, armies must focus on more traditional strategies aimed at their effective management. Such an approach must focus on the human aspect of conflict—emphasizing effective leadership, military education and training, in concert with the acquisition of advanced and emerging technologies.

Warfare will continue to require soldiers and leaders who have the fighting spirit backed by the ethos, culture and values that enable them to withstand the stress, uncertainty and risk inherent in combat. Recognizing people, rather than material attributes as the nexus of an army, is fundamental not only to future relevance, but also ultimately and most importantly, to its effectiveness and success in the years to come.

CONCLUSION

"Revolutions in military affairs," argue Williamson Murray and Macgregor Knox, "remain rooted in and limited by strategic givens and by the nature of war. They are not a substitute for strategy—as is so often assumed by the utopians—but merely an operational or tactical means… Nor can technology abolish war's central essence as the realm of uncertainty and of the clash of wills. Processing power can no more replace discernment and sheer guts at the strategic level than on the battlefield itself."[15]

The point that Murray and Knox cite is a salient one. Recognizing and understanding the human dimension of conflict, and the enduring factors that accompany it, is essential to the preparation of our soldiers and leaders for future battle. The dynamic nature of conflict and the long list of physical and mental hardships that soldiers typically must endure are factors that we must prepare for regardless of promises of advanced and emerging technological solutions. This will demand conviction and dedication of purpose, as well as flexibility of thought. Only then will it be possible to achieve not only sufficient understanding of conflict, but also the capacity to cope with it effectively.

Our military ethos must be maintained and energized to prepare our personnel for the mental and physical rigors of war and armed conflict. The basic tenants of judgement, discipline and courage are essential elements of a military ethos. Indeed, while physical needs must also be considered (e.g. food, water, rest, hygiene and physical fitness), social and psychological needs (e.g. trust, cohesion, comradeship and ethics) remain just as necessary and relevant. Toward this end, we must continue to focus on our people and promote effective leadership, education, training, organization, personnel policies and practices as the foundation for ensuring the long-term capability of the Army.

ENDNOTES TO CHAPTER 5

1 S.L.A. Marshall, *Men Against Fire: The Problem of Command in Future War* (New York: Morrow 1947).

2 In fact, it can be argued that one central purpose of waging war is to reduce the enemy's motivation to fight.

3 Material resources, their allocation, and human motivation represent key variables affecting the potential of parties to conduct war. See for instance, Klaus Knorr, *The War Potential of Nation*, (Princeton: Princeton University Press, 1956), 41.

4 While army doctrine describes the dimensions of conflict as physical and moral, the term "cognitive" may serve as a preferable substitute for the latter as it better describes "the where and how will is created" (i.e in the human mind). The term cognitive is less value-laden-avoiding implied notions of right or wrong associated with moral behaviour. Instead, the term focuses on the process through which beliefs and resulting actions are generated. The change is subtle but significant in the longer-term consideration of conflict.

5 The beliefs, attitudes and ideas of a nation's leadership and public are especially important. Indeed, it is at this level that the national will and resolve required to undertake and successfully sustain armed conflict is created. The cognitive dimension is similarly crucial for the military. Absent the proper mind-set for the conduct of battle, not only is national will likely to waiver, but also objectives sought in armed conflict may well be compromised.

6 Paul Seabury and Angelo Codevilla, *War: Ends and Means* (New York: Basic Books, 1989), 6–7.

7 For an extended treatment of risk and its impacts see, Peter Gerald Moore, *The Anatomy of Decisions* (New York: Penguin, 1976).

8 For a useful synopsis of Clausewitz thought, see Patrick M. Cronin, "Clausewitz Condensed," in Colonel Arthur F. Lykke, Jr., *Military Strategy: Theory and Application* (PA; US Army War College; 1989), 88–89.

9 The dangers which friction can pose are vividly illustrated by the American experience in Somalia, most notably in the US operation portrayed in the book, Black Hawk Down. Indeed, while the mission itself was expected to take less than one hour, countless minor incidents transformed what was initially regarded as a routine and rapidly executable operation into an 18-hour debacle that resulted in the deaths of 19 American soldiers and hundreds of Somalis. Notably, there was no backup plan, and few hedges for uncertainty or friction.

10 Department of National Defence, *Canada's Army: We Stand on Guard for Thee* (Ottawa, Department of National Defence; 1998), 77.

11 For a good survey of the impact of nature on military operations, see Harold A. Winter, ed., *Battling the Elements: Weather and Terrain in the Conduct of War* (Baltimore: Johns Hopkins University Press, 1998).

12 Canada, *Canada's Army: We Stand on Guard for Thee* (Ottawa: DND, 1998), 36.

13 Ibid.

14 In fact, the Soviet experience in Afghanistan, American involvement in Vietnam, and more recently Russian problems in Chechnya, all attest to the degree to which materially and technologically inferior forces can successfully confront more well equipped counterparts given sufficient motivation.

15 Williamson Murray and Macgregor Knox, "The Future Behind Us," in *The Dynamics of Military Revolution: 1300–2050* (United Kingdom: Cambridge University Press: 2000), 193.

PART II
INTEGRATION OF THE
OPERATIONAL FUNCTIONS

CHAPTER 6
OPERATIONAL FUNCTIONS

*If you know more you can act with greater precision,
you can rapidly adapt to fluid situations and you can move about the
battlespace with far greater effect than ever deemed possible in the past.*

Admiral Ed Giambastiani, Commander US JFCOM[1]

INTRODUCTION

The likely chaotic and turbulent international security environment of the future, combined with exponential advances in technology, has created the possibility of a future battlespace that will be multi-dimensional, dispersed, continuous and non-contiguous in nature. Moreover, it will be characterized by increased tempo and lethality, as well as a broad continuum of operations (e.g. the "Three Block War" [2]) that will demand an approach quite different from that employed during the linear operations of the Cold War. In many respects, the types of operations that the Canadian Army is most likely to become involved in, and the manner in which they will be conducted, will differ radically from those of the past.

Operations will be conducted in all realms—land, sea, air, space and cyberspace. They will increasingly focus on the use of timely precision manoeuvre and effects.[3]   As such, command will demand dynamic trade-offs on a myriad of issues including ensuring the adherence to the rules of engagement (ROE) in the face of highly automated engagement systems, the prioritization of targets, and minimization of the time required to pass information directly from sensor platforms to engagement platforms.

THE OPERATIONAL FUNCTIONS

In the past, Canadian doctrine defined battlespace tasks in terms of six combat functions: command; information operations; manoeuvre; firepower; protection; and sustainment. However, these terms are too narrow and restrictive in light of likely developments in the future. Accordingly, and in an effort to ensure future relevance, Directorate Land Strategic Concepts(DLSC) advanced five operational functions in 2001, which the Army has generally accepted.

The operational functions are comprised of five essential components: *Command*; *Sense*; *Act*; *Shield*; and *Sustain*.[4]   These functions are more flexible and broader in scope than the previous combat functions, and more precisely complement our

current views and perceptions of the battlespace and concepts of operations within the future security environment. These functions will be used as the foundation upon which to build future Army capabilities.

The following thumbnails of the operational functions are intended as a brief introductory overview. Each function will be dealt with in greater detail in subsequent chapters.

Command

Future commanders must be capable of conducting operations throughout the entire spectrum of conflict at a very high tempo and over the complete breadth of the battlespace employing widely dispersed, highly mobile and lethal forces. Moreover, commanders will need skills to operate in a fast paced and technologically advanced environment, while at the same time ensuring human dominance in decision making. In this respect, commanders and staff will require a suite of technically competent command systems to exercise command and control. Indeed, *Command* will be the central function that "binds" the others together within a command-centric, network-enabled battlespace.

Sense

The *Sense* function integrates those assets that collect data and provide first level analysis to produce information and eventually knowledge. New technology will replace traditional means of gathering data. Sensors will be more capable, passage of data will be faster, and more data will be available on a continuous and real-time basis. Commanders and staff will have access to data at the touch of a button on a scale not possible today. Sensor management and data fusion within a command support framework will be essential to gain full advantage of all the sensor platforms in the future battlespace.

Act

The relationship between manoeuvre and information operations continues to evolve. It is becoming increasingly integrated and interdependent. In the future battlespace, *Act* will foster precision synchronization of manoeuvre and effects and the gathering of data.[5] In essence, forces and their supporting effects will remain dispersed and, only when necessary, will they be concentrated long enough to bring decisive effects against the enemy.

Shield

Access to potentially lethal technology is increasing. This, coupled with an ever-present asymmetric threat and the ease with which certain groups can

gain detailed information on friendly forces, demands a *Shield* capability. Quite simply, shield facilitates friendly force freedom of action and ensures the protection of assets. Within the context of the future security environment, *Shield* will account for deployed forces and those in the homeland.

Sustain

Undoubtedly, future technology will decrease the strain on the sustainment system. This is significant since reducing the demand on the system is the single most important contributor to a condensed sustainment footprint in the future battlespace. Through *Sustain*, the current supply-based sustainment system that focuses on stockpiling within echelons will give way to a distribution-based system founded on timely delivery from goods held in a "pipeline." Furthermore, traditional emphasis on permanent lines of communication (LOC) will most likely be eclipsed by a focus on sustainment nodes that generate unique task organized elements to address immediate requirements. Methods such as precision aerial delivery will increase agility. Given the fluidity of the battlespace it may well be necessary to assign troops, on a temporary basis, to open and or secure LOCs as required. Alternatively, special force capability, or the supporting troops themselves, can be trained and equipped to complete such tasks. In essence, *Sustain* will emphasize timely assured delivery of the required commodities, and not on the process, source or agent of delivery.

INTEGRATION OF THE OPERATIONAL FUNCTIONS

As stated earlier, the five operational functions offer a broad and flexible approach for determining what capabilities will be required and the coordination necessary to operate in the future battlespace. However, a philosophical concept is required to assist in the integration of the operational functions and the conduct of operations. Toward this end, American doctrine offers some useful insights. Indeed, the Americans espouse a paradigm of "See First, Understand First, and Act First." The core of this concept is encompassed in USECT (*Understand*, *Shape*, *Engage*, *Consolidate* and *Transition*) in regards to the battlespace.

The process is simple in design. It is not only useful for the process of planning and conducting an operation, but it is also a logical approach for explaining how and why operational functions interact and

USECT- Conceptual Approach

UNDERSTAND

   SHAPE

      ENGAGE

         CONSOLIDATE

           TRANSITION
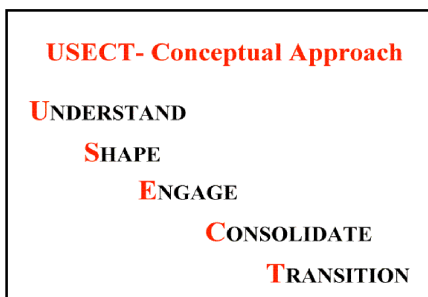
Figure 6-2

what capabilities are required across those functions. Although presented sequentially, the components of USECT operate in a dependent, continuous, and often-simultaneous cycle. *Understanding* is continuous, and while *Shaping*, *Engagement*, *Consolidation* and *Transition* may appear sequential, these activities are interrelated as any armed force could potentially be conducting several activities along the continuum of operations at the same time. Depending upon the operation, some activities may take on greater or lesser importance. It is even possible that all five elements may not be required. In other cases, some activities may have to be conducted more than once.[6]

Understand

Understand is an all inclusive and continuous process. Simply put, it consists of the intelligence / information collection operations that provide friendly forces with an understanding of the battlespace. In this regard, the commander and his staff must be proactive and must constantly evaluate their surroundings to determine the necessary courses of action to ensure mission success.
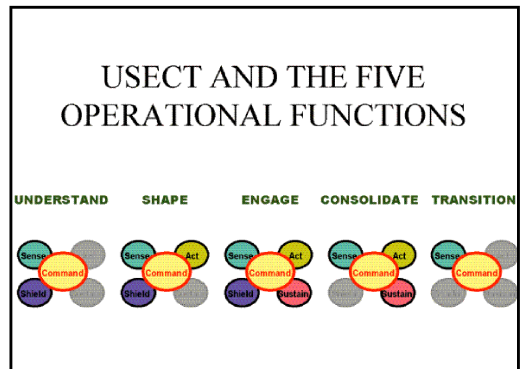
Figure 6-1

This is not a passive process. Rather, it involves a robust intelligence system built upon a network of sensors and continuous information gathering and fusion capabilities. This evaluation must cover all aspects of the expanded battlespace, including such issues as the intricacies of complex terrain and the large number of entities operating in the area. This involves the entire spectrum from well-defined organized military troops to criminal gangs, terrorists and paramilitary factions. It must also account for non-combatants, governmental agencies, non-governmental organizations (NGOs), and any other group or organization that is in, or can affect, an area of operation (AO). *Understand*, in this regard, must be all-inclusive to include knowledge on cultural, economic and political issues, in addition to simple quantitative data on definition of opposing forces (e.g. numbers, identifying features, capabilities, equipment).

Crucial to the planning of any activity or operation is intelligence preparation of the battlefield (IPB). Forces must have the technical capability to capitalize on multi-source information and intelligence

fusion to include rapid analysis and dissemination along the chain of command. Before, during, and after hostilities within an AO, ground, human intelligence (HUMINT)), airborne, maritime, and space based intelligence and reconnaissance assets must be used to bridge the information gap often presented in an expanded battlespace. This is equally true in an enclosed and quickly changing environment such as complex terrain.

Shape

Shaping the battlespace entails those actions taken by friendly forces that set the conditions for continued operations and friendly force success. It includes all those actions that forces must take to seize the initiative and establish the conditions for mission accomplishment. The intent is to restrict enemy freedom of manoeuvre and action.

A force shapes the battlespace to best suit operational and tactical objectives by exerting appropriate influence on the opponent, friendly forces and the information environment. Essentially, *Shape* brings all the necessary capabilities (e.g. lethal and non-lethal effects, information operations) to bear to achieve a desired effect on an adversary so as to defeat him at a time and place of your choosing.

Critical to *Shape* is the understanding that it can be achieved through means other than just engagement in combat. Often, the battlespace can be influenced through information operations, psychological operations (PYSOPS), or active civil-military cooperation (CIMIC) and public affairs (PAff) campaigns. Equally, political action to influence domestic and international audiences is also vital.

However, military force is a key component of Shape. Direct and indirect effects can be used to create favourable conditions for precision tactical manoeuvre. In turn, precision manoeuvre can be used to set the conditions for the defeat of belligerents by forcing them to deploy, and thus fall victim to precision effects, or close combat

Regardless of method, commanders must appreciate the requirement to shape the entire battlespace as a prerequisite for success. A critical factor of this is the ability to achieve and sustain information superiority. This must be attained as quickly as possible, and sustained. By extension, this means that the disruption of the enemy's internal and external communications is a priority. It will destroy his ability to conduct information operations (info ops) and it will destroy his unity of effort.

Engage

Engage refers to deliberate actions taken by friendly forces directed against an opponent in order to achieve the desired effects. To do this, the Army must be able to bring its full dimensional capabilities to bear in a timely manner. Engagement spans the full range of spectrum of conflict from warfighting to peace support operations to humanitarian assistance (e.g. disaster relief operations). In combat, successful engagement requires full spectrum dominance of the battlespace. This can include seizure, disruption, control or destruction of the opponents' critical factors to include their centre of gravity (COG).[7] Critical factors may include material components such as infrastructure, as well as more intangible socio-economic or political factors such as cultural sensitivities and morale.

Consolidate

Consolidate embraces those actions designed to secure and establish control and protect what has been gained. It also includes the repositioning of forces to meet subsequent tasks and to provide for post-conflict sustainment and recovery. In war, and in operations other than war (OOTW), the focus of *Consolidation* involves not only protecting gains, but also maintaining the initiative to disorganize the opponent if and when necessary. This necessitates an ongoing process of organizing and strengthening the force as the situation unfolds. *Consolidate* will place heavy requirements on force protection, logistic support, damage repair, and response to non-combatants.

Transition

In general, the end-state in any conflict is the termination of operations after strategic and operational objectives have been met. As such, *Transition* refers to the transfer of control to local civilian authorities or an international organization, and the restoration of infrastructure and services. *Transition* must be an integral part of any overall plan and must be considered in detail prior to the cessation of hostilities. *Transition* may occur in one part of the AO while in another active operations are still occurring. In any conflict, the ability to ensure that *Transition* is accomplished in a quick and efficient manner may well become the critical element to mission success.

CONCLUSION

"The five operational functions," asserted the former Chief of Land Staff, Lieutenant-General (retired) M.K. Jeffery, "provide a good framework for discussion about the Future Army." He added, "placing *Command* in the

centre gives the function its proper due. *Shield*, *Sense*, *Act* and *Sustain* conjure up the image of a continuum that stretches from the strategic level to the front line soldier. There will be no barriers."[8]

The former Commander's emphasis on the necessity that "there will be no barriers" was prescient. In the future, the very nature of conflict will change and the Canadian Army's approach to operations will have to evolve accordingly. As already clearly articulated, the future battlespace will be significantly different from that of the Cold War. Renowned strategist Steven Metz has argued that the future will see the decline of large-scale state-on-state warfare and the rise of ambiguous, protracted, indecisive conflict in complex environments. He believes that the future battlespace will expand the concept of armed conflict by placing the operational aspects within a broader context to include political, economic, social, ecological, demographic, legal, normative, diplomatic and technological factors.[9]

To deal with this ambiguous and complex future security environment, the Canadian Army will need to evolve its methodology and doctrine. In short, the battlespace must be placed in its broader context. In this respect, the five operational functions (*Command*, *Sense*, *Shield*, *Act* and *Sustain*) provide a framework that allows the battlespace to be treated as a comprehensive continuum, rather than as a number of isolated actions and events independent of one another. In this vein, the conceptual framework of USECT (*Understand*, *Shape*, *Engage*, *Consolidate* and *Transition*) provides a further methodology that allows for a more complete comprehension and integration the five operational functions. Each operational function will now be examined in greater detail in the following chapters.

ENDNOTES TO CHAPTER 6

1 Admiral Ed Giambastiani, Commander US JFCOM, speech given at the US Armed Forces Communications Electronic Association's Tecnet 2003 Conference, 13–15 May 03.

2 Charles C. Krulak, "The Three Block War: Fighting in Urban Areas," National Press Club, *Vital Speeches of the Day*, 15 December 1997; and General Charles C Krulak, "The Urban Operations Journal. The Strategic Corporal and the Three-Block War," http://www.urbanoperations.com/strategiccorporal.htm accessed 27 March 2003. See also Chapter 4—Future Battlespace.

3 Precision manoeuvre can be described as involving a cycle of dispersion, concentration and further dispersion in harmony with the operational tempo. This will require information domination and precision engagements.

4 These operational functions exclude important functions that will be performed above the tactical level such as force generation and the subsequent deployment of that force into the battlespace.

5 "Effects" are the results of a conceived and planned operation that uses the full range of direct and indirect capabilities. Effects may be achieved by the synergistic and cumulative application of political, military, economic, social or information capabilities at all levels. (DCDS Concept paper, *Effects Based Operations in a Canadian Context—Plan Pegasus*). At the tactical level the application of "effects" implies bringing those capabilities to bear to achieve the desired results (e.g. indirect fire, direct fire, close combat, precision manoeuvre, info ops and PSYOPS).

6 This section is based predominately on US Army Publication JP 3-06 *Doctrine for Joint Urban Operations*, Chapter 2.

7 COG is that aspect of the enemy's overall capacity, which if attacked and eliminated will lead to his inevitable defeat or his wish to sue for peace through negotiations. (B-GL-300-003/FP-000 *Land Force Command* July 1997, Glossary.

8 Quoted in Canada. *Future Army Capabilities* (Ottawa: DND, January 2001), i.

9 Steven Metz and Raymond Millen, "Future War / Future Battlespace: The Strategic Role of American Land Power," *Strategic Studies Institute*, March 2003, http://www.carlisle.army.mil/ssi/index.html

CHAPTER 7
COMMAND

The problem is to grasp, in innumerable special cases the actual situation which is covered by the mists of uncertainty to appraise the facts correctly and to guess the unknown elements to reach a decision quickly and then carry it out forcefully and relentlessly.

Helmut von Moltke

INTRODUCTION

The way wars are fought is changing. Weapons are more sophisticated, accurate and lethal. Standoff ranges have improved exponentially, sensors are more advanced, information easier to obtain, and battlefield awareness more defined. Clearly, armies of the 21st century will be different than what they are today. Weapons, organizations, and methods of employment will continue to change as a result of new technologies and emerging threats. This will cause doctrine to be under a state of almost constant evolution. In the end, forces in the future battlespace, although smaller, will be faster, more lethal and with far greater capabilities. Through connectivity and near-real-time situational awareness, these forces will be able to mass assets and/or effects to ensure overmatch and victory on the battlefield.

But, in order for any army of the future to be successful, its leaders will require to fully understand the context of the future battlespace and learn to exploit it using all the technological resources available to them. The revolution in information technology, especially as applied to command, will compress time and space in military operations to create an unprecedented non-linear battlespace characterized by increased breadth, depth and height. In essence, the concept of battlespace has permitted a shift away from organizations of linear mass towards a simultaneous and full dimensional concentration of effects.[1]

In the very near future, commanders will be able to see the entire battlespace through improved situational awareness (SA) and a common operating picture (COP).[2] Using an extensive and fully digitized communications network, linked to all the platforms in the battlespace, commanders at all levels will have a degree of SA in a portable format never before available. The command support system of the future, a combination of people and technologies, will provide them with near-real-time

battlespace awareness. Although commanders will still issue orders, the SA enjoyed by subordinates will allow those orders to be extremely concise—focusing heavily on the commander's intent.

Furthermore, the operational functions of *Command*, *Sense*, *Act*, *Shield* and *Sustain* will be integrated within a single construct. The emphasis will be on integration rather than on co-location. The operational functions, with *Command* as the nexus, together will form a battle

Figure 7-1: Operational functions

operating system that will be both horizontal within a given level (i.e. tactical, operational or strategic) and vertical to both higher and lower levels. Although each level of command will have some discretionary capability within each function, it is anticipated that information technology will facilitate the creation of continua that will allow tasks to be completed at the most appropriate level. It is within this context that future Canadian army leaders will exercise command.
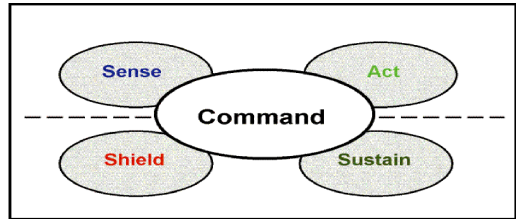
COMMAND-CENTRIC WARFARE

Current armies including that of our closest ally, the Americans, are transforming to digitized forces that embrace command-centric warfare as a result of existing and emerging information technologies. Command-centric warfare can be considered the linking of a system of systems, which in effect
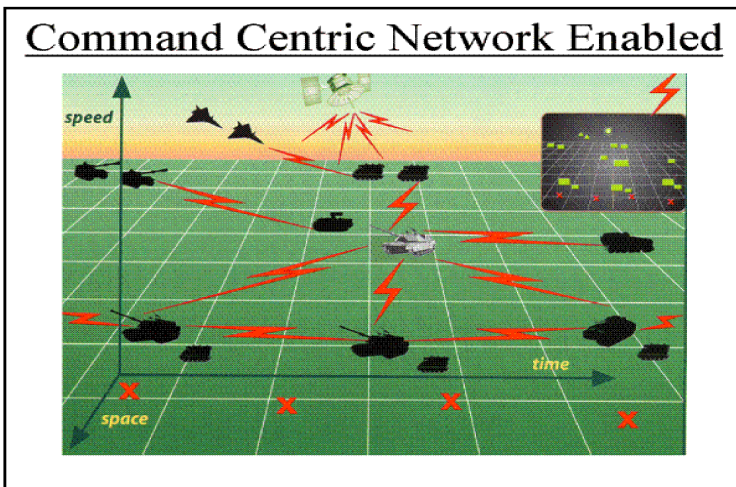
Figure 7-2: Digitized battlespace

connect all key elements to produce one shared awareness network.[3] This network connectivity will greatly enhance SA across the battlespace and allow for more effective and rapid coordination and response to opportunities created by the digitization of the battlespace. The networking of an organization will allow that force access to a new and previously unreachable domain of data and information. The ability to operate in this realm will facilitate information dominance. The inherent advantage gained by sharing and collaborating on the information that is available on a network-wide system will be a key enabler to success in future operations. Indeed, it will create the potential for dramatically improved shared SA within any force.

In order to be successful on the future battlefield, the Army must transform itself to exploit command-centric warfare. This can only be accomplished if the domains in which command during conflict takes place are fully understood and the impact of networking fully appreciated. As such, the future Canadian Army must be networked to exploit the relationship of conflict in two domains, physical and cognitive.[4]

Firstly, the physical domain is the traditional arena of battle. It is here that *Command*, *Sense*, *Shield*, *Act* and *Sustain* are conducted in the spheres of land, sea, air and space. This is traditionally the domain in which infrastructure and equipment platforms reside. Secondly, the cognitive domain is where information is created, manipulated and shared. It is the domain that facilitates communication among forces where intent is conveyed and where control is devolved. It exists in the minds of the individual soldiers, as well as the population at large that are involved in the conflict. Most importantly, it is in this domain of the commander's intent.

COMMAND IN THE PHYSICAL DOMAIN

Technology, driven by digitization, will present the opportunity for a quantum leap in command support capabilities. Rather than simply automating the reporting system, technology will be used to expedite the time and energy-consuming tasks of collection, analysis, presentation and dissemination. The tempo and complexity of the future battlespace will require adaptable, highly deployable, command and control packages that are capable of sustained operations. All systems must allow commanders to exercise leadership and decision making anywhere, anytime—either when stationary, or on the move. In addition, they must allow commanders and their staffs seamless opportunities to collaborate on mission orders and plans on demand.

Beyond this, all command systems must be fully integrated across the entire force and across all operational functions. They must be ultra-reliable, modular, scaleable and interoperable with collation and national forces, and

preferably with non-governmental organizations (NGO).[5] Furthermore, they must be robust enough to support deployments under austere conditions without reliance on fixed points or immediate staging areas.

Such systems will ensure a wider degree, and greater depth, of knowledge. This will allow commanders to plan more complex operations, in less time, with greater resolution and detail than is possible today. However, this comes with a cost. Given this seemingly unlimited access to ever-increasing amounts of information, commanders must discipline themselves not to become involved in concerns more properly dealt with in the domain of their subordinates. At the same time, the advantages of increased SA must not be lost. The onus will be on the command support system to fuse data and turn information into knowledge relevant for commanders at various levels. As such, the command system of the future must at a minimum:

· Be totally inter-connected across the entire battlespace. This means that all platforms must be linked through a network-enabled web and be capable of communicating with each other regardless of affiliation. The system must be designed to fuse all the relevant information available in the form of SA into an agreed COP.

· Allow for command from both static and mobile platforms. In future operations, tactical commanders will be constantly on the move and will be responsible for greatly expanded areas of operations. *Command* systems must allow the commander the same degree of SA regardless of where he is located. The concept of a tactical headquarters (Tac HQ) with lesser capabilities than a Main headquarters (Main HQ) will be dismissed.

· Allow for the ability to conduct collaborative planning at all levels. In essence, this means that the production of the initial plan, and any subsequent changes or future plans, is done through brainstorming. This multi-level interactive process will produce the most viable plan to deal with a complex, high-tempo and non-linear battlespace not readily given to the norms of conventional stovepipe planning.

· Be interoperable nationally and internationally. A system that is not interoperable will be irrelevant within the future battlespace. Common communication protocols must be developed that allow for the sharing of information with our Allies and coalition partners. Consequently, mechanisms must be in place to facilitate interoperability with coalition partners who may not be technologically advanced, but would likely work with or be placed under tactical control (e.g. countries still using analog systems).

· Be robust and sufficiently automated to allow for simultaneous planning and execution.

· Be as automated as appropriate to expedite mundane tasks, such as message composition, and adequately sophisticated to relay data to specific sites for action. For example, a contact made via laser should be automatically transmitted as a contact/target report to a platform without human intervention.

· Allow for en route mission planning, which will be especially critical given the increased tempo of the future battlespace. Forces will be required to transition rapidly from one operation to another over extended spaces with little pause. In these cases, a command system must be totally inter-connected and capable of supporting geographically separated units in the conduct of virtual rehearsals that, as closely as possible, depict the conditions of the actual mission.

COMMAND IN THE COGNITIVE DOMAIN[6]

Command is a human endeavour that relies more on the dynamics and interaction that exist between a commander and his subordinates than simply legal authority. Put another way, it is the creative expression of human will necessary to accomplish the mission.[7] In the future, the rapid transfer, availability, and processing of data and information into knowledge will serve to create a common operational understanding among subordinate commanders. This will facilitate a comprehensive understanding, of the mission, environment and forces, through continuous interaction between all levels of command, thus, resulting in a dynamic and accelerated mission-pace well beyond that experienced today. But, future operations will be of a complexity and tempo that will create unique problems and situations that will render the most detailed and thorough of plans obsolete. Therefore, it will be within the cognitive domain that data and information pertaining to these crises and situations is gathered, processed and turned into knowledge so that commanders can make timely enlightened decisions.

Within this domain, there are many aspects of command with which the commander must be fully aware. It is in this realm that the will of not only his soldiers, but also that of his government and society, as well as that of his opponents and their nation rests. It is within this domain that the complexities of domestic and international acceptance and support and the ever-influential "CNN factor" reside. With near-real-time media access to the battlespace even the smallest of "incidents" can have a disproportionate effect on a mission. Therefore, information and psychological operations will take on an increased importance.

The commander must be aware of these constraints and realities. Despite this complexity, and given the anticipated tempo of future operations, commanders will not have the luxury of time to issue detailed orders for every eventuality within the battlespace. Neither will they be everywhere to respond to every occurrence. In any event, to do so would rob the subordinates of initiative and lose advantages gained through information dominance. However, it remains a fact that such eventualities must be treated in a manner that the commander deems suitable, and in line with the aims and objectives of the organization. So, if there is insufficient time to cater to every eventuality within this fast paced battlespace, how can commanders ensure that their missions are accomplished in line with their goals and objectives? The answer, or more accurately success within the future battlespace, will hinge on an understanding of the commander's intent.[8]

Commander's intent, according to defence scientists Carol McCann and Ross Pigeau, is defined as "an aim or purpose along with all of its associated connotations." Central to commander's intent are explicit and implicit intent. Explicit intent, from a military point of view, are orders given as instructions or directives to accomplish a specific aim or objective. These are physically communicated and often do not leave much leeway for individual interpretation. Implicit intent, on the other hand, refers to all of the connotations latent with a specific explicit aim. Implicit intent is based on a combination of an individual's habits, experiences, beliefs and values that reflect personal, military, cultural and national experiences.
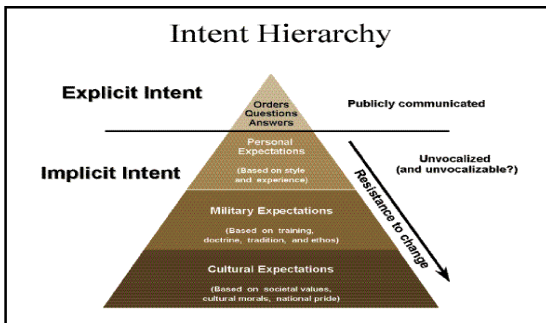
Figure 7-3: Intent hierarchy

Explicit intent is the most visible and easily communicated aspect of overall intent. Intent, however, is built on a whole set of implicit and largely un-communicated personal expectations. These expectations are built on a larger foundation of national interests and cultural expectations. Establishing shared implicit intent is critical in the preparatory phases of an operation, and it can be argued, that it is an activity to which commanders, supported by the entire military organization, must commit considerable time and effort.

However, implicit intent is not something that is developed overnight, nor is it developed for an operation and then discarded. Instead, implicit intent is developed based upon the moral and cultural structure of the organization. Commanders must support the development of shared implicit intent through augmenting education and training with leadership, team-building and continual interaction with subordinates. The military in general must establish a command climate based upon duty, honour, and integrity that fosters trust, confidence, risk acceptance, motivation, creativity, initiative, pride, discipline, and esprit de corps. At every stage of an individual's development, the military must continuously reinforce development of implicit intent.

Explicit intent is shared through "orders" or direction from the commander. Conversely, implicit intent is shared based upon common organizational and personal expectations and beliefs. These two intents combine to form an understanding of the commander's intent or "common intent." Both the explicit and implicit elements of intent must be present in order for this common intent to be established. Common intent, best described by McCann and Pigeau as the sum of the shared explicit intent plus operationally relevant shared implicit intent, is the precursor for coordinated action. McCann and Pigeau argue that sharing implicit intent is a time-consuming activity that must occur well before a force is committed to operations. Typically, during operations there is little time for sharing expectations, values and beliefs. Therefore, if implicit intent is not well-developed prior to the operation, then common intent can only be established by increased explicit intent. In other words, commanders will spend more time on issuing orders—orders that will be exactingly detailed. In addition, more time will be required for questions and feedback.

Armies that do not have the ability to develop the commander's intent or common intent based in large part on implicit intent, will not be able to function in the future battlespace. A high level of explicit intent coupled with low levels of implicit intent lead to highly centralized organizations. These organizations rely on complex and long chains of command, a preponderance of ridged instructions or operating procedures, extensive and lengthy planning cycles, and the issuance of complex, detailed and lengthy orders. Typically, these organizations foster creativity only at the highest levels, function through subordinates doing exactly as directed, and they tend to perform effectively predominantly in stable, well-defined, non-complex operations.

Achieving commander's / common intent in an atmosphere marked by high levels of implicit intent and low levels of explicit intent is indicative of a decentralized organization. *Command* within this type of organization is

often referred to as mission command based upon the German doctrine of *Auftragstraktik*.[9] In accordance with *Auftragstraktik*, a subordinate commander is given a mission without being told how it should be accomplished. The concept requires commanders at all levels to think and act autonomously. These organizations typically spread decision making authority downward to subordinates empowering them with command initiative and independence.

This action, i.e. decentralization of authority to make decisions, capitalizes on the intelligence, motivation and SA of those most closely associated with an ongoing operation. Commanders give orders for what must be done and allow individual initiative and creativity to determine how best to accomplish the task. In this type of organization, individuals understand and share the organization's overarching intent, as well as the commander's specific intents. There is little or no requirement for detailed repetition of explicit intent often characterized by micro-management, and detailed orders and instructions.

Given the complexity and increased tempo of the future battlespace, a strong argument can be made that if a future army is to be successful it must have mechanisms in place that allow for rapid and shared decision making. In order to realize this, it can be further argued that the organization must exhibit decentralized command based upon common intent. In this respect, technology poses a double-edged sword. It allows for a more complete picture of the battlespace through sensors and data fusion, which arguably will reduce the fog of war. Yet, it also poses a potential menace through the sheer volume of data and information that become available to commanders and their staffs. This avalanche of inputs can literally drown them with information. Without the proper filtering, processing and analysis of the copious amounts of information that will become available, commanders will experience information overload and suffer "paralysis by analysis."[10]

Moreover, there is also the potential that superior commanders will become increasingly mired in too much tactical-level information, which could cause commanders, through lack of self-discipline or aversion to risk, to develop and exercise a stifling directive style of command. Based upon near-real-time SA, connectivity and reliable communications, higher-level commanders will be capable of communicating their impressions and decisions in regard to tactical events directly to the soldier or leader on the ground, bypassing the chain of command.

The current Canadian Army philosophy of command devolves decision making authority to subordinate commanders better enabling them to deal with the problem of uncertainty and time. In the future battlespace, as technology compresses the time available to make decisions, mission

command will be critical to success. As such, the Army, particularly its commanders, must ensure that it remains true to the philosophy.

HUMAN IN COMMAND

Clearly, tomorrow's leaders will need very high levels of competency to deal with the complexities that their wide-ranging responsibilities will demand. The skills necessary to operate in this technologically rich environment and within the fast-paced operational setting will need to be subjected to continuous upgrading through progressive training and education. The potential for operations in virtually any corner of the globe will dictate the requirement for commanders to be astute in both national and international affairs. Professional military education must continue to expand to include study in economic, political, sociological, ideological, scientific and technological fields. The Army must place a high priority on education that is intellectually stimulating with an emphasis on cognitive skill development.[11]

Furthermore, leaders must excel in the human dimension of leadership. They must possess the ability to build cohesive teams rapidly. They must have the interpersonal skills to communicate and work effectively with diverse groups of people ranging from coalition and intergovernmental organizations to ethnically diverse foreign nationals and the media. Future leaders must excel at critical thinking and must possess high-level cognitive skills that enable them to adjust and adapt their thinking and tactical decision making to rapidly changing operational situations and conditions. They must be able to clearly define their information requirements and have the ability to synthesize understanding of the situation from the information provided.

Culturally aware	Creative
Geo-politically astute	Highly developed cognitive skills
Well educated in:	Adaptable to life-long learning
Economics	Tolerant to risk
History	Highly developed interpersonal skills
Ideology and Sociology	Effective communication skills
Technology	Highly defined aptitude for computer-based learning
Law of conflict	Comfortable with advanced computer-based technologies
Capable of making rapid decisions under stressful situations	Above average maturity

Figure 7-4: Attributes of the Future Leader

Leaders must be trained and educated to develop and clearly articulate their intent. They must develop tactical and technical skills to lead a force that is capable of operating across the entire spectrum of conflict (see Figure 4-1) as part of a joint, combined, national or international coalition operation.[12]

Leaders of tomorrow will be responsible for leading an Army that is increasingly diverse—representative of an ever-changing Canadian society. Soldiers of the future will come from a wider variety of cultural backgrounds than in the past, with an equally wide variety of values. The inculcation of a military ethos and the process of developing a sense of identification with Canada's Army and building on its success will be of continued and perhaps increased importance.[13]   The future focus of moulding leaders must clearly be place on training and professional education. The Army's success will be directly tied to its commitment to developing competent professional leaders with the skills and tools to operate in the 21st Century.

CONCLUSION

The future battlespace will impose stringent demands on Army leaders. Future command will be characterized by increased operational tempo, over-extended areas, all within complex and expanded terrain. Technology will allow for near-real-time information and SA, but it will also carry with it the requirement to filter, analyze and process information to the point that useable knowledge is produced to assist commanders to make timely decisions.

However, that same technology will also provide opponents with equal opportunity. Therefore, decision cycles will have to be swift, and authority devolved to the lowest level, to allow on-spot leaders to make the necessary decisions to capitalize on opportunity. As such, the commander's intent will become critical in providing the guidance and parameters in which subordinate commanders and their soldiers will act.

In sum, the Army must adapt and evolve into a knowledge-based, command-centric, network-enabled force. Technology will provide the tools. However, the Army will have to ensure that it selects capable, intelligent individuals who it will then train and educate continually so that they are able to deal with the complexities and challenges of the future battlespace.

ENDNOTES TO CHAPTER 7

1   Michael Evans, "From Kadesh to Kandahar. Military Theory and the Future of War." *Naval War College Review,*Vol 56, No. 3, Summer 2003, 144.

2   See Terminology Repertoire, Directorate of Army Doctrine, which defines SA as the combined knowledge of friendly forces, hostile forces, the environment and other aspects of the battlespace to include blue, red and brown situational awareness. COP is further defined as a representation of operations that can be tailored by users based on common data and information shared by more than one command. In simplest terms, SA is the understanding of the situation in the local and immediate area and area of responsibility. A COP fuses SA through the commander and his staff who analyse the data and produce a coherent understanding of the situation across the force. The COP facilitates collaborative planning and assists all echelons to achieve situational understanding.

3   DCDS concept paper, "Network Centric Warfare (NCW) in a Canadian Context."

4   Ibid.

5   TRADOC PAM 525-66, *Military Operations—Operational Capability Requirements*, 1 December 1995.

6   This section is based on the work of Dr Ross Pigeau and Carol McCann of the Defence and Civil Institute of Environmental Medicine, specifically their publication *The Human in Command—Exploring the Modern Military Experience* (New York: Kluwer Academic/Plenum Publishers, 2000), 163-184.

7   Ross Pigeau and Carol McCann, *Clarifying the Concepts of Control and Command* (Toronto DCIEM, 1999).

8   The commander's intent is a clear concise statement of what the force must do to succeed with respect to the enemy, the terrain and the desired end-state. It provides the link between the mission and the concept by stating key tasks that, along with the mission, are the basis for subordinates to exercise initiative when unexpected opportunities arise, or when the original concept of operations no longer applies. US Field Manual 101-5 *Staff Organizations and Operations* (Washington, DC: Department of the Army 1997).

9   Mission Command is designed to achieve unity of effort at all levels; it depends upon decentralization. It requires the development of trust and mutual understanding between commanders and subordinates throughout the chain of command, and timely and effective decision making together with initiative at all levels, the keys to getting inside the enemy's decision cycle. See Canada, *Command,* B-GL-300-003/FP-000 (Ottawa: DND, 1996)

10 *Command*, 16.

11 Based on the work of Dr Ross Pigeau and Carol McCann of DCIEM (Quoted in DLSC Future Army Capabilities, 2001); and TRADOC Pamphlet 525-66 *Military Operations—Operational Capability Requirements*, 1 December 1995.

12 TRADOC PAM 525-66, *Military Operations—Operational Capability Requirements*, 1 December 1995, 104.

13 Canada, *Future Army Capabilities—DLSC Report 01/01* (Ottawa: DND, 2001), 17.

CHAPTER 8
SENSE

Success in future operations will require achieving and maintaining information dominance over an enemy or adversary in all phases of conflict.

Canada's Army[1]

BACKGROUND

Future military operations will depend more than ever before on accurate and timely information. An ambiguous and uncertain threat environment will prevent military forces from being able to prepare for potential conflict scenarios in a detailed and comprehensive manner. Accordingly, possession of the capability to collect, process and disseminate information about any area of operations (AO) efficiently and rapidly will be a critical determinant of success. Moreover, the predicted movement towards smaller, more agile forces will also necessitate a greater dependence on accurate and timely information to achieve the tactical overmatch previously gained through mass and firepower. In addition, increased reliance on precision weaponry, and demands of force protection in non-contiguous, asymmetric (i.e. view 2) conflict scenarios, will heighten further the need for precise, accurate and accessible information. Simply put, the capability to collect, process, disseminate and use information swiftly and effectively will be a key determinant of success in future operations.

The *Sense* function is a dynamic, real-time activity. Underpinned by technology, it aims at providing a shared understanding of the battlespace or situational awareness (SA)[2]. In essence, *Sense* is a fundamental enabler of *Command* and an essential component of *Act*, *Shield* and *Sustain*. Although there is considerable overlap between all five operational functions, *Sense* and *Command* are the two that are the most closely integrated. *Command* aims at providing guidance and direction, and in turn, *Sense* provides the information, and ultimately, the picture of understanding within which *Command* operates.

Sense also generates the information and produces the knowledge essential for *Act*, *Shield*, and *Sustain*. *Sense* builds on the current components and concepts of intelligence, surveillance, target acquisition and reconnaissance

(ISTAR) by extending the amount and type of information collected and processed to create an integrated, all-inclusive, accurate understanding of the battlespace at all levels from strategic to tactical, and from commander to soldier. In fact, *Sense* encompasses the entire process and all of the assets used to gain a full situational understanding of the physical, cultural, political, and moral dimensions of the future battlespace.

In the simplest terms, *Sense* is about knowledge, described in the cognitive hierarchy as analyzed information that provides meaning and value. *Sense* entails acquiring and collecting information, usually with respect to a particular battlespace, analyzing and integrating that information, and finally presenting it as knowledge to produce situational awareness. *Sense* is not synonymous with ISTAR, although there is considerable common ground. Nor, is it solely focused on the task of "sensing" the threat. Rather, it is a broader concept that embraces all battlespace information including that pertains to the enemy, non-combatants, the general physical environment, and friendly forces.[3]

THE FUTURE SENSE ENVIRONMENT

The future environment in which *Sense* will operate presents challenges and opportunities. One significant challenge will be the changing nature of the threat. Non-traditional methods of warfare, asymmetrical attacks, non-conventional weapons, civilian combatants, and terrorism are some of the more dominant trends expected in the future security environment. Adversaries who employ these methods of combat or attack create a complex, multi-dimensional battlespace within which to identify and collect information and make predictions about future actions. This type of threat, combined with an increased likelihood that operations will be conducted in complex terrain (predominantly urban environments), may render conventional information collectors and sensors ineffective. Accordingly, new sensors with greater precision and fidelity will be needed to "identify" and "isolate" these threats.

Advances in computing power, communications capacity, and space-based sensors will have significant impact on future *Sense* capabilities. Anticipated improvements in these areas will enable simultaneous, near-real-time sharing of information from collector (sensor) to user and across all levels of command from strategic to tactical. High capacity communications systems will enable collaborative analysis, which, in turn, will lead to more effective, timely and accurate information / intelligence, and ultimately, to better knowledge about the battlespace. Virtual data warehouses and improved knowledge management practices will form the basis of a true global information grid. At the same time, anticipated growth in space-based and

low-orbit sensors will allow for an expanded global monitoring and a near-continuous coverage of specific regions or areas of interest, in effect, providing a near 24/7 over-watch capability.

With such an expanded ability to collect data on the battlespace, the challenge will no longer be deciding where and when to position the sensors, but rather on choosing how and what to process out of the volumes of data collected. In effect, emphasis will shift from managing the collection of information to prioritizing and managing the analysis and interpretation processes.

FUTURE SENSE CAPABILITIES

Sense capabilities will make maximum use of robotics and autonomous intelligent systems. Unmanned aerial and ground vehicles equipped with multi and hyper-spectral sensors will add redundancy, range and accuracy to future reconnaissance and surveillance capability, while reducing the risk to the soldier of having to physically collect the information (i.e. eyes on the target). In time, the requirement for human involvement in traditional reconnaissance and surveillance activities will be reduced in favour of unmanned or

Figure 8-1: UAV in urban centre

unattended sensors. With the possible exception of human intelligence (HUMINT), soldiers in the future will be employed less and less in the physical task of collecting data, and increasingly in the mental task of analyzing and interpreting the data that is amassed.[4]

In the future, a combination of advanced global space-based and tactical air and ground sensors linked to high-volume communication networks and data fusion centres will produce a near-real-time, continuous picture of the battlespace. Although gaps will still exist in this "picture," the level of uncertainty about what might lie beyond the horizon, over the next hill or around the corner of a building will be sharply reduced. As such, the tactical manoeuvre of "advance to contact" to locate and define an enemy force may no longer be necessary.[5] Instead, *Sense* capabilities will provide commanders with near-real-time, accurate and reliable information that will

enable informed decision making as to when, where and how to make contact, if at all.

Sense Capabilities in the Expanded (Open) Battlespace

In the first Directorate of Land Strategic Concepts (DLSC) experiment in 2001, enhanced *Sense* capabilities were identified as an essential requirement for operating effectively in the expanded battlespace.[6] The effective use of precision fires and long-range strike assets depended on a multi-layered array of long-range, accurate sensors, primarily unmanned aerial vehicles (UAV) and space-based surveillance systems, all feeding back to a fusion centre that generated a shared common operating picture (COP). The experiment also employed well-established "sensor to shooter links" that enabled rapid engagements of pre-determined high-payoff targets, thereby, taking full advantage of the long-range target acquisition capabilities of the future land force.

Long-range sensors and a shared, all-informed COP, created a significant tactical overmatch in the expanded battlespace. However, reliance on these systems had the potential of creating a dependency, and consequently, a vulnerability that might have been exploited by an opposing force. As such, shielding of future *Sense* capabilities will be an operational imperative.

Sense Capabilities in the Complex (Urban) Battlespace

Increasingly, future conflicts will be waged in complex terrain, particularly within an urban environment, most likely against an unconventional or asymmetric force. The urban scenario poses significant challenges for reconnaissance and surveillance, both in terms of the infrastructure and terrain, and in accurately assessing the nature of the threat. Buildings and urban clutter mask fields of observation and provide a bounty of cover and concealment for a defending force. Identifying the combatants can also be a challenge when they are not a traditional military or paramilitary organization, but instead are indistinguishable from the civilian population. Indeed, much more detail is required on the environment itself, on critical nodes (e.g. hospitals, water plants, power grids) and on inhabitants in general.

The results of the second DLSC experiment in 2002, again demonstrated that UAVs, and unmanned ground vehicles
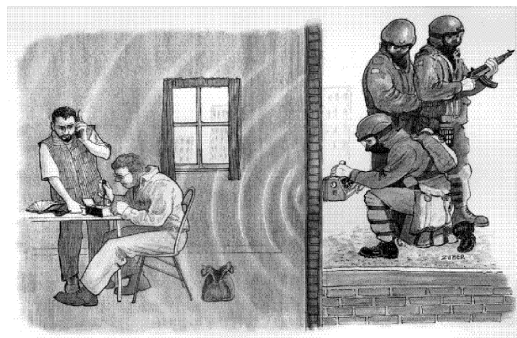
Figure 8-2: Wall radar

(UGVs) and unattended ground sensors (UGSs) provided an essential capability to a force operating in an urban environment.[7] Contrary to the long-range, wide-area coverage needed in the expanded battlespace, the preference in urban operations was for small, shorter range, soldier-operated tactical sensors employed down to the lowest level. Real-time downlinks enabled section and platoon commanders to acquire essential tactical information quickly and in relative safety. Micro-sensor networks and UGS were viewed as mobility enablers, freeing troops from static positions of observation to take a more active role in urban operations. The ability of relatively inexpensive systems to cue other sensors, or elicit a response from a roving patrol or reserve force, was considered cost-effective and enhanced combat power.

HUMAN INTELLIGENCE

In the future, the task of collecting information on the future battlefield will become an increasingly automated function. An exception, however, will lie in the area of HUMINT. Although not immune to technological advances, such as automatic voice translators and improved mobile communications, HUMINT will remain largely a human endeavour, relying heavily on human interaction for information collection.

Indeed, HUMINT is defined as "a category of intelligence derived from information collected and provided by human sources."[8] More than that, HUMINT represents a specific capability for collection, a process of human interaction, and an intelligence product. The complex terrain and asymmetric threat scenarios likely to characterize the future environment may limit the effectiveness of traditional "technical" intelligence gathering techniques. In these cases, HUMINT may become the only viable (or practicable) information source.

HUMINT is also the best means of gaining intelligence about the intentions and perceptions of an enemy, belligerent, or the local population. This information often relates to the moral plane of the battlespace. Understanding it can be as important as knowing the battlespace's physical characteristics.

CONCLUSION

Sense is an overarching concept that extends beyond current capabilities of information collection and processing to link all entities in the future battlespace into an integrated, real-time information grid. The spectrum of the *Sense* function includes enemy, environment, opposing forces, non-combatants, and the full array of friendly information, from positional data to equipment status, to operational readiness and eventually to the health and

well-being of individual soldiers. The product of *Sense* is knowledge, and as such it is a fundamental enabler of *Command* and an essential component of *Act*, *Shield* and *Sustain*. *Sense* represents the entire process and all of the capabilities used to gain a full situational understanding of the physical, cultural, political, and moral dimensions of the future battlespace.

Future *Sense* capabilities will need to operate in an ambiguous, uncertain and unpredictable threat environment in which adversaries may not be easily recognizable and in which they may not employ conventional means of attack or combat. Future *Sense* capabilities will also require greater range, precision, and redundancy. Additionally, anticipated increases in computing power, communications bandwidth, and the exploitation of space will enable near-complete and continuous collection of data on the battlespace. The effect of these advances will be to shift the focus of *Sense* from collection to analysis. Moreover, the increased use of robotics and autonomous intelligent systems to collect and pre-process data will gradually reduce the requirement (and risk) for human involvement in collection tasks. The one exception will be HUMINT, which, for the foreseeable future, will remain an important source of information not obtainable by technical collection means.

In summary, operational success in the future security environment will depend on highly developed *Sense* capabilities to collect, process and disseminate information. The knowledge derived from the *Sense* function will enable smaller, more agile forces to act with precision rather than mass and firepower. *Sense* is the essential component of command. The shared information and knowledge obtained through *Sense* will integrate commanders, staffs and soldiers in a common understanding of the battlespace, which, in turn, will enable each to make informed, coordinated decisions in pursuit of tactical, operational and strategic objectives.

ENDNOTES TO CHAPTER 8

1   Canada, *Canada's Army*, B-GL-300-000/FP-000 (Kingston: DND, 01 April 1998), 116.

2   Canada, *Advancing With Purpose: The Army Strategy* (Ottawa: DND, May 2002).

3   Friendly information includes more than just positional data. It is real-time information on the operational status of individual equipments, weapon systems, vehicles, sustainment assets, and personnel-to include real-time sensors to detect and monitor the physical and mental well-being of individual soldiers. In the future, the array of ISTAR sensors will expand to include "sensors" on all battlespace systems and entities, from single vehicles in a convoy, to weapons platforms to individual soldiers. The Sense function will connect all of these separate entities to a common, shared information grid.

4   This does not necessarily imply a reduced human involvement in the Sense function. Despite significant advances in computing power and data processing over the past decade, for the foreseeable future the analysis and interpretation of information remains a human-intensive task.

5   Lieutenant-Colonel (retd) Robert R. Leonhard, "Factors of Conflict in the Early 21st Century," *Army Magazine*, January 2003.

6   DLSC, "Future Army Experiment: Operations in the Expanded Battlespace," June 2001.

7   DLSC, "Future Army Experiment: Operations in the Urban Battlespace," May 2002.

8   NATO, *Glossary of Terms and Definitions*, AAP-6, December 2002.

CHAPTER 9
ACT

The 21st Century Army will combine the effects of battlespace awareness and precision fires to derive the full potential of strategic speed and dominant manoeuvre.

Major General (retired) Scales, US Army

INTRODUCTION

Act integrates manoeuvre, firepower and offensive information operations to provide a concentration on the desired strategic, operational and tactical effect. In essence, there is a shift in focus from the method (manoeuvre, firepower, information operations) to the desired physical and moral end-state (or effect)— the results gained from the synchronized application of each of these offensive capabilities. This concept is relevant across the continuum of operations, from domestic and humanitarian missions to conflict and warfighting.

As such, *Act* is concerned with both physical and cognitive effects.[1] In order to identify and group broad capability requirements for future land operations, *Act* advocates a methodology based upon three integrated domains close, extended (physical) and information operations (info ops) (cognitive).[2] This methodology further suggests that since the battlespace will include all of these domains at all times there is a synergy to be gained from the close integration and employment of capabilities that can achieve effects across the entire battlespace. As such, *Act* argues for the acquisition of a wider range of capabilities that allow for far more precise and effective actions against adversarial forces. Moreover, it recognizes that knowledge has become a potential centre of gravity (COG).

The *Act* operational function integrates joint, combined and land force capabilities and activities to achieve a desired cognitive and / or physical effect on adversaries. It is fundamentally manoeuvrist in design, defeating opposing COGs both physically and cognitively. In doing so, this function presumes precision—military and often political in application.[3] Consequently, *Act* is tightly linked to the functions of *Command* and *Sense* and is, as already stated, relevant across the spectrum of conflict. Finally, while predominately proactive and offensive in nature, this will not always necessarily be the case.

 In articulating a model of three integrated and interdependent domains, the Army has drawn on allied analysis and its own historical experience. Current Canadian tactical forces predominantly focus on close combat, accepting that our allies can, and will, provide operational and strategic deep operations capability. The danger of relying exclusively on this close combat construct in which our allies will "take care" of the expanded battlespace is that, although marginally suitable for current tactical operations, it lacks organic extended *Sense* and *Act* capabilities that will be required within the future battlespace. This can create severe vulnerabilities in terms of effects reach (or striking power), protection and integration within a coalition force.

Undoubtedly, this could have a significant impact. The challenges facing future tactical land forces include: the multidimensional, physical expansion of the battlespace; the increasingly blurred nature of the threat; the greater tactical velocity and growing lethality of opponents; and the compression of time. Furthermore, in this future battlespace, operations will be conducted simultaneously on land, sea, air, and space, as well as in cyber space. Moreover, operations will be non-contiguous and non-linear (i.e. operations will be distributed throughout the entire battlespace without the historical linear approach where the frontages and flanks of opposing forces delineated the actual battlefield, and where boundaries, report lines and axis of advance defined the scope of manoeuvre of a commander, unit or formation.) Rather, the future operational environment will be
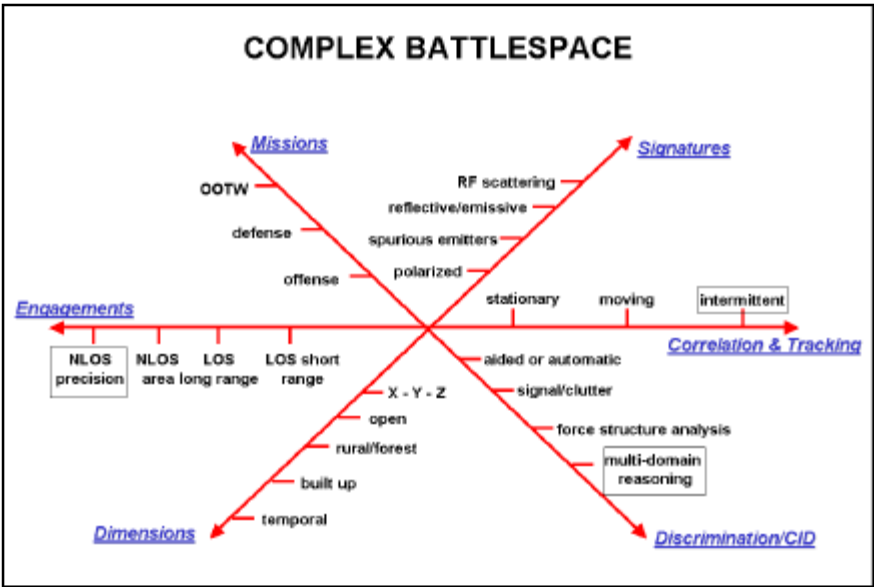
Figure 9-1: Complex battlespace

characterized by numerous parallel and simultaneous operations spanning the entire spectrum of conflict, conducted by diverse, yet interconnected and interdependent forces, dispersed throughout a battlespace that is less dense and with no defined boundaries. In short, close, expanded and information capabilities can no longer be separated, and must be integrated into a single tactical framework that covers the assigned areas of operations (AO).[4] For the Canadian Army, this still remains a tactical construct. However, units and formations will require a suite of capabilities to enable them to execute operations across the entire battlespace.[5] To be capable of Acting effectively, only within a small close combat envelope, can potentially render the Canadian Army irrelevant in the future battlespace.

ACT IN THE FUTURE BATTLESPACE

The expanded and complex battlespace of the future will require new operational methodology. In order to *Act* across the entire battlespace, forces at all levels must be interconnected within a command-centric, network-enabled system that provides situational awareness (SA) and a common operating picture (COP).[6] In the aftermath of the 1991 Gulf War, it became apparent that the key factors of success were best explained within the context of the acquisition and processing of information and the integration of this information into a base of knowledge on which to *Act*.[7] This was further confirmed during the War on Terrorism in Afghanistan in 2001, and during the was in Iraq in 2003. American "information dominance" in both these conflicts denied their opponents freedom of movement and action. In addition, it enabled timely tactical, operational and strategic decision making, and quick action to effect precision targeting and focus info ops.

As these conflicts demonstrated, the integration of information at all levels in the battlespace enables forces to deliver precise lethal and non-lethal effects as required. This capability is critical and has become a predominant and decisive factor in conflict. Simply put, an increased understanding of the battlespace at all levels creates the conditions for decisive, relevant and precise action. In light of political and societal expectations in regards to military action, it can also minimize casualties and collateral damage, thus, increasing the likelihood of domestic and international support.

Understanding the situation within the battlespace is arguably the first and most important step in setting the essential conditions to effectively engage an adversary. Under the conceptual model USECT (Understand, Shape, Engage, Consolidate and Transition), "setting of the conditions" is commonly referred to as shaping the battlespace. It includes all those actions taken by friendly forces that set the conditions for continued operations and their
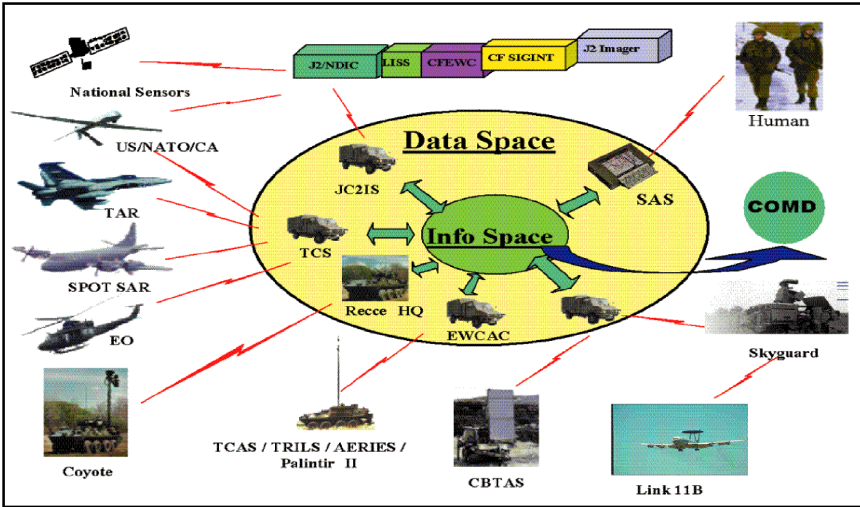
Figure 9-2: Situational awareness

success. It refers to bringing required capabilities to bear and to achieve a desired effect on an adversary at a time and place of your choosing. Simply put, a force shapes the battlespace to achieve operational and tactical objectives by exerting appropriate influence on adversaries and the information environment.

Importantly, actions need not always be lethal to achieve the desired result. A force with information dominance can use *Act* assets (lethal and non-lethal) to shape the battlespace to a degree not previously possible. For instance, a commander may employ info ops through civil-military cooperation (CIMIC), public affairs (PAff), or phychological operations (PSYOPS) specialists to influence an adversary's behaviour, rather than, or in conjunction with, more traditional strike assets. Nonetheless, the necessity to possess "effects" platforms that are capable of shaping the battlespace through the destruction of an enemy's personnel, equipment and infrastructure, or the denial of his freedom of movement and manoeuvre are also critical.

Information operation capabilities and related activities are fundamental to achieving offensive and defensive info ops objectives. Offensive objectives include attacking the perceptions of an adversary's leaders, as well as disrupting or destroying his decision-making and communication COGs. In addition, it also includes influencing non-aligned and/or potential adversarial leaders to support friendly operations, or to remain neutral. Conversely, defensive objectives include protection of command, control, computers, communications, intelligence, surveillance and reconnaissance (C4ISR)

capabilities, specifically focusing on command and control (C2) nodes, computer networks and other means, including individual soldiers. Additionally, defensive objectives also encompass countering or blinding the adversaries' C4ISR capabilities. As such, info ops functions include: synchronized computer network attacks; computer network defence; PSYOPS; deception; electronic warfare; physical destruction; operational security; counter-propaganda; counter-deception; physical security of C2; counter-intelligence; and the related activities of CIMIC, PAff and PSYOPS.

The scope and potential impact of info ops is significant. Info ops can effectively influence ideas, perceptions, beliefs, opinions and decisions to shape the enemy's behaviour through world opinion, his political structure and his population base.[8] It has the potential to determine a desired outcome before even resorting to conflict.

Additionally, info ops can be critical to isolating parts of the battlespace that will be essential as commanders deal with the effects of complex terrain, especially urban areas. Traditional methods of isolating the battlespace, or more correctly portions thereof, have been very difficult, time consuming and resource intensive. However, info ops—ensuring information dominance and thus, keeping the enemy blind and unable to move or manoeuvre his forces, or restricting his options through the court of world opinion—offers an efficient and effective manner in which to achieve the desired degree of isolation. As such, forces must have the capability to achieve as quickly as possible, and sustain, information superiority, and thus, cut off an enemy's internal and external communications as required. This includes exerting control over indigenous radio, television, web-based and other media sources. Quite simply, to control the information flow into, and out of an isolated area, is to separate the enemy C2 system from its leadership. This further prevents the enemy from communicating with its forces and its population base. The overall result is the disruption of the opponent's unity of effort.[9]

In the future, the initial planning stages of any operation must include an aggressive info ops plan that articulates a scheme for continually shaping the battlespace. Commanders must become cognizant of the fundamental importance and requirement to use all their resources to shape the entire battlespace, before engaging an adversary, both in the physical and cognitive domains. Precision effects (both direct and indirect) can be used to create the conditions for tactical manoeuvre.[10] Equally, precision tactical manoeuvre can be used to set the conditions for the use of direct and indirect effects. In sum, precision effects (including manoeuvre) can destroy an adversary's force to improve the friendly / enemy ratio. In addition, it

can deny the enemy the flow of reinforcements and supplies, disrupt its C2, and reduce or destroy its capability to commence or sustain operations over the long-term. Furthermore, precision will enable the destruction of forces in complex terrain, while minimizing friendly and non-combatant casualties and collateral damage.
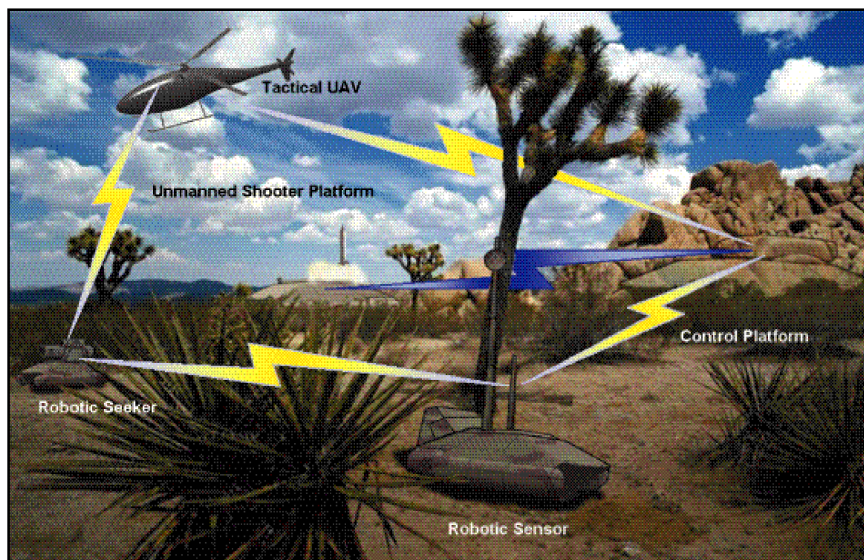
Figure 9-3

Clearly, once information dominance is achieved and the battlespace has been shaped, friendly forces would be in a position to decisively engage their opponent. But, due to precision effects (fire and manoeuvre), operational concepts of the future would also allow forces the ability and freedom to deliver lethal blows to an enemy without becoming decisively engaged in close combat; that is, unless they desire to do so. Based upon the SA and the connectivity of networked effects in support of tactical manoeuvre, smaller forces will be capable of greater destruction at greater distances.

Additionally, due to enhanced *Sense* capabilities, forces will be able to *Act* farther and use precision engagement to mass effects and strike the enemy from multiple directions simultaneously. Within the future battlespace, forces will be widely dispersed and will be massed only when necessary to conduct a specific mission.[11] Moreover, precision munitions and massed weapons effects will increase standoff distances, and while the close battle may not disappear, every effort will be made to avoid close-quarter fighting.

ACT COMPONENTS IN THE FUTURE BATTLESPACE

The non-contiguous nature of the future battlespace will blur current concepts. For instance, the distinction between direct and indirect effects will most likely become obscure as infantry and armour units gain extended capabilities—perhaps negating the requirement for such traditional unit indirect assets as the infantry mortar platoon. Certainly, the respective range bands for both direct and indirect assets will continue to expand and overlap.

In the future, combat platforms will possess line-of-sight (LOS), beyond-line-of-sight (BLOS), and non-line-of-sight (NLOS) capabilities. As a rule, LOS includes those engagements that are not masked by weather or the terrain and can be seen with the naked eye, or with the assistance of viewing devices on the combat platform up to eight kilometres (km). Furthermore, the sensor, shooter and decider are all resident within the combat system engaging the target.

BLOS generally refers to engagements between 8–20 km. In essence, BLOS enables standoff engagements through the exploitation of mobile, or other sensors, to expand their vision into the BLOS band. This extension of direct vision enables engagement using the capabilities of their own platform or other integral effects platforms.

NLOS is traditionally considered indirect fire. In the future battlespace, an extended tactical range of 100 km for a brigade would not be unreasonable. Important to note is that engagement ranges will not be strictly tied to the definitions of LOS, BLOS or NLOS, and all components will be linked and capable of acting across the entire battlespace. It is anticipated that future combat systems will have the capability for LOS, BLOS and eventually NLOS.[12]

The components of *Act* required to effectively shape and then decisively engage adversaries within the future battlespace are noted below. While some of these components fit neatly into the traditional Canadian Army context of the close battle (e.g. integral capabilities)[13], this is not meant to limit capabilities or assign capabilities. Neither is it meant to dictate certain ranges, roles, or define inflexible groupings. Rather, the close, expanded and info ops domains are simply constructs designed to visualize the battlespace. Units and formations must be designed in such a manner as to be capable of operating with all available resources throughout the battlespace:

· **Manoeuvre Forces**. These forces comprise both mounted and dismounted elements, each possessing LOS / BLOS capabilities. They are designed to conduct assigned missions throughout the spectrum of conflict.

· **Indirect Attack Assets**. Manoeuvre forces will continue to be supported by permanently assigned indirect attack assets (lethal and non-lethal). However, the distinction between direct and indirect fire will blur as infantry and armour units gain BLOS capabilities. In addition, this suggests that the current split of responsibilities, based upon the ability to see the target, will shift to engagements based upon target type within the close contact area. Certainly, the respective range bands for both direct and indirect assets will continue to expand and overlap.

· **Affiliated Land Force Attack Assets**. Affiliated land force lethal and non-lethal assets will continue to support manoeuvre forces, albeit at greatly extended ranges. Considerable effort must be made to ensure the establishment of effective linkages between close and supporting forces, such as reinforcing indirect fire elements, attack aviation, and offensive electronic warfare (EW) systems.

· **Air and Maritime Attack Assets**. There will continue to exist the need for a maritime and air-land attack capability. Given the future security environment and the likely types of operations in which the Canadian Army will become involved, maritime and air assets must be closely integrated and capable of providing direct (air / sea to ground) support to land operations.

· **Air Manoeuvre Forces**. Air manoeuvre forces comprise attack aviation and / or air assault forces. Air manoeuvre groupings may include attack aviation elements, aviation support and service units (often including utility or medium lift aviation) and helicopter-borne ground manoeuvre and shield (especially air defence) assets. In general, air manoeuvre forces are increasingly organizing around the attack helicopter as the key weapon system, particularly in View 1 operations. Integrated ground manoeuvre assets are now routinely being used as a method to project attack aviation, establishing and securing forward operating bases from which aviation can strike more effectively throughout the battlespace. This does not deny the utility of air assault forces, especially against a weaker enemy force or in View 2 operations, but rather reflects the increasing power and capabilities of attack aviation.

· **Strike Forces**. Strike forces provide extended and precise fires. These forces include the multiple launch rocket system (MLRS) and surface-to-surface rocket systems. Improvements to these

systems, both in terms of carrier rockets and sub-munitions, allow for the accurate engagement of large target groupings. The development of munitions possessing autonomous terminal guidance, coupled with extended sensor systems, will transform the relationship between traditional "direct" and "indirect" weapons systems. Future strike operations may well include advanced unmanned aerial vehicles (UAVs) equipped with targeting and / or weapons systems, supplanting or replacing traditional extended range strike systems. In addition, remotely emplaced weapons systems (the "rocket-in-a-box" concept) may also serve as a form of extended range firepower, allowing for engagements throughout the depth of the battlespace.

· **Asymmetric Operating Forces**. These forces include elements that attack both physical and cognitive targets. They are comprised of such entities as special operations forces (SOF), PSYOPS forces and CIMIC elements. These forces provide the capability to shape or strike adversaries, as well as provide extended sensing capabilities. As such, they are extremely useful across the spectrum of operations.

· **Electronic Warfare (EW) Assets**. During the conduct of operations, EW elements must have the capability to conduct electronic countermeasures (ECM), including electronic jamming, electronic deception and electronic neutralization. In addition, these capabilities must include the ability to acquire, define, record and hand-off targets.

· **Deception Assets**. Deception at every level requires detailed planning and coordination-synchronizing all activities against a specific target set. Even at the tactical level, deception requires a good understanding of enemy intentions, situational awareness, clear direction, the tasking (or even creation) of specific units to achieve this mission, and the allocation of proper equipment and resources.

· **Psychological Operations (PSYOPS) Forces**. Psychological operations are designed to influence specific target audiences, employing relevant and credible messages to achieve this aim. PSYOPS provide the reverse image to deception, yet the two must be integrated and considered as a whole within the broader context of the plan. Although not specifically PSYOPS resources, CIMIC and PAff capabilities must be considered, and when necessary, synchronized with psychological operations.

- · **Computer Network Attack (CNA)**. CNA can be executed in a variety of ways including the use of ECM. Although currently of limited value to the tactical land battle, CNA will likely increase in importance given the proliferation of land force tactical computers. In addition, technology will facilitate the rapid selection and neutralization of specific computer systems within the tactical battlespace.

CONCLUSION

If the Army continues to adhere to its present tactical construct of close combat, which essentially dominates Canadian Army doctrine, it may soon become irrelevant. The complex and expanded battlespace of the future, characterized by increased tempo and non-contiguous operations across greatly increased ranges, will dictate that units or formations will have to have the integral capabilities required to act effectively across the entire battlespace. In simplest terms, this means the Army cannot continue to rely on, or assume that our allies will continue to provide those capabilities that are too expensive or specialized to acquire or maintain. To remain relevant, the Canadian Army must have a credible capability to act within coalition operations within the future battlespace. Increasingly, it will be difficult to remain a tactically decisive, relevant force by structuring the Army on a footing of "general-purpose capability." The battlespace of the future is changing. To meet its complex requirements, the Canadian Army must evolve into a force that possesses a suite of integral *Act* capabilities if it is to remain a credible and effective fighting force.

ENDNOTES TO CHAPTER 9

1   See Chapter 5 for discussion of physical and cognitive dimensions.

2   This chapter builds on previous DLSC work—see Canada, Director Land Strategic Concepts Report 01/01, *Future Army Capabilities* (Kingston: DND, January 2001), 23-24.

3   In "View 1" operations, an example of military precision would be the destruction of critical Iraqi Air Defence nodes by land aviation as a precursor to the initiation of the air campaign. An example of political and military precision in "View 2" would be the identification and arrest of suspected war criminals in the Former Republic of Yugoslavia.

4   See Chapter 4.

5   See Chapter 4 for additional details. Battlespace complexity will increase exponentially due to factors such as the asymmetric nature of the threat, the antagonists' choice of urbanized terrain, blurred operations, expansion of the battlefield, the technological / human interface and the exploitation of real-time media coverage.

6   See Terminology Repertoire, Directorate of Army Doctrine, which defines SA as the combined knowledge of friendly forces, hostile forces, the environment and other aspects of the battlespace to include blue, red and brown situational awareness. COP is further defined as a representation of operations that can be tailored by users based on common data and information shared by more than one command. In simplest terms, SA is the understanding of the situation in the local and immediate area and area of responsibility. A COP fuses SA through the commander and his staff who analyse the data and produce a coherent understanding of the situation across the force. The COP facilitates collaborative planning and assists all echelons to achieve situational understanding.

7   Randall Whitaker, "Desert Storm—The Evidence for Third Wave Warfare," November 1995, http://www.informatik.umu.se/~rwhit/GulfWar.html

8   US TRADOC Pamphlet 525-66 *Military Operations—Force operating Capabilities*, 28-29.

9   US JP 3-06 *Fundamentals for Planning and Conducting Joint Urban Operations*, II-11

10 US Joint Vision 2020 *America's Military: Preparing for Tomorrow* defines precision engagement as the ability to locate, survey, discern and track objectives or targets; select, organize and use the correct systems; generate desired effects; assess results; and reengage with decisive speed and overwhelming operational tempo as required throughout the full range of military operations.

11 Precision manoeuvre involves a cycle of dispersion, concentration and further dispersion in harmony with the operational tempo. This will require information domination and precision engagements.

12 US TRADOC Pamphlet 525–66 *Military Operations—Force Operating Capabilities*, 45-57.

13 Integral capabilities comprise those forces permanently grouped within an organization. These forces usually include manoeuvre forces and permanently assigned direct and indirect attack assets (lethal and non-lethal).

CHAPTER 10
SHIELD

The only thing I ever learned in the defence world is that the unexpected always happen. When I was Secretary of Defence, I remember asking two questions: how many times since World War II had British troops been engaged in hostilities? The answer was 40 times. And how many times had the circumstances been foreseen and plans made? Only twice.

Lord Carrington, UK Secretary of State for Defence, 1970–1974

INTRODUCTION

Although striving for overmatch and extended engagements is critical to achieving success in the future battlespace, defensive measures must never be ignored. To be capable of fighting at all, soldiers must first be able of surviving, both physically and mentally. As such, the *Shield* function is a layered, integrated and fully-dimensional operational function that seeks to prevent any influence on friendly forces across the physical, moral, electromagnetic or cyber planes that could affect survivability or freedom of action.[1]

Indeed, *Shield* extends beyond traditional definitions of force protection and security to include all aspects of protection on both the physical and cognitive planes in the battlespace. *Shield* incorporates all aspects of the soldier's physical protection, health and welfare, as well as the physical protection and integrity of the operational unit or formation, its sustainment system and the homeland.[2] The concept of *Shield* also extends to include non-combatants, physical property and infrastructure, information and information systems. *Shield* integrates the activities of warning and detection with the appropriate protection and countermeasures.

Clearly, all armed forces engaged in combat or employed in a potentially hostile battlespace depend upon some degree of *Shield* for their survival. Additionally, civilians employed by the Army in the battlespace (e.g. contractors) also depend upon the *Shield* capabilities of the Army. In the simplest terms, *Shield* is an operational enabler that increases the survivability and freedom of action of a military force. The effective employment of *Shield* capabilities will reduce or mitigate the effects of an enemy attack, thereby conserving a friendly force's combat power and cognitive well-being. Although *Shield* itself cannot achieve victory, failure to *Shield* can result in defeat.

In addition to the military operational imperatives for *Shield*, there are equally compelling moral and political reasons for developing more effective protection capabilities. On purely moral grounds, the value of human life demands that modern armies employ all available measures to prevent or mitigate the impact of foreseeable threats to soldiers. Despite the inherent risks of combat, the protection and preservation of life and limb must remain a priority. Western democratic societies (both the political and public sectors) have a low tolerance for casualties or collateral damage. This intolerance often manifests itself in a general reluctance within a society to undertake military action, or as in the case of American forces in Somalia, an overwhelming public outcry to withdraw from operations because of casualties. Thus, in those instances when Canadian Forces (CF) are committed to combat, or are deployed into a hostile environment, it is incumbent upon the Government and its military to take every possible measure to ensure force protection and minimize casualties.

SHIELD IN THE FUTURE BATTLESPACE

Shield capabilities are primarily passive (e.g. stealth, and wearing nuclear biological and chemical defence (NBCD) ensembles). However, some capabilities, such as air and missile defence, employ active means to engage a threat before it can cause harm. When confronted with a known threat, there are two possible courses of action: undertake proactive offensive action (*Act*) to defeat, subdue or neutralize the threat;[3] or take defensive measures (*Shield*) to protect against the effects of the threat. In the latter case, the aim is to survive through avoiding detection, or if detected, the use of protective measures.

While the soldier remains the key resource to protect, *Shield* capabilities are also required to safeguard critical systems and capabilities (e.g. command and control (C2), sensors, information networks, sustainment capability). Toward this end:

- *Shield* can either be a physical or a procedural capability (e.g. OPSEC (operational security), tactical movement, or standard drills).

- *Shield* capabilities are threat-based. Capabilities must be flexible and adaptive to changing threats and environments. Consequently, highly effective battlespace situational awareness (SA) will help ensure that soldiers are shielded through avoidance of surprise (i.e. always know what is happening, know where potential threats are, and know how to avoid being harmed by those threats).

SHIELD ON THE PHYSICAL PLANE

Physical *Shield* is a system of integrated and overlapping capabilities built from the soldier up. It must be present across the entire continuum of an operation, to include deployment, movement, and manoeuvre in and out of theatre areas (especially in the battlespace). It must account for all force elements present in the battlespace and not concentrate solely on combat elements. For example, *Sustain* entities that are working and operating in the same threat environment must also be adequately protected. To appreciate what can happen when physical *Shield* is ignored in any segment of the battlespace, one need only look at the American experience during the invasion of Iraq in 2003, where a US Maintenance Company was ambushed in the rear area. The result comprised of fatalities, wounded personnel and the capture of a number of US soldiers. Significant numbers of combat troops were subsequently taken from their primary task and employed (after the fact) as the *Shield* capability for US lines of communication spanning from Kuwait to Baghdad. In the end, the American maxim is relevant— don't be seen, if seen don't be acquired, if acquired don't be hit, if hit don't be killed. As such, physical *Shield* includes:

· Protection against enemy ballistic, blast and projectile effects (including air / missile attack).

· Protection of friendly networks / systems from cyber attack.

· Protection from laser dazzles and the blinding effects of smoke.

· Protection from enemy information operations.

· Protection from weapons of mass destruction (e.g. NBC early detection / warning systems, integral platform NBCD systems and soldier NBCD ensembles).

· Protection from active medical threats (i.e. subsequent to becoming a casualty), a condition advanced by such measures as casualty evacuation and treatment in the battlespace.

· Protection (including preventative and corrective medical treatment measures) from passive threats such as hazardous climates (e.g. extreme heat / cold and dehydration) and environments (e.g. toxins, disease, wildlife).

· Protection against surprise. Toward this end, SA is vital to survival across the entire battlespace. SA will enhance the soldier's ability to be proactive, avoid surprise and, thus survive. In a poorly understood

situation, surprise can come from friendly forces as well as the enemy. Loss of life due to friendly fire is a reflection of inadequate *Shield* measures within the safe embrace of SA. Friendly fire incidents have the potential to undermine the morale of an otherwise highly motivated combat force.

· Passive protection from detection (e.g. stealth-advanced camouflage, mobility, cloaking devices (chameleon-type) and deception).

· The proactive ability to apply lethal *Act* effects against a potential threat before it can engage.

Figure 10-1

Technology promises some dramatic advancement in *Shield*. For instance, nano-science promises to revolutionize the way the physical *Shield* capability is viewed. Scientists at the Massachusetts Institute of Technology (MIT) are currently pursuing revolutionary new designs for individual protection. They revealed, "in the not-too-distant future, American soldiers may wear Kevlar vests that will protect against biological agents as well as stop bullets. With the flick of a switch, the sleeves of their uniform may stiffen into anti-shrapnel armour or a medical splint."[4]

In addition, MIT scientists are attempting to drastically reduce the weight soldiers would have to carry. Success in this area would contribute to the physical *Shield* of the soldiers by reducing fatigue / exhaustion. This would be especially true for light forces working for prolonged periods in complex terrain and in hot climates. The scientists assert that their goal is to design a multi-functional uniform with built-in features that would decrease the weight of gear from more than 100 pounds to 40 pounds, with an eventual end-state of only 15 pounds.[5]

Figure 10-2

SHIELD ON THE COGNITIVE PLANE

Cognitive *Shield* includes all measures aimed at protecting soldiers' cognitive well-being. It encompasses all protective measures taken to defeat attacks against the "mental fortitude" of personnel engaged in operations (i.e. their will to complete their mission). The key to the cognitive well-being of soldiers is to *Shield* them as fully as possible from potentially "stress inducing" situations. Attacks on the cognitive plane can involve:

·   **Physical Attacks against the Homeland**. Assurances as to the safety of the home nation (especially a soldier's immediate family) are central to a soldier's ability to concentrate on the mission. Attacks against the nation, if allowed to continue unabated, can quickly erode the confidence and morale of soldiers while deployed away from home. If soldiers cannot be assured of the safety of their families when they are physically unable to help, their "commitment" to the mission or operation, or larger cause can falter. The result could be catastrophic. If on the other hand, an attack on the homeland is defeated or appropriate measures are taken to prevent further occurrences, soldiers will be more inclined to remain committed to the mission / operation (probably more so to the extent that they are secure in the knowledge that the threat is real and the realization that what they are doing is contributing to its defeat). Consequently, the Army should make every effort to assure soldiers that the home front is safe.[6] Assurances as to the Nation's support for the cause for which soldiers are committed, and perhaps fighting and dying for, is also critical to a soldier's cognitive well-being. A deployed force's collective mental fortitude toward completing a task would be severely undermined should its own people fail to support the mission.[7] Consequently, there should be a high priority afforded by the Army to ensuring its soldiers believe in what they are doing (i.e. a moral and honourable thing to be doing).

·   **Internal Uncertainty and Turmoil**. The Army must also be cognizant of the need to *Shield* soldiers from attacks on their cognitive well-being that originate from internal uncertainties and the turmoil which often accompanies combat. Toward this end, shielding soldiers will be enhanced by:

·   **Maintaining Mission Legitimacy in the Minds of the Soldiers**. Initially, mission legitimacy will be established by a just cause (e.g. a morally justified war). However, as an intervention (or operation) progresses, mishaps, errors, collateral damage, or immoral behaviour on the part of soldiers (e.g. Canadians in Somalia), can lead to civil unrest (in theatre and at home). This type of development can

quickly undermine mission legitimacy in the minds of soldiers and / or place soldiers in harm's way by having them viewed as "the enemy", and by default, part of the problem, vice a force which is there to help. Accordingly, efforts to reinforce a belief in the just nature of the mission are essential throughout its course.

· **Well-defined Rules of Engagement (ROE)**. Although not often considered as a factor in *Shield*, well-defined ROE combined with soldiers who are well-versed in them, can play a key *Shield* role on the cognitive plane. Strict enforcement of the ROE can *Shield* soldiers against acting inadvertently in an inappropriate manner. Furthermore, soldier confidence in the mission will not falter if soldiers believe they have appropriate ROE and that their actions (within the ROE) will be subsequently supported in a court of law.

· **Ensuring Proper Relationships with the Indigenous Population**. Portraying the proper image to the indigenous population is key to *Shield*. Soldiers who believe in what they are doing (i.e. the legitimacy of the mission), combined with a local population that supports the military intervention and recognizes it is in its best interests to cooperate, will engender an environment that is conducive to mission accomplishment.

CONCLUSION

In the end, *Shield* encompasses all-inclusive actions and steps to protect the most important resource in battlespace—the individual soldier—as well as the other platforms and friendly force systems required to ensure freedom of action. An absolute *Shield* capability spans every element of the physical and cognitive planes across the entire battlespace and on the home front. As such, *Shield* must include a mix of active and passive measures to assure the best possible chance of surviving against the myriad of threats (both physical and cognitive) likely to exist in the future battlespace. After all, to succeed and win while deployed operationally, soldiers must be secure in the knowledge that they are shielded by the very best individual soldier systems, weapons platforms, health care, and casualty evacuation systems. Additionally, they must remain firm in the belief that their cause is just, that their families and loved ones are safe, and that they have the support of their nation. In sum, the *Shield* function is responsible for ensuring that these complex and interrelated issues are effectively addressed.

ENDNOTES TO CHAPTER 10

1 Shield definition derived from the *DLSC Operational Function Working Group*, November 2002.

2 Indeed, given its importance, sustainment elements in the future battlespace must be afforded the same protective measures as their combat arms counterparts.

3 This may include pre-emption similar to the Bush Administration's policy in the US-led war against terrorism, but at the tactical level in the battlespace.

4 S. Schrrow, "MIT Targets High Technology Innovations for U.S. Soldiers," *Boston Herald*, January 2002, http://www.smalltimes.com/document.

5 Ibid.

6 This will require a joint military and governmental effort with the Army playing an important, but not necessarily leading role. For instance, the Army could provide NBCD support and train / assist local authorities in disaster relief, and supplement health-care workers when absolutely necessary.

7 Examples-the eventual waning of US national support during Vietnam, and more recently, the potential waning of US and/or UK (United Kingdom) national support for continued involvement in Iraq and the effects that a waning of public opinion would have on the soldiers' resolve to continue with the mission.

CHAPTER 11
SUSTAIN

A logical extension of changing the way warfare is undertaken is the requirement to consider and adapt the way forces logistically prepare and sustain forces. It has been said that there will be no Revolution in Military Affairs (RMA) unless there is a complementary Revolution in Military Logistics (RML).

D.J. Reimer[1]

INTRODUCTION

Sustain is one of the Army's five core operational functions. It encompasses logistics (i.e. supply, transportation, maintenance and health care) along with personnel support, legal, financial, religious, public affairs and sustainment engineering services.[2] However, this report will focus solely on logistics—the science of planning and executing the movement and maintenance of forces.

Not surprisingly, the present Canadian Forces (CF) sustainment system is dated. It comprises a hierarchical chain of relatively secure support echelons designed to sustain a Cold War linear battlespace. Each echelon in effect represents a "stockpile" of some type. Ill-equipped and labour-intensive, the system relies upon mass (e.g. stockpiling) to reduce the effects of uncertainty, inaccuracy and slow planning cycles.[3] Moreover, it does not efficiently use industry's containerized distribution system.[4] As already highlighted throughout this document, rapid, dispersed, non-linear/non-contiguous manoeuvre operations and precision effects will characterize the future battlespace. Emphasis will be on dominating the information spectrum and establishing, and subsequently maintaining, high-tempo operations. Real-time situational awareness (SA) will increasingly characterize the entire battlespace. This will allow commanders at all levels to make timely and informed decisions, thus enabling them to maintain the initiative throughout an entire mission. But, the Army's current sustainment structure and distribution system are not conducive to operating effectively in such an environment.

Such a high-paced environment will require a revolution in the manner by which the Army provides sustainment support. The fluidity of the future battlespace, coupled with the operational commander's desire to relentlessly maintain the initiative through high-tempo operations over extended distances, will demand an extremely agile, flexible and proactive sustainment system. However, to a large degree it will be the sustainment system that will determine the tempo of future military operations. As tactical army units (TAUs)[5] of the future Army will have to be tailored for specific missions and terrain, so too must the future sustainment system. Toward this end, it will be necessary to find the appropriate balance between reducing the sustainment footprint and still assuring high levels of responsiveness.

As such, the Canadian Army must change the current practice of reacting to demand for sustainment services and/or pushing massive quantities of supplies forward to the theatre of operations (e.g. stockpiling) despite the lack of a definitive requirement. This inefficient system / process must be replaced. It must transform to a proactive/anticipatory sustainment system where predicting requirements becomes the standard. The future sustainment system must function as a continuous pipeline of supplies with all segments of the pipeline interfaced and working together as one entity.

This transformation must begin immediately to ensure that the proper partnerships are developed, and more importantly, decisions are made to assist the sustainment community in attaining the required end-state. For example, new combat system designs must incorporate those technologies that contribute the most toward the overall reduction of demand. In the end, robust TAUs and technologically-advanced *Sense* and *Shield* elements will matter little if forces cannot be sustained. Simply put, inadequate sustainment will lead to failure in the future battlespace. Accordingly, the reduction of the sustainment footprint must be a key priority for future defence investment.

REDUCING THE SUSTAINMENT FOOTPRINT IN THE FUTURE BATTLESPACE

Reducing the sustainment footprint is central to implementing a sustainment system that is able to operate effectively in the future battlespace. The sustainment system must be knowledge-based. Moreover, it must transition from the current supply-based system to a distribution-based system. Distribution-based sustainment includes: visibility; management and transportation of the resources flowing to supported forces; and the information systems, communications, physical and resource networks of the distribution system.[6] Precise velocity distribution will be a hallmark of its design. It will incorporate asset visibility throughout the sustainment pipeline and SA across the entire battlespace.

Furthermore, sustainment equipment must be conducive to operating in a non-contiguous battlespace where non-secured lines of communication (LOC) will be common and resupply not always possible via traditional ground transport. A containerized distribution system, as well as configured loads (CLs)[7] will be key enablers of this velocity-capable sustainment system.

The task of the distribution-based sustainment pipeline, once a CL has been inputted, will be to move the CL as quickly as possible (i.e. velocity-capable) to the user. An effective sustainment information management system (SIMS) capable of real-time total asset visibility (TAV) and SA, along with decision authority pushed to the lowest viable level, will be a key enabler to this occurring. Furthermore, pulsed resupply will assure units of mission self-sufficiency. The result will be a streamlined system featuring inventory reductions, much quicker response times, and a drastically reduced logistical footprint.

Nonetheless, to achieve the desired sustainment system, the following critical areas must be emphasized:

· Reducing demand.

· Knowledge-based sustainment system.

· Distribution-based sustainment system.

· An appropriately equipped distribution system.

· Mission self-sufficiency.

· Containerization.

· Predictive equipment maintenance programme.

· A world-class battlefield health care system.

Reducing Demand

Figure 11-1
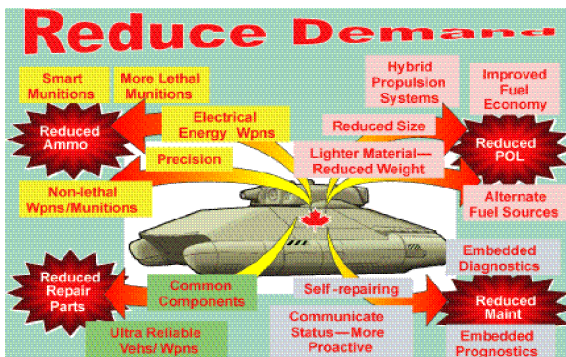
The single most important challenge for the Army will be to do everything possible to reduce demand.[8] A reduction in the overall demand of material and consumables is central to reducing the overall sustainment footprint in the future battlespace. To be successful in reducing

137

demand, everything the Army does will have to be measured against the impact it will have on the sustainment system. Consequently, a *sustainment impact* step should be an integral component of the Army's Strategic Planning Process.[9] Critical to achieving a reduction in demand will be:

· **Reducing Consumption**. A reduction in consumption in any of the following vital areas will have a direct impact on the volume of supplies that the distribution system must process; hence, a reduction in demand:

  · **Water**. Soldiers cannot function without water. In some environments, a prolonged period without water can be measured in hours. It represents the largest demand by volume on the sustainment system. Consequently, every effort should be made to have water produced as far forward in the battlespace as possible. This includes installing water production systems on every major vehicle (Class A, B and C), providing soldiers with individual lightweight water production systems, and introducing propulsion systems that produce water as a bi-product (e.g. hydrogen hybrid systems).

  · **Fuel**. Reducing the demand for fuel is one of the leading ways to decrease the sustainment footprint. Toward this end, future propulsion systems that use traditional fossil fuels should be designed to achieve a minimum improvement of 200–300 percent in fuel efficiency. The Army's longer-term objectives should envision major equipment less dependent on fossil fuels. Hybrid propulsion systems offer significant advantage in this area.

  · **Ammunition**. Ammunition capable of enhanced range, increased precision and lethality is becoming significantly more prevalent in the modern battlespace. Out-ranging the enemy and introducing the concept of the one-shot kill will dramatically reduce the demand for ammunition (both in volume and nature) and the number of times weapon systems are fired. This in turn will lead to less weapons systems required, reduced requirement for heavy lift, fewer spare parts, fewer repair teams and fewer replacement components.

  · **Power**. Without power the Army's high technology suite of equipment would be rendered useless. Yet, the Army's dependency on power sources will become more acute in the future battlespace. Consequently, the sustainment task of supplying power in the future will become increasingly vital. To assist, reducing the demand for power can be achieved by focussing on two main areas: the introduction of advanced power sources; and limiting the amount of

power-consuming equipment. New technologically advanced power sources are a fraction of the size / weight of today's batteries and provide significantly more power for longer periods. Subsequently, the Army should insist on reusable power sources that are at least a tenth the size of current ones, equipment that consumes as a minimum 50 percent less power,[10] and the standardization of power sources across the entire battlespace.[11]

· **Repair Parts and Major Assemblies**. Practically all material/ equipment found in the battlespace requires some level of regular maintenance in order to sustain its operation. Moreover, significant tactical lift is committed to moving repair parts and assemblies forward, and large segments of infrastructure are needed to store them. Ultra-reliability of repair parts and assemblies, along with embedded diagnostics and prognostics in major equipment, would contribute greatly to a reduced demand in this area.

· **Reducing Size and Weight**. Everything in the battlespace has mass. This represents the total weight and volume of demand having to be moved by the sustainment system. Thus, reducing the mass of items will contribute significantly to reducing the overall demand. Key focus areas for reducing size and weight should be:

· **Armour**. Replacing current armour with lightweight but stronger materials and developing smaller vehicle platforms will substantially reduce demand on fuel and lubricants, and improve air deployability of key weapons systems. Stress on vehicle suspension systems will also be reduced, thereby reducing demand for spare parts and maintenance effort. For example, if a 20-ton armoured vehicle could be replaced in 20 years with a substantially smaller platform weighing 50 percent less, it would have a dramatic impact on the sustainment system.[12]

· **Individual Soldier Loads**. Reducing the mass of the gear carried by today's soldiers would significantly contribute toward reducing demand. It would also lessen the energy drain on soldiers due to the decreased weight being carried, especially true for light forces working for prolonged periods in complex terrain and in hot climates. Nanotechnology promises to provide significant changes in this area. For example, scientists at the Massachusetts Institute of Technology (MIT) are using nano-science to design a multi-functional uniform with built-in features that would decrease the weight of gear from more than 100 pounds to 40 pounds, and eventually down to only 15 pounds.[13]

- **Lightweight Containers**. All consumables should be transported in modularized containers that are constructed of ultra-light materials. This includes International Organization for Standardization (ISO) containers and the actual containers used to pack/store commodities that would go into the ISO containers. As a result, the overall weight being transported by logistic vehicles would be reduced, thereby enabling the acquisition of smaller, more lightweight logistics vehicles, which in turn would reduce fuel consumption and maintenance effort. Lighter containers would also increase the payloads feasible for delivery by air.

Knowledge-based Sustainment System

The Army must strive toward a single command-centric sustainment system. Such a system would facilitate sharing of accurate real-time sustainment and operational information along the entire LOC. Essential to a command-centric sustainment system are:

- **Sustainment Information Management System (SIMS)**. A dedicated and secure SIMS would span all sustainment echelons and be seamlessly fused into the overall battlespace communications system. The ultimate SIMS would have global reach and the capacity to deliver critical unimpeded real-time logistic information (see Figure 11-2). By tracking the readiness condition of the manoeuvre forces throughout the entirety of a mission, both the operators and sustainment personnel would be better able to manage risk and avoid surprise. Hence, the sustainment commander and staff would be able to anticipate demand, calculate the arrival of assets, and make appropriate real-time adjustments to the sustainment plan in synchronization with the common operating picture (COP). Sustainment personnel would be able to see, understand and subsequently act readily and accurately in support of the operational commander's requirements with speed and accuracy not previously possible, thus establishing SIMS as a critical planning tool.
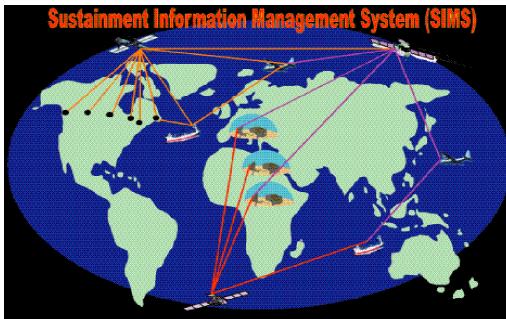
Figure 11-2

- **Total Asset Visibility**. TAV is critical throughout the entire distribution system.[14] It provides real-time visibility of assets and enables real-time sustainment control and distribution management. The Army must have the visibility of all assets in the pipeline and the ability to move those assets where threats and priorities dictate. Consequently, this includes an

easy means to query the contents and location of containers from the moment they enter the sustainment pipeline all the way to the final user. It also implies that the detailed contents of any container would be available on demand to anyone within the sustainment system.

Distribution-based Sustainment System

A distribution-based sustainment system is a highly responsive pipeline within which all sustainment commodities flow forward to the end-user in a precise, fluid, controlled and deliberate manner. The flow's volume can be adjusted up or down, the CLs adjusted and/or the direction of flow changed as necessary in response to rapidly changing tactical situations. Simply put, the sustainment rhythm can be increased or decreased as necessary to synchronize with the operational commander's battle rhythm. Fundamental characteristics of a distribution-based sustainment system include:

· **Balance in Design**. There will always be a limit on how small the sustainment footprint can get without degrading support to the manoeuvre units. A balance between austerity (e.g. the bare bones—the just-in-time mentality) and insurance against the unexpected (e.g. the stockpile—the just-in-case mentality) will always be a challenge in sustainment planning. Striking the optimum stability between the two management philosophies is a balancing act between efficiency[15] and effectiveness.[16] In effect—exercising risk management. Battlespace SA, TAV, a dedicated SIMS and the proper equipment will be key to achieving the most favourable balance, and thereby mitigating risk.[17]

· **Organizational Modularity**. Organizational Modularity refers to scalable, versatile and adaptable capabilities that can be rapidly reorganized into effective sustainment units for specific missions and environments. Sustainment organizations must have the capacity to scale up / down in size as well as in technical capability. A modular approach will enable the sustainment commander to attain the appropriate balance / mix of sustainment capabilities.

· **Precision and Flexibility**. Sustainment and operational SA will enable sustainment planners to forecast (with near-perfect accuracy) the moment-to-moment needs of the manoeuvre units. Precision combined with flexibility will ensure delivery of support to the right place at the right time and in the exact configuration needed.[18] A precise and flexible sustainment system will result in quicker response times with distribution cycles significantly reduced. Through the timely flow of accurately calculated CLs there would also be a significant reduction in inventory holdings, sustainment personnel, and material handling equipment and waste would be minimized.[19] The end result would be that resupply of

manoeuvre forces would occur less often (i.e. via precisely configured pulsed loads), and only against a defined requirement.[20]

· **Survivability**. The protection of sustainment assets within the future battlespace will be a significant challenge given that LOC will be more vulnerable than ever before. Consequently, sustainment elements could be required to fight commodities forward along non-secure LOC. For this reason, it is absolutely critical that the future sustainment system be sufficiently robust. Two contributing factors for survivability will be:

Figure 11-3

· **Well-protected Logistic Platforms**. Logistic prime movers will require appropriate ballistic protection. Some may need to be simply another variant of a common family of combat vehicles with the same mobility, ballistic protection, and direct firepower for self-protection (see figures 11-3 and 11-4).[21]   Logistic vehicles providing supplies directly to combat vehicles should be equipped with a fully automated ammunition handling sub-system, thereby allowing the crew of the re-supply vehicle to transfer the full ammunition up-load within minutes and under armoured protection (see figure 11-5).[22]

· **Well-dispersed Sustainment Footprint**. A well-dispersed sustainment footprint would

Figure 11-4

have small temporary holdings of fast-moving loads (CLs) in transit along the LOC. Faster and more abundant / robust delivery platforms would ensure that these temporary holdings would only remain stationary for as long as is tactically required, thereby offering few (if any) concentrations of sustainment assets as targets along the LOC. There would be no static sustainment installations in the forward area.
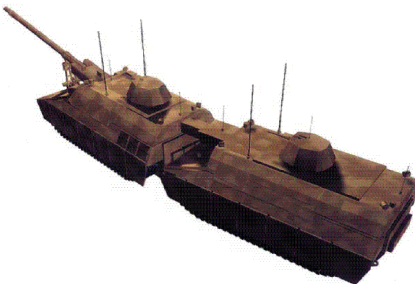
Figure 11-5

An Appropriately Equipped Distribution System

The Army's fleet of medium and heavy standard military pattern (SMP) vehicles (less the palletized loading system (PLS) variants) are unable to transport ISO containers. Furthermore, they are not compatible for transport by C-130 Hercules aircraft, and therefore unsuitable for rapid deployment by air. Needless to say, the future Army sustainment system must be capable of moving logistic assets along the entire LOC in a precise and controlled manner from the moment the system takes control of these assets until they are delivered to the end-users. Flexibility will be vital to achieving a sustainment system that is able to easily and quickly adjust its posture in response to a changing operational situation, without having to undergo major change itself. Moreover, redundancy in the number and types of delivery platforms will be central to making the system sufficiently robust to adjust to temporary disruptions in flow. When interdicted, the system must "self-seal" and continue the forward flow of sustainment.

Essential to success will be a balanced combination of technologically advanced containers, container-handling equipment, ground delivery platforms (ISO-compatible) and unmanned precision aerial delivery systems. While army staffs continually study ways to improve the performance of ground platforms, commonality between the various platforms has been largely ignored. Nor has much study been afforded to the potential use of precision aerial delivery as a means of supplementing ground transport. As such, the following areas warrant further study in the context of the future battlespace:

· **Maximum Commonality between Major Equipment**. Currently, the Army replaces its major vehicle fleets according to sequential timelines with little effort to incorporate commonality between platforms.[23] This results in having to cater to a wide variety of key tactical vehicles through extensive scaling of spares, tools and test equipment. Future reform must strive to eliminate such an insular, unsophisticated and wasteful practice. Consequently, army planners should strive to minimize equipment variants and maximize commonality between platforms.[24]

· **Precision Aerial Delivery Systems**. The sustainment system should have at its disposal a variety of delivery means. At the tactical level, aerial delivery would greatly supplement the logistic ground platforms. Toward this end, the Army's strategic planners should actively study developments in precision air drop systems currently being pursued by the US . For example, the US Army is studying a system called Precision and Extended Glide Airdrop System (PEGASYS). This system is designed for a variety of weight ranges

and is capable of being dropped from an altitude of 25,000 feet at a 30 kilometre standoff distance and has a delivery accuracy to within 50–100 metres. The system has successfully tested loads up to 2,200 pounds, and it is anticipated that a platform capable of carrying 10 tons (approximate weight of a loaded 20-foot ISO container) will be tested in the very near future. Figure 11-6 shows PEGASYS deploying a 650-pound payload. The US is striving to develop the system to the point where it could deliver an armoured fighting vehicle (AFV) up to 20 tons (complete with crew) directly to the front line and ready to fight. Figure 11-7 is an artist's depiction of PEGASYS deploying AFVs.[25]
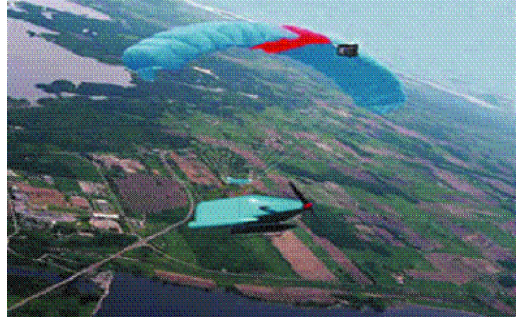
Figure 11-6

· **Airships**. While PEGASYS and other like-capabilities are well suited to meet the tactical lift requirements of the Canadian Army, airships offer operational and strategic lift capacity. Civilian companies (such as SkyCat) are developing airship technology to the point where it

Figure 11-7

once again represent a viable method of providing global distribution of cargo. The SkyCat 20, 200 and 1000 series of hybrid air vehicles are capable of payloads of 20, 200 and 1000 tons and cruising ranges of 1225, 3225 and 4000 nautical miles respectively. To put the airship's potential into prospective, the SkyCat 20 is capable of transporting one light armoured vehicle (LAV), while the SkyCat 200 payload is in excess of three C-17 Globemaster III aircraft (see figures 11-8 and figures 9-11).[26]   The SkyCat 1000 is expected to be ready for production in 2008 and will have a payload equivalent to fifteen C-17 aircraft. Airships would also offer the CF an excellent method of mass casualty evacuation and for supporting national disaster relief and / or international humanitarian relief operations.
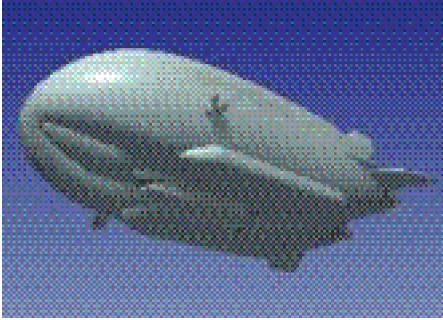
Figure 11-8

Mission Self-sufficiency

In order to achieve mission self-sufficiency, the Canadian Army has depended upon organized daily resupply. However, in an asymmetric and expanded battlespace, there may not be the opportunity, nor the capacity to carry out daily replenishment as it may not be possible to maintain clear and defined LOCs (i.e. LOCs will certainly not be linear, nor will they necessarily be

secure). Combat forces will be involved in operations in this complex and non-contiguous battlespace, often at the other end of these non-secured LOCs, yet will still depend on assured support to carry out their missions. Therefore, to achieve mission self-sufficiency in the future battlespace, TAUs will need to be plugged into a precise/proactive distribution-based sustainment system.
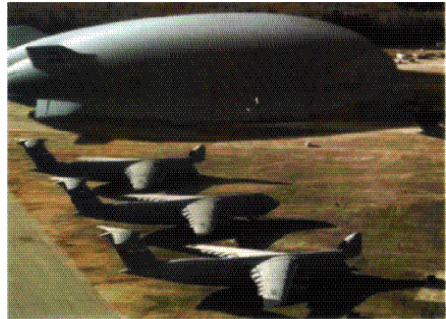
Figure 11-9

In lieu of being replenished daily, forces could conceivably receive regular pulsed-replenishment (i.e. receive a unit CL every three, four, five days). By using pulsed-replenishment, there would theoretically be no limit to mission duration. The mission could continue indefinitely with the frequency of resupply being adjusted as necessary to adapt to an increase/decrease in operational tempo, with "emergency pulses" available upon demand. In other words, the battle rhythm could be matched by an appropriately designed/tailored sustainment rhythm. Commanders would be in a position to exploit success, secure in the knowledge that they are supported by a flexible and responsive distribution-based sustainment system capable of effective operations regardless of mission duration.

Containerization

The Army of the future will require a well-balanced containerized distribution system (complete with modern asset tracking technology) in order to be effective and efficient. However, the medium and heavy SMP fleets must be transformed so that they are ISO container-compatible. In sum, a well-balanced system comprises the three main categories of containers (transport, accommodation and warehousing) with the mainstay being transport.[27]

Maintenance is another principal sustainment capability that has many facets that lend themselves to containerization. Although expensive, containerization should be viewed as a positive investment by the Army, an investment that will garner significant payback both in terms of effectiveness and efficiencies for the Army's future sustainment system.[28]

Predictive Equipment Maintenance Programme

Technological advances and improvements in key areas of land equipment maintenance will be critical to reducing demand. For example, an anticipatory / proactive approach to equipment maintenance (driven by embedded diagnostics, prognostics and highly trained vehicle crews), coupled with ultra-reliable equipment designs, promises to greatly improve equipment availability and dramatically reduce demand for spare parts and major assemblies. Contributors to such a maintenance programme could include:

· **Vetronics**.[29] If the Army is to transition to a predictive / anticipatory maintenance programme from the current reactionary system, it must ensure that vetronics are standard features of all new major equipment. If properly developed, the system would achieve real-time maintenance SA. The maintainers and equipment crews would be warned of impending system failure, thus enabling them to accurately determine when a system can be expected to fail and fix it before failure occurs. In many cases the crew would be able to fix the problem. The added onus on crew maintenance would dramatically increase equipment availability and allow one mobile repair team (MRT) to communicate with a number of crews, thus effecting concurrent repairs. A residual affect would be the reduction in MRTs on the battlefield, further contributing to a reduction of the maintenance footprint.

· **Ultra-reliable Equipment**. The Army should insist on having equipment designed with specifications that would increase the mean time between failure (MTBF) and reduce overall maintenance costs by 50 and 100 percent respectively.[30]   The overall objective should be to force the manufactures of future army equipments to achieve ultra-reliability.

· **Less Corrosive and More Durable Materials**. Industry must be challenged to manufacture major equipments using improved anti-corrosive and highly durable materials. For such vehicles, rust-out would be eliminated thereby dramatically reducing the need for costly refurbishment programmes. Theoretically, the only major bodywork required would be as a result of battle damage.

· **Self-healing Systems**. Systems that would have the ability to work autonomously in view of an impending failure, and subsequently continue to function until the mission has been completed, would dramatically reduce the downtime of key weapons systems and ensure their availability when it counts (i.e. during the battle).

· **Replicator Machines**. In only a matter of few years, through the use of rapid manufacturing systems (RMS) technology, it will be possible to efficiently manufacture repair parts in the forward areas of the battlespace. RMS technology exists today for fully dense metal parts. Tank Automotive Command's mobile parts hospital(TACOM MPH) is an example of RMS being developed for military use. At present, however, RMS machines are still too large and slow to be effectively employed in operations.[31]

A World Class Battlefield Health Care System

Historical analysis has demonstrated that over 80 percent of those killed in action die within the first 30 minutes of being wounded, and 50 percent of those die from loss of blood. With this in mind, the future Canadian medical system must be world class. It must have the capacity to find, stabilize and expeditiously evacuate casualties. Key to success will be:

· **Advanced Casualty Treatment Capability**. Canada must explore revolutionary methods of providing its soldiers with the best medical care possible in the future battlespace. Rapid advances in bio-materials, as part of ongoing research in the area of nanotechnology, will offer enormous potential for the Canadian Army in the not to distant future. MIT has established a department called the Institute for Soldier Nanotechnologies (ISN). One of the teams within ISN is dedicated to determining ways of using nanotechnology to improve the way we detect and treat life-threatening injuries such as haemorrhage, fracture, or infection.[32] The team's mandate is to develop new approaches to providing triage and automatic first aid for a wounded or disabled soldier, with the ultimate goal being to at least begin, if not complete, recovery while the patient is still on the battlefield.[33]

· **Assured Casualty Evacuation**. The Army's current medical casualty evacuation system is still primarily land-based and manpower intensive. Complex terrain in the future battlespace will present significant challenges to the current system when confronted with a determined adversary who is prepared to attack medical entities[34]. Consequently, the Army must develop a world-class casualty evacuation system capable of extracting soldiers from any type of battlespace. Such a system must be equipped with survivable ground and air platforms able to move

casualties across hostile spaces. Toward this end, the potential for using air platforms other than helicopters should be studied.

CONCLUSION

The Army's present sustainment system relies on mass and linearity to reduce the effects of uncertainty, inaccuracy and slow planning cycles. This system will not be effective or efficient in the non-contiguous battlespace of the future, increasingly characterized by high tempo, dispersed and non-contiguous operations. Such a high-paced environment will require a revolution in the manner by which the army provides sustainment. Consequently, striking a balance between austerity and insurance against the unexpected through mass will remain the key challenge in sustainment planning.

Critical to making the future distribution-based sustainment pipeline work in a precise and timely manner will be ensuring that all parts of the pipeline are interoperable and work as a well synchronized system. SA, a dedicated SIMS, TAV, appropriate delivery platforms (ground and air), and containerization are essential to this effort. Reducing demand by the manoeuvre force will be the single most important issue with respect to reducing the sustainment footprint. Toward this end, leveraging technology will go a long way towards achieving success.

The process of transforming Canada's dated sustainment system to a highly agile and precise distribution-based system must be viewed as a long-term initiative. The process of acquiring new capabilities and delivering them to the field force takes years to complete. However, to get started on the road to change, traditional thinking must be challenged and innovation encouraged. Consequently, the Army must be prepared to accept risk in supporting new ideas that have the potential for high returns in sustainment effectiveness. Through well-planned modernized initiatives and aggressive pursuit of selected enabling technologies, the current sustainment system will transform into a world-class asset that the Army can depend upon across the full spectrum of conflict on the future battlefield.

ENDNOTES TO CHAPTER 11

1 D.J. Reimer, "The Revolution in Military Logistics," *United States Army Logistician*, Vol 1, Issue 1, January–February 1999.

2 DLSC documentation to date, i.e. *Future Army Capabilities* (January 2001) and the two future Army experiments— *Operations in the Expanded Battlespace* (June 2001) and *Operations in the Urban Battlespace* (May 2002)—have focused primarily on the mainstream logistics functions of supply, transportation and maintenance (of land equipments), and to a lesser degree, health care.

3 While not overly efficient, stockpiling mitigates the risk of sustainment systems failing (i.e. better to stock an item just in case it is needed as opposed to acquiring an item against a known requirement). Stockpiles comprise various stores of supplies (e.g. 3, 7, 21, 30, 60 days). Many commodities in these stockpiles remain unused and eventually must be retrograded to Canada upon theatre closure.

4 Containerization that is compatible with industry and our allies is almost never used, and when it is, the CF is very unfamiliar with how to control/manage a containerized resupply pipeline (i.e. TAV [total asset visibility] is very limited). Commodity loads are palletized and packaged using dated technology (e.g. supplies are not packed or delivered ready to use in modern modular/reusable containers). Distribution is the process of planning, organizing, directing and controlling the flow of personnel, material and services. It integrates demand, procurement, inventory management, warehousing, movements, transport, financial management and information management.

5 See Chapter 14 for further explanation on TAUs.

6 Final approved draft of US Field Manual No. 4-0—*Combat Service Support*, September 2002, 22.

7 A CL is a single or multi-commodity load of supplies built to the anticipated or actual needs of a consuming unit, thereby facilitating throughput to the lowest possible echelon.CLs (packaged ready to use) significantly reduce, and in some cases even eliminate, the requirement to constantly manhandle and bulk-break sustainment loads along the LOC.

8 Demand can be defined as everything a force requires (i.e. all supplies) to function and thus everything it demands from the sustainment system.

9 For example, criteria for future weapons platform design and / or weapons system upgrades on existing systems, should include an assessment of the system's impact in areas such as: improved fuel efficiency; weight reduction; improved reliability; reduced power requirements; on board water production; predictability of system failure, etc.

10 For example: communication equipment; sensors; fire control systems; propulsion; and weapon systems etc.

11 All equipment found in the battlespace should use the same family of power sources, and where possible, exactly the same power source. This would have a reduce demand tremendously.

12 Numbers of fuel transporters / fuel storage containers and fuel handling equipment would be reduced thereby further reducing demand for fuel, spare parts, repair teams and replacement components.

13 S. Schrrow, "MIT Targets High Technology Innovations for U.S. Soldiers," *Boston Herald,* January 2002, http://www.smalltimes.com/document.

14 The CF currently has no effective means of tracking commodities once inserted into the civilian shipping system, nor is there any effective means of tracking the containers once they arrive in theatre, and are subsequently inserted into the theatre LOC.

15 Efficiency means getting the most out of resources available in the most cost effective manner. Sometimes effectiveness is traded in favour of reducing cost.

16 Effectiveness is the focused application of resources to produce the optimum support to the end-user. Cost effectiveness is secondary to ensuring that a service is provided.

17 If sustainment cannot be guaranteed during all potential scenarios, then the sustainment footprint has been reduced too far, or has not been sufficiently equipped.

18 There will be the ability to cross-load material throughout the Area of Operations as priorities change.

19 The only resources retrograded would be modular containers and other key re-usable materials that are integral components of the overall sustainment system itself.

20 Precise pulses will negate the need for a constant flow of supply requests and the requisite number of sustainment personnel to manage them.

21 Figures 11-3 and 11-4 are an artist's depiction of what armoured logistics vehicles might look like in the future. Source: COSCOM presentation on "Manoeuvre Sustainment Concept Overview," February 2003.

22 Figure 11-5 depicts an automated ammunition resupply taking place with the crew under full protection. Source: COSCOM presentation on "Manoeuvre Sustainment Concept Overview," February 2003.

23 For example, the LSVW, LUVW, MLVW and HLVW are completely different. They are generally from different manufac-
turers and have no common propulsion system parts.

24 For the Canadian Army, the LSVW and LUVW fleets could be replaced with one vehicle (Light Vehicle fleet) and the same
could be done with the MLVW and HLVW fleets (Heavy / Medium fleet). In addition, both fleets should be from the same
manufacturer and have the maximum percentage of commonality as possible. As well, Canada should consider introduc-
ing "common family of vehicles" synergies when it replaces its current fleets of major indirect (or NLOS) and direct fire
weapons systems. If possible, these weapons systems should be mounted on the current LAV III platform.

25 Figures 11-6 and 11-7. Source: Combined Arms Support Command (CASCOM) presentation entitled "Key Emerging
Technology Areas for FCS / Objective Force Deployment and Sustainment."

26 Figures 11-8 and 11-9. Source: *World SkyCat* website - http://www.airship.com.

27 Each category has numerous variations. The following types of transport containers (to name only a few) are available
COTS: standard cargo container; refrigerated containers; bulk liquid containers; hazardous material containers; half-height
containers; full access containers; side loading containers; and folding bulkhead containers.

28 A good starting point is to determine the next generation of containers being developed by industry for the US Army and
purchase them MCOTS (military commercial off the shelf). This would make the CF immediately compatible with the US
sustainment system and industry's global distribution network. As well, Canada would be well positioned to capitalize on
any future technological advances developed by the US, or to upgrade the system by acquiring future "smart containers"
that become available from industry.

29 Vetronics incorporates embedded diagnostics, prognostics and sensors to continuously monitor and report the platform's
"health status" (i.e. its maintenance state) as well as fuel and ammunition levels.

30 The technology required to achieve ultra-high reliability systems is available, but has not become part of the industrial
norm because a major portion of industry's profit margin is achieved through the servicing and repair of products such as
the average car. The Army must ensure that Industry fully appreciates that it is not the average customer buying the aver-
age car. Toward this end, the Army should be insisting upon far more reliable equipment from industry.

31 In its current state, TACOM's MPH requires two fully expandable ISO containers for accommodation and it can take up to
12 hours to manufacture one part. To provide an advantage over the current resupply system and have a major impact on
the battlespace at the tactical level, the RMS manufacture time would have to be reduced to a couple of hours.

32 S. Schrrow, "MIT Targets High Technology Innovations for U.S. Soldiers," *Boston Herald*, January 2002, http://www.small-
times.com/document.

33 Key areas of research mentioned by Stephanie Scharow of MIT's NIS department, include:

· Developing ways to monitor patient physiology as well as novel materials for wound healing.

· Battle suit sensors that can relay details to the battlefield headquarters and the healthcare system about a soldier's real-
time location and physical condition.

· New nano-surfaces that can detect biological and chemical agents and then protect the future soldier from those
threats.

· Biomedical monitoring that can use ultrasound to detect a haemorrhage in the injured soldier and then cauterize vessels
to staunch the bleeding.

· Soldier uniforms that can become exo-muscular devices for medical applications, such as splints for broken bones.

· Nano-materials that are capable of instantaneously changing their properties by electrical switching, thereby controlling
the delivery and release of life-saving medications.

34 Land casualty evacuation proved next to impossible during the DLSC experiment "Operations in an Urban Battlespace"
in the face of a determined guerrilla force focused on disruption of the LOC. Casualty evacuation via helicopters proved
too costly with almost all helicopters being lost due to low technology hand-held weapons such as RPGs. Tactical non-
armoured ambulances were ambushed trying to perform casualty evacuation with loss of equipment, crew and casualties.

PART III
OPTIONS FOR THE FUTURE

CHAPTER 12
ARMY CORE COMPETENCY

The most precious commodity with which the Army deals is the individual soldier who is the heart and soul of our combat forces.

General J. Lawton Collins[1]

INTRODUCTION

Uncertainty and complexity in the future security environment requires Canada to be ready to face a broad range of potential threats with varying degrees of intensity. Recent events and ongoing international developments highlight the danger and unpredictable way of the world. For instance, Operation APOLLO in Afghanistan in 2002 required combat-capable forces to assist in combating international terrorism. Similarly, Operation ATHENA in 2003 necessitated the deployment of stabilization forces to maintain Afghanistan's security during rebuilding efforts. Elsewhere, sub-Saharan Africa, and in particular the Congo, continue to suffer from ethnic, economic and rival force tensions that fuel instability and large-scale suffering. Moreover, the Middle East remains a source of unresolved friction that will continue to require stabilization and assistance from the international community.

Clearly, the world's volatile nature, coupled with potential operations ranging from humanitarian assistance through stabilization to warfighting, demands adaptable combat-capable forces. Only they can provide the requisite robustness needed to meet national objectives, satisfy mission objectives, and remain relevant in international affairs.

Notwithstanding the clear and present requirement for combat forces in the increasingly complex and ever-changing global environment, there is always the danger that the Army itself can lose focus of those things that matter most and that are central to its identity and purpose. This realization is critical to the Army, which has as its underlying strength—its personnel. For the Army to remain focused, its leaders and soldiers must have a clear unity of purpose and an understanding of the Army's purpose, tasks and core competency. In the end, despite the Army's innate ability to fulfill many tasks and missions, its fundamental purpose is to defend the nation and its vital interests. To do this it must rely on its core competency, the ability to conduct land combat in order to fight and win in war.

WHAT IS AN ARMY?

The Canadian Oxford Dictionary defines an army as "an organized force armed for fighting on land." [2] For a nation state, an army is a group of citizens trained, organized, and equipped to fight on land.[3] But these definitions fail to provide the necessary detail to fully comprehend an army's purpose, and it's interface with society. Central to its *raison d'être* is the primary function of conducting combat or warfighting.

Combat operations are those where the threat of, or actual use of force, including lethal force, is essential to impose a nation's will on an opponent or to accomplish a mission.[4] In particular, land combat focuses on the defeat, or destruction of an adversary; seizing, occupying; or controlling people, resources or land areas.

Not surprisingly, the Army has a direct and critical relationship with its society. Society elects the government that formulates and implements policy and direction for the national good. Armed forces, of which the army is a component, remain subordinate to civil authority and conduct those tasks directed by government. As a fundamental instrument of national power, an army supports the national purposes and possesses the capability to respond to both domestic and international crises.

Simply put, an army is a subset of the society it serves. Citizens are the cornerstones on which an army is built. In the first instance, it is societal values and beliefs inherent in citizens that are the foundation from which the army is created. Further, "there is an important relationship between the profession of arms and society itself. Society depends ultimately upon the profession for its very survival; however, at the same time, the profession can only remain healthy with the full support of its parent society."[5] In the final analysis, an army is borne from society, interwoven with society, and a subservient of society.

MISSION AND TASKS

The mission and tasks of Canada's Army are derived from Government defence policy (*1994 White Paper on Defence*),[6] National Defence departmental policy (*Shaping the Future of the Canadian Forces: A Strategy for 2020*)[7], and annual defence planning guidance (*Defence Plan 2003*)[8]. From this direction the Army derives its mission, which is "to generate and maintain combat-capable, multi-purpose land forces to meet Canada's Defence objectives."[9] Assigned Army tasks are found in the annual Defence Plan to support the broad defence objectives.[10]

CANADIAN ARMY ETHOS

Canadian Army Tasks

- Defence of Canada and protection of Canadian sovereignty
- Continental defence operations with US forces
- Defence of NATO member states
- Immediate Reaction Forces for domestic operations in aid of the civil power or assistance to civil authorities
- Land based surveillance within Canadian territory
- Humanitarian assistance and conduct of disaster relief operations at home and abroad
- Combat and combat support forces for contingency operations anywhere in the world

- Maintain plans and resources to activate a joint headquarters for CF operations within Canada or alternatively to provide personnel augmentation to any other Canadian Forces headquarters that may be activated for domestic operations
- Sustainable combat and combat support forces as part of Canada's contribution to UN Standby Arrangements
- Individuals for UN military observer duties and in arms control verification and other tasks in support of Canadian foreign policy
- Assist in the protection and evacuation of Canadians from areas of conflict

Figure 12-1[11]

"Ethos," commented the Minister's Monitoring Committee, "is the heart of the military profession and operational effectiveness." [12] Army ethos in turn "is the unifying spirit that embraces and reflects the imperatives, values and beliefs of army professionalism, the requirements of operations and national values and beliefs."[13] The Canadian Army's ethos is anchored on four values: duty, integrity, discipline and honour.[14] These values serve to reinforce professional and ethical values, and provide a clear understanding of the moral purpose intrinsic to Army service.

The inculcation of this ethos is critical. The Army prepares soldiers for unlimited liability and combat through individual training to develop specific personal soldier-skills. Collective training is then conducted to integrate these skills, and to form groups of soldiers into disciplined teams and the cohesive organization inculcated with the will to fight.

Cohesion and will are historically identified as the most important requirements of combat forces.[15] Cohesion is the unity that binds individual soldiers toward a common purpose and creates the will to succeed. It is built on a sense of belonging and purpose, good morale and discipline. How leaders and soldiers are trained, educated, led and prepared for the roles they perform, are critical determinants to success. Soldiers instilled

Army Core Values

- **Duty**
- **Integrity**
- **Discipline**
- **Honour**

Photo Canadian Press—copyright 2003 The Halifax Herald Limited.
Accessed from internet:
http://www.herald.ns.ca/stories/2003/06/16/fOpinion155.raw.html
Article " Henault must cut fat where it counts"
Figure 12-2

with discipline and military ethos, and who are bonded into a cohesive whole, form the framework upon which an army is developed. They permit an army to execute its tasks under the most demanding of situations.[16]

CANADIAN ARMY COMPETENCY

As noted earlier, the primary purpose of Canada Army's is to defend the nation and fight for national interests as determined by the duly elected government.[17] However, this does not mean the Army exists solely for combat or warfighting. Its characteristics—discipline, flexibility, adaptability, well-trained, highly-educated, well-organized, self-contained, well-equipped, and connected by effective communications—forge a powerful resource suited to meet any national or international emergency or contingency. The Army, therefore, must be prepared to support domestic security missions to assist civil authorities when governmental or civilian institutions are incapable of resolving human crises or natural events, and to externally support international security operations whether combat, stabilization, or assistance.[18]

In sum, operations can be divided into three mission categories: combat; stabilization; and assistance operations. This breakdown facilitates an understanding of army roles and how best to respond to national defence objectives.

The conduct of combat operations designed for defeating threats, whether an enemy state or discernible adversaries to Canada, North America and/or to international security, is clearly the core or primary task for the Canadian Forces (CF) and therefore, the Army.[19] No other Canadian institution has the responsibility for such operations. Nor could any organization undertake them. As such, the ability to conduct combat operations is the core competency of all three environments ; land, maritime and air. Stabilization and assistance operations are secondary tasks, albeit more frequent.

Stabilization operations are those international operations designed for prevention, modernization, and restoration of security in a state or region. They include peace support operations (PSO), operations in support of United Nations (UN) Charter Chapter 6 or 7 sanctions, arms control verification, post-conflict stability operations, and other confidence-building measures designed to restore security or stability. Examples: Former Yugoslavia 1991–present; Somalia 1993; Haiti 1997; Kosovo 1999; East Timor 1999; Ethiopia 2000–01; and Afghanistan 2003.

Assistance operations are non-combat operations that include domestic or international missions conducted to assist Canadians, other nations, and other governmental or non-governmental agencies following a conflict, crisis or natural disaster. They cover a myriad of tasks, including domestic operations (i.e. aid to civil power and disaster relief) and humanitarian operations. Examples include: Rwanda 1993–95; Red River Flood in Winnipeg 1997; and Eastern Canada Ice Storm 1998.

Capable of performing other tasks by virtue of its design for land combat, the Canadian Army has conducted successful operations across the entire spectrum of conflict (see figure 4-1), from assistance to stabilization

operations, as well as most recently, combat in Afghanistan in 2002. This has been possible because of the Army's focus on combat training, which created cohesive teams and robust, agile and adaptable organizations. It has also developed tools to form the baseline skill sets, equipment, technology, resources, and the military cohesion and ethos necessary to be effective.

Army Hierarchy of Tasks

Primary Mission
- Combat Operations

Secondary Missions
- Stabilization Operations
- Assistance Operations

Supporting Missions
- National Command
- Evacuation Operations
- Information Operations
- Strategic Deployment
- Strategic Sustainment

Figure 12-3

Experience has shown that a force trained for combat can perform all other missions with little difficulty. Yet, the opposite is not true.

In the harsh global geopolitical environment witnessed in such places as the Balkans, Africa and Asia, there will always be factions that respect only a demonstrated combat-capable force, despite the fact that the majority of the populace may desire peace. "In the military art," insisted strategist Michel Evans, "one can 'trade down,' but one can never 'trade up'…all the evidence indicates that success in peace support operations requires the kinds of conventional firepower, mobility, and force protection available only to military establishments that are optimized for conventional warfighting."[20]

Unfortunately, the ability to perform many critical missions and tasks for the nation has the potential to blur the distinction between those that are central to our existence and to which we must focus our efforts, and those which we can perform by virtue of maintaining our core competency. Clearly, the Army must focus where the potential danger to the nation and national interest is greatest and it must maintain this primary capability. This does not reduce the importance of maintaining the ability to effectively respond to any tasks assigned by Government. However, it does ensure the proper emphasis on the Army's core competency—land combat—which in turn provides clarity of purpose. Failure to ensure this capability could result in catastrophic failure.

NEW REALITIES AND CHALLENGES

A clear trend in the future security environment is a convergence of disparate operations. The recent Iraqi War in 2003 highlighted this phenomenon. Warfighting was not enough. There was a requirement for concurrent humanitarian, policing and reconstruction efforts. Previously, these types of operations were separate activities on the spectrum of conflict, and soldiers were not required to concurrently employ such a variety of significantly different skill sets. The PSO missions in the Former
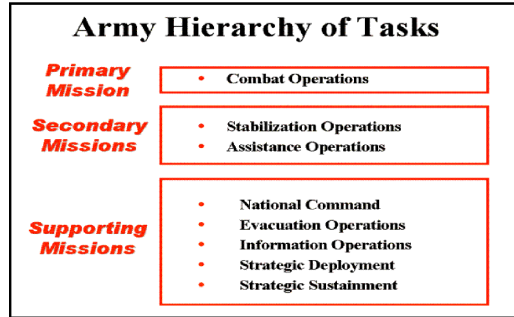
Yugoslavia in the 1990s, where Canadian soldiers were either directly attacked or caught in the crossfire while conducting so-called peace operations, also demonstrates this convergence of operations, as well as the necessity to retain combat capability. As such, the utility and relevance of a combat-focus permits the conduct of lower risk operations while providing the necessary ability to respond to higher scale conflict and war.

For the foreseeable future, land forces will require the ability to simultaneously conduct all types of tasks and operations throughout the depth and breath of their battlespace and along the entire spectrum of conflict. The agility to transition and adapt to varying operational conditions will be key characteristics that leaders and soldiers will require.

Moreover, the future battlespace will necessitate land combat forces to possess organic long-range assets for protection, pre-emption and provision of the effects in support of non-contiguous operations. Tactical overmatch provided by organic resources and the ability to cue effects from combined and joint forces will be necessary capabilities for combat-capable forces. Clearly, the mix of soldiers, resources, equipment and organizations that can meet the requirement for the "three-block war" will be essential to success.[21]

Also, prioritization of which combat systems the Army will require to perform these missions is a difficult task. In this regard, the Army must balance the risk of casualties and mission success, all while maintaining the fiscal perspective that reflects the realities of Canada's defence budget, and the remaining flexible to meet future challenges.

Long-term focus on maintaining combat-capable forces remains an enduring truth, as well as a prudent approach for an uncertain future. This focus provides the flexibility to deal with all lesser contingencies and crises while retaining the ability to respond to lethal threats to national and international security.

CONCLUSION

The purpose of the Canadian Army is to defend the nation and its vital interests. To ensure its efficacy, it is necessary that the Army inculcate its ethos and its values of duty, integrity, discipline and honour. They are critical determinants to success, as is the proper prioritization and acquisition of combat systems required to perform the assigned missions and tasks that would fulfill the expectations of the Government and the people of Canada. However, most essential to ultimate success is the emphasis on the Army's competency—land combat operations. It is a historically accepted fact that an Army trained for combat is best able to adapt to other mission such as stabilization and assistance operations. However, the opposite is not the case. In the end, the price of failure can carry dire consequences.

ENDNOTES TO CHAPTER 12

1 Harold Moore and Joseph Gallaway, *We Were Soldiers Once…and Young* (New York: Harper Perennial, 1993), 107.

2 *Canadian Oxford Paperback Dictionary*, (Toronto: Oxford University Press, 2000), 43.

3 Additionally, it may provide the land component within joint, amphibious and airborne operations.

4 Canada. *Canada's Army* B-GL-300-000/FP-000, (Ottawa, DND, 1998), 75. In contrast, non-combat military operations may have military weapons present, but their use or threatened use is for self-protection and is not otherwise essential to the accomplishment of the mission.

5 *Duty With Honour: The Profession of Arms in Canada*, First Draft May 2003, 31.

6 Canada. *1994 White Paper on Defence*, (Ottawa: DND, 1994).

7 The *CF Strategy 2020* document is intended to help guide DND / CF toward objectives for the year 2020. It identifies both the challenges and opportunities facing the CF and DND as they adapt to change in a rapidly evolving, complex and unpredictable world.

8 Canada. *Department of National Defence Plan Online 2002.* See VCDS intranet site. The Defence Plan On-line (formerly the *Defence Plan* and *Defence Planning Guidance*) is the internal DND / CF Business Plan for execution in the upcoming fiscal year and it also provides planning guidance for the subsequent three years. It assigns tasks and initiatives to senior managers, describes horizontal priorities, displays high-level force structure, and includes resource allocations.

9 Canada. *Advancing with Purpose: The Army Strategy*, (Ottawa: CLS, 2002), 63.

10 The *Defence Plan On-line* assigns tasks and initiatives to senior managers, describes horizontal priorities, displays high-level force structure and includes resource allocations.

11 In addition, the Army contributes elements to support joint or combined missions with the CF or multinational participants. Supporting Joint Task missions include Army elements provided to: exercise national command; conduct evacuation operations-permissive or non-permissive environment; conduct information operations; conduct strategic deployment; and conduct strategic sustainment

12 Quote taken from Minister's Monitoring Committee on Change in the Department of National Defence and the Canadian Forces, Final Report quoted in *Duty With Honour: The Profession of Arms in Canada*, 17.

13 *Canada's Army*, 52.

14 Ibid., 34.

15 For example see S.L.A. Marshall, *Men Against Fire* (New York: Morrow, 1947); and N.A. Kellet, *Combat Motivation* (Ottawa: DND Operational Research and Analysis Establishment, 1986).

16 This assessment is widely supported within the CF. See Chapter 2 *The Profession of Arms* manual and Chapter 2 of *Canada's Army*.

17 *Canada's Army*, 2.

18 Combat Operations are those operations where the use of force or threat of force, including lethal force, is essential to impose a nation's will on an opponent or to accomplish a mission. Stabilization operations are operations characterized by military forces employed in support of international peace and security efforts, such as: arms control verification; peace support operations (PSO); UN Charter Chapter 6 and 7; post conflict stability operations; and nation support operations. Assistance operations are characterized by the provision of military assistance to internal domestic agencies such as in Aid to Civil Power and Assistance to Civil Authority operations, or internationally by supporting or providing relief such as humanitarian relief (e.g. CF DART [Disaster Relief Team]).

19 Combat Operations are those operations where the use of force or threat of force, including lethal force, is essential to impose a nation's will on an opponent or to accomplish a mission. *Canada's Army*, 75.

20 Michael Evans, "From Kadesh to Kandahar: MilitaryTheory and the Future of War", published in the *Naval War College Review* , Summer 2003 Vol.LVI, No 3 page 140.

21 Charles C. Krulak, "The Three Block War: Fighting in Urban Areas," *National Press Club, Vital Speeches of the Day*, 15 December 1997. See also Chapter 4—The Future Battlespace.

CHAPTER 13
ARMY TACTICAL SELF-SUFFICIENCY

There are over two thousand years of experience to tell us that the only thing harder then getting a new idea into the military mind is to get an old one out.

B.H. Liddell Hart

BACKGROUND

Although it is virtually impossible to predict with any certainty the exact nature of the future battlespace, one can reasonably ascertain that it will be filled with ambiguity, complexity, uncertainty and volatility. Operations will often be characterized by what the former Commandant of the United States Marine Corps (USMC), General Charles Krulak, has labelled the "three block war", where one can "expect to be providing humanitarian assistance in one part of the city, conducting peacekeeping operations in another and be fighting a lethal mid-intensity battle in yet a third part of the city."[1] Moreover, the transition from one type of activity to the next could be measured in minutes.

To add to the complexity and difficulty, operations will occur under the omnipresent lights of the media who beam events in real-time into the living rooms of an naïve public that has unrealistic expectations about the costs and timelines of war.[2] This will drive the continuing necessity for force structures that are strategically relevant and capable of responding to a myriad of threats and tasks almost instantaneously. By necessity, it will be imperative that they are capable of precision strikes that minimize casualties and collateral damage. Of greater importance, they must be cohesive, resilient, and robust to minimize, if not avoid, friendly casualties.

Moreover, the challenges these forces will have to face will never be fully defined or fixed. Global disorder will continue to flourish. The diffusion of threats due to such factors as population expansion and the resultant stress on the environment, as well as competition for energy, food, water and economical and societal well-being will continue to feed inter and intra-state conflict.

Therefore, future forces must be tactically decisive and capable of a multitude of missions or functions whether challenged by domestic, national or asymmetric threats. By necessity, they must also be agile, cohesive, lethal and versatile. Additionally, they must be survivable, rapidly deployable and sustainable. Furthermore, they must be strategically relevant—their structure must permit them to make a significant contribution when deployed independently or within the context of a coalition. For the Americans this translates to the "creation of a force that is dominant across the full spectrum of military operations—persuasive in peace, decisive in war, and pre-eminent in any form of conflict."[3] It is no different for Canada.

THE NATIONAL CONTEXT

Designing a force structure with these characteristics and one that is capable of responding to the unpredictable future security environment is further complicated when national realities are considered. History has demonstrated that there is a distinct manner in which the Canadian Government has used the military or military force to support national policy. This "Canadian way of war" has traditionally focused on alliances or coalitions. As such, the emphasis has been almost exclusively at the tactical level with Canada providing forces that can plug-in to a larger formation and overall strategy. This posture is largely born from our middle-power/junior-partner tradition. It is also an instinctive reaction based upon a risk-averse culture that attempts to minimize defence costs and commitment to possibly costly endeavours (in terms of money, resources and casualties) that could embroil the nation in a larger conflict or long-standing quagmire. For this reason, military forces are often deployed as a follow-on component to a larger effort. It is always easier to follow a beaten path than it is to break trail. In addition, fiscal constraint and saliency have long been key determinants of force commitment. In sum, all these factors—economic, political and social—must be considered when postulating the future framework.[4] They provide clear boundaries and constraints that assist in developing a relevant capable and affordable Army.

And so, the question remains—what is the framework to work towards for the Army of the future? The Army is charged "to generate and maintain combat-capable, multi-purpose land forces to meet Canada's Defence objectives."[5] These objectives span the range of protecting vital national interests, contributing to international peace and security, to promoting national unity, democracy, the rule of law, and individual rights and freedoms. They also include promoting peace, order and good government, as well as the pursuit of economic well-being. Therefore, the force must be structured for domestic and expeditionary missions and be capable of tasks

across the entire spectrum of conflict (see figure 4-1). Moreover, it must be knowledge-based, sustainable, tactically decisive and strategically relevant.

MODULARITY

In consonance with the aforementioned constraints and limitations, the Canadian Forces (CF) are incapable of achieving operational goals by themselves in international situations.[6] As a result, fundamental to CF force structuring is the ability to task-tailor a component that is capable of integrating into an international coalition or national force involved in joint and combined operations. The limited size of the CF, the types of missions the Government is willing to accept for its armed forces, and the cost associated with overseas deployments dictate that the size of Canadian commitments to land force expeditionary ventures will be limited to sub-unit, unit and headquarter components.

The Army lives with this reality. However, it has also identified that the missions it will be committed to will be in diverse theatres and in complex terrain anywhere in the world. Its possible area of operations (AO) could range from a very small sector in an urban centre to thousands of square kilometres in an open environment. Clearly each mission would demand a specifically task-oriented organization. As a result, the Army has decided to adopt a modular structure that provides flexibility and adaptability.[7] It is also moving towards an emphasis on operational functions (*Command*, *Sense*, *Act*, *Shield* and *Sustain*) instead of a traditional concentration on the specific corps.[8]

Simply put, to achieve its operational aims in the future security environment the Army has focused on a scalable and modular approach. This is largely driven by current practice. Normally, missions are assigned to specific Land Force Area Headquarters (LFA HQs), which in turn are responsible for force generation. Normally, a unit is nominally assigned to provide the mission headquarters, as well as a number of sub-unit components (whether infantry or armoured) of a battle group depending on the corps affiliation of the assigned headquarters. Additional sub-units and personnel, often not affiliated with the deploying unit, are then grouped together from other units within a designated Canadian Mechanized Brigade Group (CMBG) to attach to the ad hoc battle group. This is designed to provide the necessary all-arms balance (respective infantry, armour, engineers, artillery components), and more importantly, to bring the deploying unit up to the required manpower strength. Time is then normally allotted for the ad hoc unit to complete the necessary training prior to deploying overseas. Domestic deployments are somewhat more simplistic. CMBG headquarters normally issue tasks and missions to integral units, and assigns the necessary affiliated combat and combat support

attachments as required.

The current practice of ad hoc units, however, is inefficient. Operational tempo, manning shortages, fiscal constraint, and training shortfalls are just some of the factors that impede all-arms training within a CMBG. As a result, notwithstanding existing affiliations, very little combined arms training between units is achieved. Furthermore, to cobble together the deploying unit, manpower is stripped from across the designated feeder brigade creating an ad hoc organization that lacks cohesion and is manned by individuals at different levels of operational readiness. This requires a substantial period of time for preparatory, and in some cases redundant, training prior to deployment. Of greater consequence is the command element that is not practiced at commanding a combined arms unit. Normally, the unit and sub-unit commanders will have only a theoretical knowledge of the supporting arms that are attached to the newly formed organization.

Under the current model, it is the sub-unit that is the basic building block. Units, other than those designated to supply the command headquarters element of a designated mission, are largely relegated to a role as force generators. Once tapped, the units within the designated CMBG become skeletal and capable only of further augmentation or individual/small party tasks. The process leaves the Army, or as a minimum major segments of it, in turmoil. In addition, it creates a climate of "ad hocery" and crisis management in regards to meeting operational requirements as they occur.

TACTICAL SELF-SUFFICIENT UNIT

In light of the challenges of the future geo-political security environment and battlespace, as well as the traditional national perspective and priority placed on defence, the emphasis on modularity is well placed. However, key to the concept of modularity and core to Army tactical self-sufficiency will be the Tactical Self-Sufficient Unit (TSSU). The TSSU is a permanently configured manoeuvre unit that is operationally self-sufficient and is capable of completing assigned missions either independently or by integrating into a combined force package as a task-tailored component. Integral to its composition are all five operational functions. It will have a determined amount of *Sense* and *Shield* capabilities for the complex and expanded battlespace, direct and indirect effects (i.e. integral elements of *Act*), as well as the normal *Command* and *Sustain* functions necessary to ensure self-sufficiency and independent action.

In accordance with the concept of modularity, additional capability can be attached depending on the specific mission. For example, aviation, civil-

military cooperation (CIMIC), information operations (info ops), psychological operations (PSYOPS), or special operations forces assets can be assigned based on the particular mission and/or battlespace. Or, additional assets of a specific operational function can also be added. However, fundamental to the force structure is the TSSU—a rapid deployable all-arms manoeuvre unit that is capable of conducting a wide range of tasks across the complete spectrum of conflict.

ENHANCED EFFICIENCIES OF THE TACTICAL SELF-SUFFICIENT UNIT

The TSSU model offers enhanced affordability and capability:

· **Operational Readiness**. A key advantage of the TSSU concept is the ability to deploy, on short notice, a self-contained, agile, flexible and tactically decisive TSSU (e.g. a designated high readiness TSSU) that is capable of independent action or capable of being "plugged-in" to a larger coalition to execute a wide number of tasks across the entire spectrum of conflict, whether in a domestic or international context. Its integral composition enables it to conduct all five operational functions. As such, it is capable of operating independently. However, it can also function within the framework of the larger Canadian army manoeuvre formation or in an international coalition. Its inherent flexibility allows it to adapt to a diverse set of tasks whether in constrained complex terrain or in a larger open AO. Of great importance is the cohesive make-up of the unit and its permanent all-arms command team that is practised in the organization and fighting of the unit. Designating different levels of operational readiness and manning priorities for specific units, which it turn will be capable of immediate deployment, will manage fiscal and manning shortages. The all-inclusive nature of the TSSU focuses operational readiness on given entities and avoids fragmenting formations and other units in order to prepare one organization for a deployment.

· **Command**. Cohesive, experienced command teams practised in the manoeuvre of their all-arms unit will become the norm. Their knowledge of the employment and capabilities of all components/functions integral to their organization, as well as the specific sustainment requirements, will exponentially increase their lethality and survivability. It also will assist in mitigating the risk of operational deployments.

· **Cohesion**. The TSSU will ensure that deploying units are cohesive integral organizations that have trained and exercised together, thus allowing soldiers and leadership at all levels to work as a team and develop an esprit de corps. But equally important, it will also allow

members of the unit to understand the strengths and weaknesses of individuals and form personal bonds. Although often dismissed, the fundamental importance of cohesion and primary group relationships in times of conflict and/or crisis is well-documented.[9] It has often meant the difference between success and failure.

·   **Augmentation**. Although the need for augmentation will undoubtedly always remain, the integration of a small number of individuals into a larger whole is easier to absorb without changing the fabric of the organization, than attempting to cobble together a unit by attaching a group of sub-units, themselves often an amalgamation of last minute attachments. Priority of manning, based upon a rotation of high readiness status to specific TSSUs can help mitigate this dilemma even further. This will also have a positive impact by minimizing turbulence within the larger formation.

·   **Training**. A myriad of efficiencies are possible in training. Common training standards such as minimum level of capability (MLOC) and essential level of capability (ELOC) can be achieved at the unit level based upon a standardized programme and timetable. This eliminates the incompleteness of training and the varied states of readiness that are often associated with attaching sub-units from outside organizations. It also minimizes inherent training redundancy, and ensures operational readiness and a shorter preparatory period required for deployment. In addition, it enables consistent all-arms training that fosters an understanding of unit capabilities, and the distinct characteristics, strengths and weaknesses of the varied functions. This greater integration also precludes lengthy preparatory training and the costs therein.

·   **Rationalization of Equipment and Vehicle Platforms**. Further efficiencies will be realized from the adoption of standardized equipment and vehicle platforms , whereby training and sustainment will be optimized. A range of single-subject courses, whether for communications equipment, weapons, surveillance suites, or driving vehicles, will be run for unit personnel based upon functional lines. Efficiencies of scale will be realized by running a cycle of courses at an optimal time within the TSSU training calendar/cycle to meet its exact operational requirements. For most advantageous results, standardization within the Army will be targeted for: communications suites; energy / fuel sources (e.g. single type/size nickel cadmium batteries [or more efficient replacement] and single type fuel for vehicles, ancillary equipment such as generators); vehicle fleets (single chassis/platform for

A and B fleets rationalized to minimize the number and types, and where possible compatible with commercial off-the-shelf component parts); and weapons and weapon platforms.

· **Standardization**. Standardization will substantially reduce costs. It will minimize required training for the operation and maintenance of equipment, as well as reduce the necessary inventory space and cost for spare parts. Moreover, it will lessen the lift required for sustainment of deployed units. These factors alone will streamline the TSSU and provide it with more time and resources to train and complete its tasks. Finally, standardization of equipment and platforms will also reduce internecine and parochial infighting within the Army.

· **Sustainment**. The TSSU, although capable of operational independence, will not be totally self-sufficient. This is understandable since the concept of total operational logistic self-sufficiency inherently requires an integral service support organization that would dwarf the TSSU. Rather, the manoeuvre units will be capable of lifting a designated combat load that is task-tailored for a specific geographic area and mission type/package for a set period. Sustainment beyond this period of time, whether in a domestic or international context, will be provided by formation, national or coalition resources using a variety of distribution-based logistics. The focus will be on rapid, timely, direct delivery by the most effective and efficient means possible, whether this entails military service support organizations, commercial contractors/couriers, or local purchase. Centralized management, accurate, precise and responsive connectivity between user and provider, minimum essential stocks, and timely guaranteed delivery will be key to providing sustainment to the agile, lethal and versatile TSSUs.

· **Reserve Integration**. The Army concept of modularity, particularly the core component—the manoeuvre unit—will also enhance the integration of the Reserve and Regular forces. Reserve units will be assigned tasks to constitute specific core functions (e.g. *Act*—close combat, direct or indirect effects) for a linked manoeuvre unit. These affiliations will provide a direct link between Regular and Reserve units. However, there remains flexibility and scope to use Reserve units beyond their specific affiliations to provide augmentation at the individual or sub-unit level, regionally or nationally as required. In addition, some Reserve units will be assigned specific specialty roles such as liaison, human intelligence (HUMINT), PSYOPS, public affairs (PAff) and CIMIC. In the end, each Reserve unit will have a specific mission, or more precisely an operational function (or specific sub-component thereof), to focus their training and

resources. This will ensure their continued relevance and importance to the Army's concept of modularity and focused capability.

CONCLUSION

Achieving the correct balance between innovation and change, and the maintenance of current force structures that have been successful in the past, has always been a fundamental challenge for military institutions. Nowhere are the consequences of failure more pronounced. And, nowhere is the culture more conservative, parochial or rooted in personal experience. However, to prepare for the future—we must begin to act today. Knowledge-based, sustainable, tactically relevant and strategically decisive TSSUs will provide the nation agile, lethal, responsive and versatile structures, which are capable of accomplishing assigned missions either independently or as part of a larger coalition, domestically or internationally, across the entire spectrum of conflict.

ENDNOTES TO CHAPTER 13

1 Charles C. Krulak, "The Three Block War: Fighting in Urban Areas," *National Press Club, Vital Speeches of the Day*, 15 December 1997; and General Charles C Krulak, "The Urban Operations Journal. The Strategic Corporal and the Three-Block War," http://www.urbanoperations.com/strategiccorporal.htm accessed 27 March 2003.

2 Dr. George Friedman, "The War and the Clock," *The Stratford Weekly*, 25 March 2003.

3 General G.R. Sullivan, *Torchbearer National Security Report: How "Transformational" is Army Transformation?* An AUSA Torchbearer Issue, February 2003, 5.

4 A classified official Canadian report in 1951 acknowledged "We prefer not to make commitments we are not reasonably certain we can carry out. For this reason we frequently have no definite policy on a question until almost the last minute. This makes it difficult for our representatives to engage in discussion with the Americans…." Privy Council Office, "Survey of relations between Canada and the United States," dated 20 June 1951.

5 Canada. *Advancing with Purpose: The Army Strategy* (Ottawa: CLS, 2002).

6 VCDS, *Strategic Capability Planning*, Chapter 4—Concept of Operations for the CF in 2020, Para 4.3.

7 Although modular (i.e. sub-unit size capability can be attached or detached easily) there is a "permanent" core element of "combined arms" capability (i.e all five operational functions) to better realize efficiencies and combat effectiveness, and to avoid the current "ad hocery" that is normally associated with deployed forces, whether short notice or part of a scheduled rotation.

8   Canada, *The Future Security Environment* (Kingston: DLSC, 1999), 39-41.

9 For example see S.L.A. Marshall, *Men Against Fire* (New York: Morrow, 1947); N.A. Kellet, *Combat Motivation* (Ottawa: DND Operational Research and Analysis Establishment, 1986); Donna Winslow, *The Canadian Airborne Regiment in Somalia: A Socio-Cultural Inquiry* (Ottawa: Commission of Inquiry into the Deployment of the Canadian Forces to Somalia, 1997); and Carol McCann and Ross Pigeau, eds., T*he Human In Command. Exploring the Modern Military Experience* (New York: Kluwer Academic / Plenum Publishers, 2000).

CHAPTER 14
COHERENT FORCE POSTURE

Preparing for the future will require new ways of thinking, and the development of forces and capabilities that can adapt quickly to new challenges and unexpected circumstances.

Donald Rumsfeld[1]

BACKGROUND

While Canada currently faces no immediate threat or danger, a chaotic and highly unpredictable international environment imposes prospects of constant peril to Canadian security and national interests. Accordingly, the Canadian Forces (CF), and particularly the Army, continues to represent an essential component of the Government's ability to maintain peace and security at home and abroad. Therefore, if Canada is to continue to work for the well-being of Canadians and international peace and security, it must have modern, combat-capable, multi-purpose and globally deployable forces, properly equipped with advanced capabilities that target leading edge doctrine and technologies relevant to the 21st century.[2]

But this end-state demands a coherent force structure. The Army must ensure its size, readiness and availability of forces are tailored to meet national policy within the context of operational effectiveness, Governmental constraints and societal acceptance. Theoretical constructs are always easy to articulate, however, implementation is the acid test of reality. For this reason, any model must be practicable and achievable. Furthermore, it must address not what military commanders desire, but what is required to meet the Government's expectations, which by extension represent those of the Canadian people.

This creates apparent contradictions. Normally, the more credible a threat the less likely a belligerent finds it necessary to use it, since opponents recognize the potential peril. However, this does not mean that a state can presume the threat will not be used, and hence fail to protect against it. In addition, other threats that are considered less credible may in fact be the most likely to be used as they could maximize the element of surprise and asymmetry. But, it is virtually impossible to eliminate the risk of every potential threat. In the end, it comes down to balancing risk with probability and fiscal constraints. So how does the Army posture itself to protect the nation against the uncertainties of a dangerous and volatile world?

"Our challenge in this new century," insisted American Secretary of Defense, Donald Rumsfeld, "is a difficult one: to defend our nation against the unknown, the uncertain, the unseen, and the unexpected."[3] It is no different for Canada. To meet this daunting task, the CF has implemented capability-based planning to provide the institutional framework for meeting Canadian defence commitments. Indeed, this framework allows planners to identify options and make informed decisions on the capabilities required by the CF (based upon the spectrum of conflict—see figure 4-1) to develop the optimal force structure within the available resources.[4] Key to this model is the abandonment of the focus on a specific threat or enemy (i.e. the end of the Cold War paradigm). Instead, a range of missions and threats, both domestic and international, are emphasised (e.g. global instability due to inter or intra-state conflict; terrorism; organized crime; cyber-attacks; cruise missiles, ballistic missiles, and nuclear, chemical and biological weapons; or other emerging threats).

As such, capability-based planning accords well with the current security environment. The future battlespace, as already described, will be complex, non-linear, and non-contiguous. The degradation or collapse of critical infrastructure (physical structures and systems), the contamination of food and resources, and the spread of infectious diseases, will stress states and the global geo-political security environment. In failed states, global migration and escalating environmental pressures, caused by competition for scarce resources due to over-population and resource depletion, will further exacerbate the potential for inter and intra-state violence. Threats stemming from terrorism, cyber-war, the trafficking of drugs, and weapons will only add to the likelihood for future instability and conflict.

Furthermore, the proliferation of cheap technology and weapons will compound the difficulty of ensuring national security. Antagonists will resort to asymmetric means to attack their enemies, who are economically, militarily and technologically superior. Their aim will be to disrupt, distract and disconnect; in short, to wear down their opponents. They will use robust networks that consist of dispersed organizations, or small groups of individuals, who communicate, coordinate and conduct campaigns in an internetted manner often without a precise command and control regime.

Such dangers and challenges argue for an Army force posture capable of assisting with homeland defence, domestic operations, complex stability operations and warfighting. Forces must be prepared to conduct operations along the entire spectrum of conflict, transitioning from one to another in short time, and perhaps simultaneously. For these reasons, the CF has identified in their keystone document, *Strategy 2020*, that at its core the strategy is to

ensure that the force structure of the CF provides Canada with modern, task-tailored, and globally deployable combat-capable forces that can respond quickly to crises at home and abroad, in joint or combined operations.[5]

Toward this end, Canada's Army must be agile, responsive and rapidly deployable.[6] Moreover, it must maintain flexibility at the lowest levels, capable of adapting to a rapidly evolving and transitioning operational environment. Its forces must be lighter, more sustainable and adaptable (i.e. have a broader range of capabilities / flexibility across the various types of operations) and with some specialized components. It will rely heavily on technology and achieve connectivity through simulation and communications. In fact, much of the Army's structure and organization will become virtual (i.e. there will be headquarters and units located in different parts of the country but intimately connected through information technology). As such, longstanding barriers to effectiveness and efficiency resulting from geographical dispersion will dramatically reduce. Nonetheless, the realization that human contact remains vital must not be lost. "The nature of war is immutable, just like human nature," explained Lieutenant-General Paul Van Riper, "The uncertainty of war—the danger, the fog, the friction—will not change."[7]

GENERAL

Army Formations

According to CF doctrine, a formation is an ordered arrangement of troops and / or vehicles geared toward a specific purpose. It can also be an ordered arrangement of two or more ships, or aircraft proceeding together under a single commander. In army doctrine, a formation is a grouping, either temporary or relatively permanent, of two or more units under the command or control of a single individual. An army formation may have a specific mission (e.g. a task force) or simply be available for tasks (e.g. a mechanized brigade).

Increasingly, the Army is moving towards modularity—the ability to task-tailor self-sufficient units capable of completing specific missions or tasks. However, the force posture must be responsive, flexible and sufficiently robust to allow rapid deployment of high readiness forces that are capable of accomplishing missions across the entire spectrum of conflict either independently or as an integral component of a coalition.

Assignment of Forces

The availability of rapidly deployable forces is not enough. Within the Canadian socio-political framework, the composition and location of

formations must extend across the country to fulfill a myriad of functions and purposes. Formations must be strategically located across Canada to ensure that the military can promptly and effectively meet its obligations and responsibilities as mandated by the Government. As well, the military must also remain connected to the entirety of Canadian society and its distinctive cultures.

Put simply, and notwithstanding technological advancements that allow for complete dispersion or conversely complete centralization (e.g. communication, simulation, transportation), real world necessity will drive a continuation of the current geographic footprint (i.e. manoeuvre formations located with manoeuvre units) that fulfills administrative, domestic (Immediate Reaction Unit (IRU) for emergencies/aid to the civil power), social and political functions. Ultimately, however, efficiencies will be derived more fully by locating units according to their specific function and training requirements, rather than by their affiliation with a specific formation. Technological innovation will allow real-time communications and connectivity, and thus facilitate the command and control and interpersonal relationships essential to unit cohesion and effectiveness. Such specialized manoeuvre and effects forces can be located/centralized in areas that offer the appropriate training venues (e.g. littoral, mountainous, open, urban). Other specialty units (e.g. psychological operations (PSYOPS), civil-military cooperation (CIMIC), nuclear, biological and chemical (NBC), special operations forces (SOF)) can be located near large urban centres that would leverage civilian specialist/reservists, researchers, infrastructure and organizations essential for the Army to sustain its effectiveness and relevancy. In the end, within the economic, socio-political framework, it will be training efficiency, functionality and capability that drive location of forces. Technology will provide the connectivity to ensure successful command and the span of control.

HIGHER FORMATIONS

The Canadian Government has clearly stated that the CF will not act alone in the realm of international affairs. Rather, Canada's forces will participate in coalitions of the willing. As a result, the nation has decided that it will focus on a tactical level army. Such an army is premised on a realistic assessment of Canadian resources and priorities. However, while tactical in orientation, theoretical knowledge and understanding of larger level operations and formations from division to army, is essential to the Army's effectiveness. This expertise will be maintained doctrinally and inculcated through education, training,

foreign exchange with coalition partners that maintain higher-level headquarters, and assignments to operational headquarters deployed on international operations. This will ensure that the officer corps maintains a sound theoretical comprehension of higher-level formations, and that a select number of officers gain valuable practical staff level experience.

Despite its tactical orientation, there is still an inherent necessity for the Army to operate higher-level formations capable of providing the requisite command and control, force generation, and oversight to execute tasks within the national domestic context. For this reason, an army headquarters and subordinate headquarters will continue to exist outside the field force model. Furthermore, historical experience, and the fundamental necessity to ensure primacy of national command on overseas deployments, will drive the continued existence of a joint task force headquarters, which is capable of providing an operational-level command and control capability for CF operations. In this regard, Canada has the capacity to fulfill a lead nation role.

LOWER FORMATIONS

Despite Canada's conscious decision to focus at the tactical level, it has not rejected the use of military force in international affairs. "Our influence in foreign policy terms is, in part," acknowledged John Manley, the former Canadian Minister for Foreign Affairs and International Trade, "a function of our ability to deliver in defence terms."[8] But, if Canada expects to exercise influence within the alliances and organizations to which it belongs, strategically relevant force contributions to future operations are the presumed prerequisites. Recognizing that Canada will not deploy numerically large forces, it must guarantee salience through the provision of relevant forces that have a high level of training, professional competence, and equipment that is equal to or better than its coalition partners. Moreover, these forces must be agile, combat-capable, robust, rapidly deployable, tactically decisive, and sustainable.

Historically, the Army has relied on the Cold War era mechanized brigade group concept as the framework for force generation and training of the field force. Although the theoretical foundation of this formation is valid, it must evolve to meet the requirements of a relevant capable future army.

The Tactical Army Formation

Lower formations of the future will be fashioned on the tactical army formation (TAF), which is a task-tailored organization designed for specific

missions or standing mandated tasks. It will consist of a mix of manoeuvre units that represent the core construct of the Army's deployable field force.

The TAF will remain the dominant formational structure for generating forces and training the Army's field force (see figure 14-1). It will impart the immediate command and control of army tactical units (ATU), providing the necessary direction on priorities, tasks and the allocation of resources within the formation (i.e. allocate additional integral resources to ATUs in accordance with mission requirements). It will also be capable of deployment as part of a national joint task force, or as an integral element of a coalition organization.

TACTICAL ARMY FORMATION
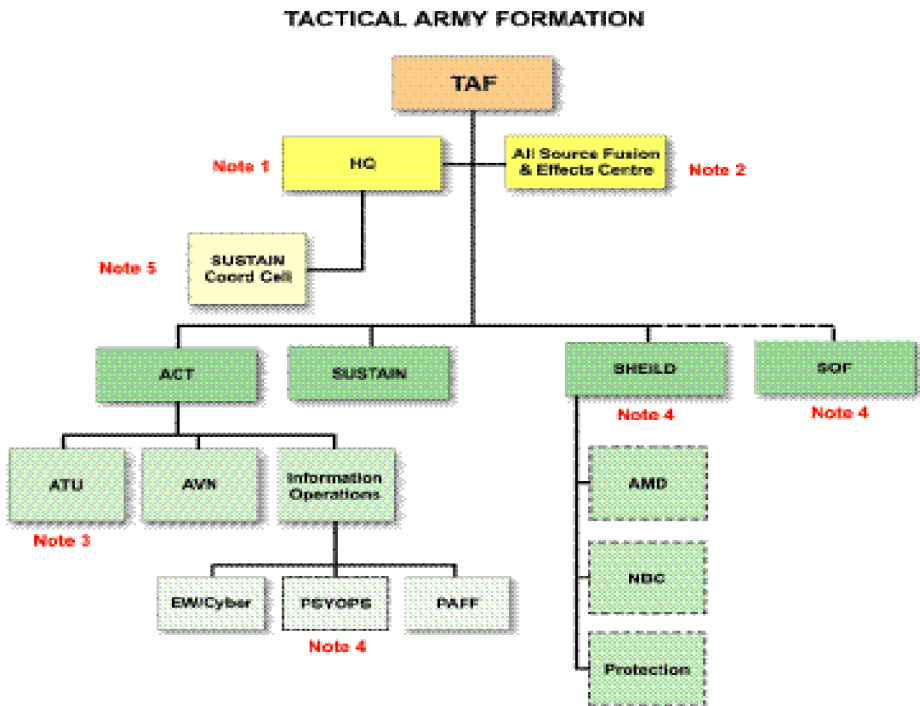
Notes:
1. Includes CIMIC and LO Cell.
2. Centre designed to tie into higher level (e.g. national ISTAR and coalition resources). Capable of joint operations.
3. Numbers of actual units can be adjusted according to mission. Actual "core" numbers to be determined based on evolving technologies and equipments.
4. Virtual organization. Attached only as required for specific missions.

Figure 14-1

The Army Tactical Unit

The ATU will be the core construct of the Army's modular field force structure (see figure 14-2). It is the embodiment of the tactical self-sufficient unit (TSSU) described in the previous chapter. It is a combat-ready, combined-arms organization capable of high readiness and rapidly deployable. Furthermore, it is self-contained and capable of independent action or "plugging-in" to a larger coalition formation.

Although the sub-unit will remain the basic building block within the Army, it is the ATU that will provide the necessary command, control and combat service support structures to ensure cohesion and sustained combat capability. It will be prepared to detach or attach sub-units for extended

ARMY TACTICAL UNIT

ATU

| HQ | All Source Fusion & Effects Centre |

ACT — SHIELD — SENSE — SUSTAIN

Close Effects — Note 1
Direct/Indirect Effects — Note 1 & 3
Mobility/Counter-mobility — Note 1
Information Operations

AMD
NBC

ISTAR
HUMINT

Medical
Logistics
Maintenance
Direct Supply Line

EW/Cyber | PSYOPS (Note 2) | PAFF

Sense | Shield

Notes:

1. Numbers of actual sub-units can be adjusted according to mission. Actual "core" numbers to be determined based on evolving technologies and equipments.

2. Virtual organisation. Attached only as required for specific missions.

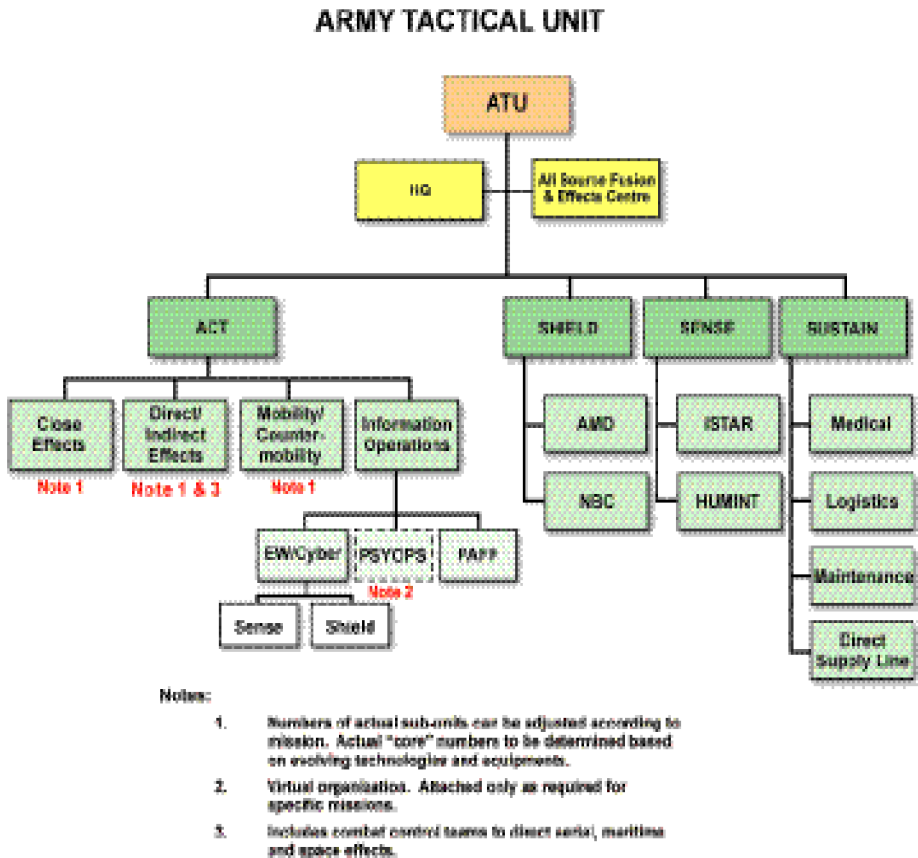3. Includes combat control teams to direct aerial, maritime and space effects.

Figure 14-2

periods of time based upon operational necessity. Its structure can be further shaped through augmentation of additional resources based upon specific missions or tasks (e.g. effects sub-units, SOF capability, CIMIC). Its central structure, however, will ensure operational readiness, situational/ organizational awareness, effective command, and strong unit cohesion. This in turn will ensure an agile and robust force that can deploy on short notice at home or abroad.[9]

Special Operations Formation

Although the requirement for multi-purpose forces will continue to exist within the context of the Army's mandated tasks, specialization will be increasingly required to meet the growing plethora of national security risks. Although law enforcement agencies, the Coast Guard, Customs, as well as other governmental organizations, will evolve and expand to meet many of these threats, the military will likewise be expected by the Government and the people of Canada to assist with ensuring security and stability at home and abroad. Beyond this, the Government will continue to look to the military to provide strategically relevant forces to commit to coalition operations that provide a valuable and highly salient contribution to international security.

In light of future threats, economic constraints, and political realities, the Army will have to enhance, evolve and refine its SOF capability. Special Operations Forces are strategic assets that lack the size and equipment for direct involvement in major land combat. They rely on the use of intelligence, stealth, surprise, superior training and operational flexibility to achieve objectives. They are built around carefully selected and highly trained personnel. Detailed intelligence, responsive command and control and thorough planning are essential.[10]

In essence, SOF are defined as "specially organized, trained and equipped military and paramilitary forces that conduct special operations to achieve military, political, economic or informational objectives by generally unconventional means in hostile, denied or politically sensitive areas."[11] Their principle missions (in accordance with US and North Atlantic Treaty Organization (NATO) doctrine) are:

· **Counter-proliferation**. Combating the proliferation of nuclear, biological and chemical weapons; intelligence collection and analysis; support of diplomacy, arms control and export controls.

· **Combating Terrorism**. Preclude, pre-empt, and resolve terrorist actions throughout the entire threat spectrum, including anti-terrorism and counterterrorism.

· **Foreign Internal Defence**. Organize, train, advise and assist host-nation military and paramilitary forces to enable these forces to free and protect their society from subversion, lawlessness and insurgency.

· **Special Reconnaissance.** Conduct reconnaissance and surveillance actions to obtain or verify information concerning the capabilities, intentions, and activities of an actual or potential enemy, or to secure data concerning characteristics of a particular action.

· **Direct Action**. Conduct short-duration strikes and other small-scale offensive actions to seize, destroy, capture, recover, or inflict damage on designated personnel or material.

· **Psychological Operations**. Induce or reinforce foreign attitudes and behaviours favourable to the originator's objectives, by conducting planned operations to convey selected information to foreign audiences to influence their emotions, motives, objective reasoning, and ultimately the behaviour of foreign governments, organizations, groups and individuals.

· **Civil Affairs**. Facilitate military operations and consolidate operational activities by assisting commanders in establishing, maintaining, influencing, or exploiting relations between military forces and civil authorities, both governmental and non-governmental, and the civilian populace in a friendly, neutral, or hostile area of operation.

· **Unconventional Warfare**. Organize, train, equip, advise, and assist indigenous and surrogate forces in military and paramilitary operations of long duration.

· **Information Operations**. Actions taken to achieve information superiority by affecting the adversary's information and information systems while defending one's own information and information systems.[12]

Collateral activities include:

· **Coalition Support**. Integrate coalition units into multinational military operations by training coalition partners on tactics and techniques, and providing communications.

· **Combat Search and Rescue**. Penetrate air defence systems and conduct joint air, ground, or sea operations deep within hostile or denied territory, at night or in adverse weather, during wartime or contingency operations, to recover distressed personnel.

· **Counter-drug Activities**. Train host-nation counter-drug forces and

domestic law enforcement agencies on the critical skills required to conduct individual and small-unit operations to detect, monitor, and interdict the cultivation, production, and trafficking of illicit drugs.

· **Humanitarian Demining Activities**. Reduce or eliminate the threat to non-combatants and friendly military forces posed by mines and other explosive devices, by training host-nation personnel in their recognition, identification, marking, and safe destruction. Provide instruction in programme management, medical and mine-awareness activities.

· **Security Assistance**. Support legislated programmes that provide military training and other defence related services by grant, loan, credit, or cash sales in the furtherance of national policies or objectives.

· **Special Activities**. Provide the capability to conduct actions abroad in support of national foreign policy objectives so that the role of the conducting government is not publicly apparent or acknowledged.[13]

Figure 14-3
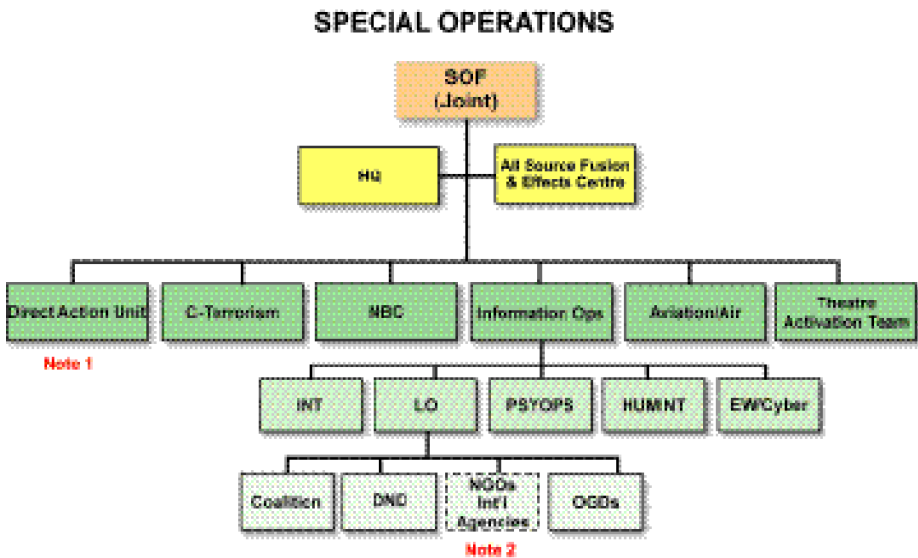
A special operations formation (see Figure 14-3) could provide the CF with a joint SOF capability to counter the complex and increasingly asymmetric nature of future conflict. Even though the Army will not "own" such a formation, it would certainly contribute to its design. In fact, there are specific roles (e.g. direct action units—agile, high readiness, specialized light organizations capable of close combat, surveillance and complex peace support operations (PSO))[14] that the CF could provide through its own capabilities. In sum, the collection of specialty units, combined under the special operations formation will provide the CF with a dedicated capability to assist civilian and governmental agencies in homeland defence, as well as providing a relevant, value-added, yet limited and cost effective contributions to coalition action in low to high intensity operations. Simply put, such involvement would allow Canada to punch above its weight—diplomatically and militarily.

Such a special operations formation will be a joint, knowledge-based, virtual organization that consists of a number of specialty units designed to provide a suite of precise capabilities. Their location will be based upon function, the skill sets of the respective operators, and the availability of requisite training areas (e.g. PSYOPS units would be centred on large urban areas providing both the necessary infrastructure and access to expertise; direct action units may be located in proximity to terrain that corresponds with their specialty—littoral, mountainous, urban).

CONCLUSION

The Army must provide Canada with modern, tactically decisive and strategically relevant forces that can respond quickly to crises at home and abroad, in joint or combined operations. This will be achieved through TAVs (tactical army formations)—task tailored organizations designed for specific missions or standing mandated tasks. They will consist of army tactical units (ATUs)—self-contained, combat ready, combined-arms units capable of independent action or "plugging-in" to larger coalition formations—as the core construct of the Army's field force. Their modular construct will provide the ability to attach and detach capability as required.

In addition, the Army will support the increasing emphasis on the capability development of special operations forces (i.e. specially organized, trained and equipped military forces that conduct special operations to achieve military, political, economic or informational objectives) in response to the growing threat in the international security environment. In total, this force posture will enhance the Army's capacity to meet its obligations to the Government and society.

ENDNOTES TO CHAPTER 14

1   Donald H. Rumsfeld, "Transforming the Military," *Foreign Affairs*, May/June 2002, 27.

2   Canada, *Defence Planning Guidance 2001* (Ottawa: DND, 2001), para 105.3

3   Rumsfeld, 23.

4   Canada, *The Defence Portfolio 2002* (Ottawa: DND, 2002), Chapter V.

5   Canada, *Shaping the Future for the Canadian Forces: A Strategy for 2020* (Ottawa: DND, 1999), Part II.

6   NATO is consistently moving towards more flexible and rapidly deployable forces. At present, NATO is attempting to develop the capability of launching a tailored joint combined force in as quick as five days. Group Captain Alastair Beedie, "Military Outcomes of Prague," NATO briefing, Oberammergau, Germany, 8 April 2003. The hard lesson learned is that little political credit or influence is attained by deploying forces after the fact—coalition partners expect their allies to share the risk and expense of initial operations.

7   "Reinventing War," *Foreign Policy*, November / December 2001, 31.

8   Douglas Bland, "Defences that impress friends and enemies," *The National Post*, 28 February 2002.

9   See Chapter 13 for additional details on the Army TSSU (Tactical Self Sufficient Unit) concept.

10 Because of the political-military nature of special operations, legal issues and rules of engagement must be given particular consideration.

11 Thomas K. Adams, *US Special Operations Forces in Action. The Challenge of Unconventional Warfare* (London: Frank Cass, 1998), 7.

12 "Information operations focus on the perception and will of the people fighting the war: the support of both the domestic population at home and the support of the indigenous population in the urban operations theater." Sean J. A. Edwards, *Mars Unmasked* (Santa Monica: RAND Arroyo Center, 2000), 47.

13 US Special Operations Command, *US Special Operations Forces. Posture Statement 2000* (Washington D.C.: Department of Defense, 2001), 1.

14 DAUs are not as robust as ATUs (i.e. they lack integral lethality / effects of the ATU). They are capable of combat entry (airmobile, airborne, maritime insertion).

CHAPTER 15
PORTFOLIO OF FUTURE ARMY CAPABILITY REQUIREMENTS

The Army will generate, employ and sustain strategically relevant and tactically decisive medium weight forces. Using progressive doctrine, realistic training and leading edge technologies, the Army will be a knowledge based and command-centric institution capable of continuous adaptation and task tailoring across the spectrum of conflict. The cohesion and morale of our soldiers will be preserved through sharing a collective covenant of trust and common understanding of explicit and implicit intent. With selfless leadership and coherent management, the Army will achieve unity of effort and resource equilibrium. The Army will synchronize force development to achieve joint integration and combined interoperability with the ground forces of the United States, other ABCA (American, British, Canadian, Australian Armies' Standardization Program) countries and selected NATO allies. As a broadly based representative national institution with a proud heritage, the Army will provide a disciplined force of last resort and contribute to national values at home and abroad.[1]

INTRODUCTION

Canada's Army must continue to explore and develop those capabilities that will ensure its relevance throughout the current and future security environment (FSE). In accordance with the Commander's vision, the Army must pursue a broad range of capabilities to ensure that it: is interoperable with other allied and coalition ground forces; can contribute to operations at home and abroad as part of a coalition; and can contribute strategically relevant and tactically decisive forces to any crisis. As such, this portfolio of future Army capability requirements is rooted in the Army Strategy. In addition, it is also based upon future trends as they pertain to the FSE, technology and what our current allies are pursuing. Moreover, this portfolio is based upon the core elements of the Commander's vision for

the Army of the future—*knowledge based*, *strategically relevant*, *sustainable* and *tactically decisive*. These core elements are further refined by other essential characteristics. Each characteristic is supported by future capability requirements. This *portfolio* is not all-inclusive, yet it covers a broad spectrum that provides a start point for further analysis of those capability requirements that the future Canadian Army should pursue.

CORE ELEMENTS

The Army, comprising both Regular and Reserve components, promotes and protects Canada's foreign and domestic policy interests. Its primary purpose is to defend the nation and to fight and win in war. Canada's Army, as an element of the Canadian Forces (CF), alone possesses the capability to seize and hold ground, dominate terrain, and physically protect people and land-based resources.[2] Through continuous innovation, the future Army will be a knowledge-based organization that is able to deliver technologically advanced, combat-capable, land forces.

CORE ELEMENTS

Element: **Knowledge Based**

Description: Canada's future Army will be a command-centric, network-enabled, information driven organization. Improved situational awareness and network connectivity will facilitate initiative and enhance mission command. The future Army will empower its personnel at all levels to make command decisions based upon a shared understanding of the Commander's intent and access to a common operating picture (COP).

The essential characteristics of the future knowledge-based Army are:

Characteristic	Description
Networked *Command*	Canada's future Army will be a command-centric, network-enabled, information-driven organization employing a decentralized decision making approach that empowers all levels to make more informed decisions based upon a common/shared understanding of the Commander's intent. Initiative, shared understanding, real-time situational awareness and network connectivity are key enablers for this network-enabled organization. Transparent connectivity permits collaborative planning and integration with national

forces, select governmental agencies and coalition, combined and joint forces. A knowledge-enabled Army provides its forces with the ability to access, understand and act upon information on demand. Networked command leverages information technology to empower commanders and combat forces.

People	The future Army will improve the soldier's natural physical and cognitive abilities and emotional well-being with technology/ human factors integration. Leaders and soldiers at all levels will be able to quickly assess the situation, make decisions and synchronize their actions.
Training	The future Army training system will make maximum use of constructive simulation, virtual simulators, embedded training applications and distance learning technologies, which will permit individual and collective training to be done anytime, anywhere, creating a near-continuous learning environment. Networked simulation war games using actual equipment systems will create a virtual manoeuvre area for training and pre-deployment preparations.
Warrior Ethos & Army Culture	The future Army will serve the nation with the highest standards of professionalism, adhering to the values of duty, integrity, discipline and honour. Professional development will include extensive and authoritative knowledge in the fields of armed conflict and peacekeeping, and encompass leadership and management skills required for planning, preparing and executing complex military operations.

Element: **Strategically Relevant**

Description: Canada's future Army will project a credible, timely, nationally and internationally recognized, Land Force capability. The future Army will provide a meaningful contribution to the country and allied/coalition operations across the full spectrum of conflict.

The essential characteristics of a strategically relevant Army are:

Characteristic	Description
Adaptable	The future Army will effectively adapt to the full spectrum of

conflict and operations (e.g. domestic, operations other than war (OOTW) and War—View 1 and View 2). It will be able to operate in complex and expanded battlespace.

Deployable   The future Army's modular design will include capabilities that allow for timely global response. The Army will be capable of responding to contingency operations at home and abroad. A tactically self-sufficient and robust element will be transportable immediately by air, while the remaining forces will be capable of rapid assembly and movement by sea.

Interoperable The future Army will operate technically, doctrinally and procedurally with other elements of the CF, with other governmental departments and police agencies (federal, provincial, municipal), as well as non-governmental organizations, coalition partners (with priority given to the US, other American, British, Canadian and Australian Armies' Standardization Program (ABCA) countries and North Atlantic Treaty Organization (NATO)), and with the international industrial base.

Modern   The future Army will follow a continuous cycle of modernization. It will use new and innovative equipment, structures, systems, facilities and methods to increase combat proficiency and maintain its interoperability with allies.

Element: Sustainable

Description: The future Army will be conceived and designed to assure continuous support primarily in health care, maintenance, supply and transport across the full spectrum of conflict. This will allow the Army to deploy mission-tailored elements globally in a timely fashion, and subsequently sustain them for as long as is required.

The essential characteristics of a sustainable Army are:

Characteristic   **Description**

Army   The future Army will have a seamless, technologically
Sustainment   advanced and fully equipped sustainment system, networked through a dedicated sustainment information management system (SIMS) and interoperable with allies and international industry. This system will be focused on enabling forces at the

tactical level to achieve mission success. Supply, transportation, maintenance, health care, personnel support, legal, chaplain, and sustainment engineering are key components of this system.

Strategic Sustainability — The future Army will incorporate sustainability as a critical step throughout the entire planning process. Army decisions at the strategic level will always include an assessment of the long-term sustainment impact on force posture, and resources.

Element: **Tactically Decisive**

Description: The future Army will integrate all capabilities required to prevail in the future battlespace. Information dominance, assured timely sustainment, and highly agile, mobile and lethal forces will provide the overmatch required to win throughout the spectrum of conflict.

The essential characteristics of a tactically decisive Army are:

Characteristic	Description
Lethal	The future Army will possess improved targeting, range, precision and concentration of scaleable effects.
Mobile	The future Army will move effectively throughout the battlespace, day, night, mounted, dismounted, in both the horizontal and vertical planes and in all-weather.
Modular	The future Army will consist of task-tailored organizations designed and built upon clearly defined capabilities to meet mission-specific requirements. These organizations will be based upon a core element that will be tactically self-sufficient and include a balanced combination of *Command*, *Sense*, *Act*, *Shield* and *Sustain*.
Survivable	The future army will protect human and material resources, as well as critical information and information systems, from destruction and / or major disruption. It will possess the capacity to identify critical vulnerabilities throughout the force as a whole and to take measures essential for its protection.

FUTURE ARMY CAPABILITY REQUIREMENTS

Central to the Army's role and purpose is its capability to apply force across the entire spectrum of conflict and continuum of operations. In order to

show the array of potential options that should be considered in building a national army force structure, the aim of this section is to refine the core elements and essential characteristics of the future Army down to basic building blocks, which describe those capability requirements that the future Army must have, but not in such detail as to prescribe actual concepts, or equipment solutions.[3]

A complete MS Access database has been developed that links capability requirements to core elements, essential characteristics, operational functions and force planning scenarios (FPS). It is difficult to represent this information in a comprehensive table without quickly losing track of most of the details. Hence, an enclosed CD contains the complete capability requirement database for detailed analysis and use.

In order to simplify their presentation, described below are the future Army capability requirements listed by operational function and CF force generation. Further details are available in the database.

FUTURE ARMY CAPABILITY REQUIREMENTS BY PRIMARY OPERATIONAL FUNCTION

Operational Function: *Command*

Capability Requirement	Description
Collaborative Planning	Automated operational planning process that allows for parallel planning to the lowest levels.
Command and Control System	Communication system that allows for networked command and decision making at an appropriate level. Network-enabled—"web" style system of systems— modular; command on the move; dismountable; capable of simultaneous planning and execution; accessible to national and allied command, control, computers, communications, intelligence, surveillance and reconnaissance (C4ISR) systems; capable of collaborative planning; capable of sharing combat and sustainment situational awareness (SA); and all combined into one C4ISR system.
Common Communications	The ability to communicate with all friendly forces in the battlespace (i.e. voice and data).
Common Operating Picture	Situational knowledge of the enemy and friendly forces within the battlespace that has been filtered and analyzed into a globally accessible database and

communications infrastructure. Hence, there will be common interpretation of the situation and courses of action that facilitates cooperative planning and execution, and fosters morale and confidence. The identification of key force vulnerabilities and sustainment posture, and the identification of appropriate measures to eliminate or minimize them are crucial elements in achieving this goal.

Global Information System	Infrastructure (databases, communications, etc) that assists networked command and decision making at an appropriate level.
Identify Vulnerabilities	Continuously monitor, assess and understand the status of own forces to determine vulnerabilities and to mitigate risks.
Liaison	Coordination and enhanced interoperability with non-digitized coalition partners through human interface and redundancy.
Situational Awareness	System that allows timely accesses to the status of the battlespace situation, including enemy, friendly, non-combatant, sustainment and the environmental elements.

Operational Function: *Sense*

Capability Requirement	Description
Data Processing / Fusion	Includes automated processing, information management (IM), and modelling / analysis of all sources.
Decision Support	Systems and databases that enhance accurate and timely human decision making.
Direction—CCIRM	Collection, coordination, information requirements management (CCIRM)—system to prioritize and manage sensor tasks to ensure consistency with the Commander's critical information requirements (CCIR).
Dissemination	Complete, accurate, timely distribution of information and analysis to all required levels.
Integrated Information	Fusion of information from all sensors and sources enabling real-time analysis, comprehension and decision making

187

| Intelligence Collection | Includes the collection of information and data on enemy forces, the environment and friendly forces using the human intelligence (HUMINT), imagery, open sources, reconnaissance and surveillance, signals intelligence (SIGINT), and soldier surveillance, target acquisition and night observation (STANO). |

Operational Function: *Act*

Capability Requirement	Description
Autonomous Systems	Systems capable of independent action and the ability to adapt to changing situations, thereby removing the individual soldier from the risk of direct engagement.
Effects	Scaleable precision effects (lethal and non-lethal) allowing overmatch to prevail on the battlefield. Effects span the physical to the cognitive domain. They are designed to minimize close combat and maximize standoff, extended range engagements.
Force Projection	Deploy forces in support of national objectives.
Individual Soldier System	Integrated systems that enhance the natural physical and cognitive abilities of the soldier.
Information Operations	Plan, participate and conduct actions aimed at influencing the moral plane in support of the overall military objectives. This entails the coordination of civil-military cooperation (CIMIC), psychological operations (PSYOPS), public affairs (PAff), and offensive and defensive information operations (info ops) to attack an adversary's ability to command, including shaping the beliefs of the hostile and neutral people, while ensuring that our command remains effective and that our population is protected.
Precision Manoeuvre	Involves the acts of dispersion, concentration and further dispersion in harmony with the operational tempo and based upon information domination and precision engagements. The ability to traverse all surfaces is essential to precision mobility. This includes counter-mobility, the ability to traverse the battlespace including complex terrain, over all surfaces, crossing or breaching obstacles, and maintaining main supply routes while in or out of contact.
Universal	Ability to operate in the native language and being

Translator   universally understood.

Operational Function: *Shield*

Capability Requirement	Description
Shielding C4ISR	Protecting the integrity of the C4ISR system.
Shielding Friendly Information	Protecting the integrity of the friendly information including C4ISR systems.
Shielding Morale and Well-being	Protection of deployed forces, home base facilities, infrastructure, dependants, and other elements related to homeland defence activities.
Shielding Platforms and Systems	Protecting the integrity of the friendly platforms and systems from adverse physical effects.
Shielding Soldiers and Non-combatants	Protecting soldiers and non-combatants against physical and cognitive effects.
Shielding Sustainment System	Protecting the integrity of the sustainment system including physical lines of communication (LOC), civilian infrastructure as required, logistics / health care infrastructure (e.g. armoured ambulances), and all material commodities, personnel and resources within the system.

Operational Function: *Sustain*

Capability Requirement	Description
Acquisition Interoperability	Facilitated worldwide acquisition of major commodities. Every effort will be made to acquire sustainment material from the closest source, in lieu of strict adherence to links back to Canada.
Casualty Evacuation	The Canadian medical system must be capable of finding, stabilizing, and subsequently evacuating critically wounded casualties to an appropriate health care facility as expeditiously as possible. A state-of-the-art casualty evacuation system will ensure that soldiers are extracted successfully from any type of battlespace over extended distances and/or within complex battlespace (such as urban terrain), and subsequently evacuated in a timely manner to a world-class health care facility.

Common Sustainment System	CF system that is capable of total asset visibility (TAV) of all assets in the pipeline.
Distribution-Based Sustainment System	The Army will develop a modern / technologically advanced and robust sustainment system.
Equipment Design / Purchase	Equipment design will embrace new technologies that contribute appropriately to the overarching objectives of reducing the demand on the sustainment system.
Health Care	World class health care at Role 1 (Unit Medical Station) and Role 2 (Field Ambulance) levels will be a high priority capability for offshore deployments. The Army will ensure its soldiers have access to the highest level of health care during all operations.
Human Resource Availability	The Land Force will actively foster ties with Canadian society to help sustain a sufficiently trained and educated personnel base.
Modular Organizational Design	The Army will consist of core elements that will be tactically self-sufficient and able to attach additional capabilities from task-tailored organizations designed to meet mission-specific requirements. They will include a balance of *Command*, *Sense*, *Act*, *Shield* and *Sustain* capabilities.
Reduce Demand	Equipment will be designed with a view to reducing demand on sustainment resources to an absolute minimum, particularly concerning ammunition, fuel, water and repair parts, and making maximum use of common and multi-role platforms and equipment.
Strategic Agreements with Key NATO/ ABCA Allies	Canada will forge strategic sustainment agreements with key NATO allies and ABCA partners that would allow small teams of experts to establish themselves in key strategic overseas locations to "prepare the sustainment ground" for potential Canadian deployments. These teams will not occupy permanent infrastructure, but simply ensure that Canada has immediate access to whatever infrastructure is needed to support impending Canadian operations in particular regions. They are not expected to move frequently from one region to another—"hot spots" have remained constant for a decade or more.

Strategic Lift	The Air Force and Navy must be capable of either providing strategic lift directly using integral resources, or by accessing it from industry or coalition partners on behalf of the Army.
Sustainability Impact Assessment	A sustainability impact assessment will be an integral part of the Army planning process to ensure that no plan will be endorsed without a clear understanding of the operational commander's sustainment considerations. The sustainment system must be capable of continuous support in all environments. This is especially important for combat supplies (especially fuel, ammunition (small arms, artillery, rocket, mortar, / AFV and water), spare parts and health care.
Tactical Lift	The Army's tactical lift must be comprised of a balanced and container-compatible fleet of ground and air platforms. Tactical ground platforms must have the same protection and mobility as their combat counterparts. Aerial delivery means will be critical to uninterrupted resupply in the complex battlespace, especially in emergency situations.
Total Asset Visibility(TAV)	The Army's distribution-based sustainment system must have global TAV on all sustainment resources at all levels (Strategic through Tactical).

Operational Function: CF Generate Forces

Capability Requirement	Description
Enhanced Training Tools	Training system must make maximum use of constructive simulation, virtual simulators, embedded training applications and distance learning technologies, which will permit individual and collective training to be done anytime, anywhere, therefore creating a near-continuous learning environment. Networked simulation war games using actual equipment systems will create a virtual manoeuvre area for training and pre-deployment preparation.
Focused Training System	Training is focused to produce productive and effective soldiers in a timely manner. Combat, combat support (CS), combat service support (CSS), and health care training facilities will continually provide the Army with trained manpower for prolonged periods. Moreover, each military

element (i.e. Regular and Reserve) will be assigned training missions that will make them viable resources. This includes ensuring that close support (CS) and general support (GS) CSS units are given clear training missions that reflect optimum use of the CSS expertise.

Force Generation over Prolonged Periods — An Army designed modularly will allow the generation and deployment of highly skilled task-tailored forces, that are sustainable over prolonged periods. The Reserve force will maintain a pool of highly skilled personnel capable of reinforcing the Regular force and / or providing specialty functions (e.g. CIMIC, reconnaissance, peace support, humanitarian assistance, PSYOPS, civil affairs, military police, health care, force protection, border security, homeland defence, critical infrastructure protection). In some cases, capabilities will reside exclusively within the Reserve force (e.g. PSYOPS).

Interoperability— SOPs and Doctrine — The Army will be interoperable through universally accepted CF, joint, combined and allied (coalition) doctrine, tactics, techniques and procedures, and standardized equipment and systems.

PRIORITIZATION OF FUTURE ARMY CAPABILITY REQUIREMENTS

The 46 capability requirements described above were prioritized using the Fundamental Investigation of Defence Objectives (FIDO) decision support software tool that allowed a group of experts to rank the 46 requirements against a set of well-defined criterion, specifically drawn from the four core elements of the future Army—knowledge based, strategically relevant, sustainable, and tactically decisive.

Participants were asked to individually rank the list of 46 capability requirements against each criterion (core element). Using these individual rankings, the software calculated the group consensus ranking for each criterion, which were subsequently used to compute an overall ranking that took criterion and evaluator weights into consideration.[4] Annex A details the prioritized list of the capability requirements by core element and essential characteristic.

Participants were also asked to rate the "operational risk" and "technical feasibility" of each of the capability requirements.[5] For operational risk, participants were asked to evaluate the degree to which the capability requirement departs from current operational doctrine (i.e. assess the

extent of the operational and/or organizational restructuring required to effectively implement the given capability requirement) and the consequences on future Army tasks and missions of not implementing a given capability requirement. The 46 capability requirements were thus ranked by operational impact, where the capability requirement with the greatest impact was listed first, and that with the least impact was listed last.

For technical feasibility, participants were asked to evaluate the maturity of the underlying, or enabling technology and the technical interdependency between capabilities (i.e. the extent to which the other capabilities rely technically upon the assessed capability requirement). Thus, the 46 capability requirements were also ranked by technical likelihood, where the capability with the highest level of interdependence and least mature enabling technology was listed first, and that with the least interdependence and most mature technology was listed last.

In a manner similar to that noted earlier, the software computed the prioritized "aggregate risk" values using the group consensus ratings for the operational impact and the technical likelihood evaluations. The aggregate risk values for each of the capability requirements is detailed at Annex B.

CONCLUSION

After the prioritization exercise, the participants reviewed the group solution, discussed why certain options were preferred to others, and encouraged an evaluation of the implied or inferred trade-offs. The objective was to realize better alternatives and to build consensus. It is important to note that the final solution ranking should be considered as the starting point of discussion, and not the undisputed answer to the problem. If a more robust prioritization list is desired, another more comprehensive ranking exercise could also be conducted with a larger group of participants.

ANNEX A
CAPABILITY REQUIREMENTS BY CORE ELEMENT AND ESSENTIAL CHARACTERISTIC

Core Element: Knowledge Based

Pri #	Cap#	Characteristic 1—Networked Command	Main Op Function
2	C4	Common Operating Picture	Command
3	C2	Command and Control System	Command
4	C3	Common Communications	Command
5	C1	Collaborative Planning	Command
6	Sen1	Data Processing / Fusion	Sense
7	Sen6	Intelligence Collection	Sense
8	Sen5	Integrated Information	Sense
9	Sen2	Decision Support	Sense
9	C5	Global Information System	Command
12	Sen4	Dissemination	Sense
13	Sen3	Direction-CCIRM	Sense
15	Sh1	Shielding C4ISR	Shield
16	Sh2	Shielding Friendly Information	Shield
17	GF5	Interoperability-SOPs and Doctrine	CF Gen For
18	C7	Liaison	Command
21	A1	Universal Translator	Act
23	A2	Autonomous Systems	Act

Pri #	Cap#	Characteristic 2—People	Main Op Function
1	C8	Situational Awareness	Command
2	C4	Common Operating Picture	Command
3	C2	Command and Control System	Command
14	C6	Identify Key Force Vulnerabilities	Command
19	GF1	Enhanced Training Tools	CF Gen For
24	A5	Individual Soldier System	Act
34	Su5	Health Care	Sustain

Pri #	Cap#	Characteristic 3—Training	Main Op Function
1	C8	Situational Awareness	Command
2	C4	Common Operating Picture	Command
3	C2	Command and Control System	Command
14	C6	Identify Key Force Vulnerabilities	Command
19	GF1	Enhanced Training Tools	CF Gen For
34	Su5	Health Care	Sustain

Pri #	Cap#	Characteristic 4—Warrior Ethos & Army Culture	Main Op Function
3	C2	Command and Control System	Command
19	GF1	Enhanced Training Tools	CF Gen For

Core element: Strategically Relevant

Pri #	Cap#	Characteristic 1— Adaptable	Main Op Function
3	C2	Command and Control System	Command
5	C3	Common Communications	Command
7	C4	Common Operating Picture	Command
10	C5	Global Information System	Command
11	A3	Effects	Act
12	A7	Precision Manoeuvre	Act
16	A6	Information Operations	Act
20	C6	Identify Key Force Vulnerabilities	Command
28	Su1	Acquisition Interoperability	Sustain

Pri #	Cap#	Characteristic 2— Deployable	Main Op Function
1	A4	Force Projection	Act
2	Su10	Strategic Lift	Sustain
3	C2	Command and Control System	Command
5	C3	Common Communications	Command
6	GF5	Interoperability-SOPs and Doctrine	CF Gen For
7	C4	Common Operating Picture	Command
7	C8	Situational Awareness	Command
10	C5	Global Information System	Command
17	GF3	Force Generation over prolonged periods	CF Gen For
23	Su2	Common Sustainment	Sustain

Pri #	Cap#	Characteristic 3—Interoperable	Main Op Function
3	C2	Command and Control System	Command
5	C3	Common Communications	Command
6	GF5	Interoperability-SOPs and Doctrine	CF Gen For
7	C4	Common Operating Picture	Command
9	C7	Liaison	Command
10	C5	Global Information System	Command
28	Su1	Acquisition Interoperability	Sustain
42	Su5	Health Care	Sustain

Core Element: Sustainable

Pri #	Cap#	Characteristic 1—Army Sustainment System	Main Op Function
5	Su12	Sustainment of Ground Forces	Sustain
5	Su15	Casualty Evacuation	Sustain
7	C3	Common Communications	Command
8	C2	Command and Control System	Command
11	Su2	Common Sustainment	Sustain
11	Su11	Sustainability Impact Assessment	Sustain
15	Su4	Equipment Design/Purchase	Sustain
18	Su5	Health Care	Sustain
22	C6	Identify Key Force Vulnerabilities	Command
29	A2	Autonomous Systems	Act
40	GF2	Focused Training System	CF Gen For
13	Sh6	Shielding Sustainment	Shield

Pri #	Cap#	Characteristic 2—Strategic Sustainability Framework	Main Op Function
1	Su14	Total Asset Visibility (TAV)	Sustain
2	C8	Situational Awareness	Command
3	Su3	Distribution Based Sustainment System	Sustain
4	C4	Common Operating Picture	Command
10	Su8	Reduce Demand	Sustain
11	Su11	Sustainability Impact Assessment	Sustain
23	Su7	Organizational Modular Design	Sustain
26	Su10	Strategic Lift	Sustain
28	Su9	Strategic Agreements with key NATO/ABCA	Sustain
33	Su6	Human Resource Availability	Sustain

Core Element: Tactically Decisive

Pri #	Cap#	Characteristic 1—Lethal	Main Op Function
1	C8	Situational Awareness	Command
2	C2	Command and Control System	Command
2	C4	Common Operating Picture	Command
5	A3	Effects	Act
6	A7	Precision Manoeuvre	Act
8	A5	Individual Soldier System	Act
16	Sen5	Integrated Information	Sense
24	A2	Autonomous Systems	Act
27	A4	Force Projection	Act

Pri #	Cap#	Characteristic 2—Mobile	Main Op Function
2	C2	Command and Control System	Command
2	C3	Common Communications	Command
2	C4	Common Operating Picture	Command
6	A7	Precision Manoeuvre	Act
8	A5	Individual Soldier System	Act
14	Su13	Tactical Lift	Sustain
27	A4	Force Projection	Act

Pri #	Cap#	Characteristic 3—Modular	Main Op Function
2	C2	Command and Control System	Command
2	C3	Common Communications	Command
2	C4	Common Operating Picture	Command
13	Sh1	Shielding C4ISR	Shield
38	Su7	Organizational Modular Design	Sustain

Pri #	Cap#	Characteristic 4—Survivable	Main Op Function
1	C8	Situational Awareness	Command
2	C2	Command and Control System	Command
2	C3	Common Communications	Command
2	C4	Common Operating Picture	Command
5	A3	Effects	Act
6	A7	Precision Manoeuvre	Act
8	A5	Individual Soldier System	Act
9	A6	Information Operations	Act
13	Sh1	Shielding C4ISR	Shield
19	C6	Identify Key Force Vulnerabilities	Command
21	Sh2	Shielding Friendly Information	Shield
22	Sh4	Shielding Platforms and Systems	Shield
24	A2	Autonomous Systems	Act
29	Sh5	Shielding Soldiers and Non-combatants	Shield
30	Sh3	Shielding Morale and Well-being	Shield
32	Sh6	Shielding Sustainment	Shield
34	Su5	Health Care	Sustain
40	Su1	Acquisition Interoperability	Sustain

ANNEX B
CAPABILITY REQUIREMENTS BY AGGREGATE RISK PRIORITY LIST

Risk #	Cap#	Capability Requirement
1	C8	Situational Awareness
2	C4	Common Operating Picture
2	A7	Precision Manoeuvre
4	Su3	Distribution Based Sustainment System
5	Su14	Total Asset Visibility (TAV)
6	Sen1	Data Processing / Fusion
6	Sen5	Integrated Information
8	C3	Common Communications
8	Sen2	Decision Support
10	A2	Autonomous Systems
10	Su2	Common Sustainment
10	A5	Individual Soldier System
10	Sh4	Shielding Platforms and Systems
10	Sh5	Shielding Soldiers and Non-combatants
10	Sh6	Shielding Sustainment
16	C2	Command and Control System
16	Sen4	Dissemination
16	A3	Effects
19	Su4	Equipment Design/Purchase
20	Su7	Organizational Modular Design
21	Su15	Casualty Evacuation
21	Sen3	Direction-CCIRM

ENDNOTES TO CHAPTER 15

1 Canada, *Advancing With Purpose: The Army Strategy* (Ottawa: DND, May 2002).

2 Canada, B-GL-300-000/FP-000 *Canada's Army* (Ottawa: DND, 1998).

3 A concept is a specific organizational, doctrinal and materiel embodiment of a particular capability.

4 Military evaluator rankings were assigned twice the weight of their civilian counterparts, and the relative weights assigned to each criterion were: 0.35—Knowledge Based; 0.15—Strategically Relevant; 0.25—Sustainable, and 0.25—Tactically Decisive.

5 A more generic name for the "Operational Risk" criterion is "Impact", and a more generic name for the "Technical Feasibility" criterion is "Likelihood".

CONCLUSION

When one door closes, another opens; but we often look so long and so regretfully, upon the closed door, that we do not see the one, that has opened for us.

Alexander Graham Bell

The world remains dynamic and unpredictable. As such, the Canadian Forces (CF) must be ready to adapt to ever changing geo-political and technological realities. Moreover, it must be prepared to conduct operations in ambiguous, volatile and uncertain environments.

The Army as well must be prepared to meet the challenges generated by changes in the strategic environment. Its posture must be aligned to conduct the operations that the Canadian Government and people expect it to undertake. Furthermore, it requires the capabilities necessary to remain effective and relevant in the future security context.

The creation of relevant future force constructs must reflect the integration of CF joint force employment concepts, multinational operations and inter-agency cooperation. It must imbue creative and innovative thinking. To achieve this, the active participation of senior Army leadership is fundamental to developing force employment concepts and the methods needed to validate potential capabilities relevant to the Canadian context.

Toward this end, *Future Force* has been written to assist the Army leadership and their staffs. It is based upon wide ranging research and it articulates a conceptual framework of what the future in 2025 could resemble. This knowledge establishes a foundation for reasoned inferences on future army capability requirements. Within this context, a database has been created to assist in building a portfolio of capability requirements to satisfy the core elements necessary for the Army of the future. It serves as a starting point by cataloguing the capability requirements and the various means of fulfilling them. As an initial effort, it establishes the foundation of basic capability requirements that can be modified to incorporate new core elements, additional descriptive characteristics, and new ways to achieve these characteristics.

Concomitant with the stated framework and database, a number of recommendations have been drawn to assist with the transformation of the Army into a relevant future force:

Reserves. Specific work aimed at developing the augmentation capability currently resident in the Reserve force is required. So too is the further refinement and development of appropriate speciality roles and capabilities associated with civilian qualifications, expertise, and that are relevant to the future operating environment. Examples include: human intelligence (HUMINT); information operations; psychological operations (PSYOPS); support to special operation forces; nuclear, biological, chemical defence (NBCD) specialists; and other capabilities. This examination must include the Land Force Reserve Restructure team, the Combat Development Board and input from serving Reservists.

Science, Technology and Operational Research.   Science, technology and operational research under the auspices of Defence and Research Canada (DRDC) must be continuously engaged to explore and refine concepts, and to evaluate their potential effectives within the defence team. This can be accomplished through the Combat Development process and continued staff involvement in the DRDC Thrust Advisory Groups (TAGS).

Joint Capabilities. The Army must actively work with CF joint agencies such as Directorate of Defence Analysis (DDA) and Canadian Forces Experimentation Centre (CFEC), and other governmental agencies in developing mutual understanding and joint capabilities relevant for the future. A joint focus will encourage the development of an integrated CF capability to create networks to share information, and to coordinate and deliver effects on land in support of mission objectives. The Army's long-term focus must be to remain interconnected and networked. Equally critical, the Army must be able to conduct joint operations with national and allied joint forces.

To assist with the transformation process, Directorate of land Strategic Concepts (DLSC) will continue to explore future concepts. Specifically, under the auspices of the Combat Development process, DLSC will focus on:

· Determining the operational function core components and capability requirements required for an Army Tactical Unit (ATU), in priority for the complex and expanded battlespace.

· Examining precision manoeuvre and precision effects within future force constructs.

· In the development of combat systems and components, analyze methods to reduce demand (the logistics footprint)

· Renewing an emphasis on the study of capability requirements in complex terrain, specifically the urban environment.

· Developing standard criterion for use for assessing the utility and relevance of combat capabilities in relation to the Army Strategy.

· Examining the requirement for special operations forces (SOF) capabilities in the joint context, and in cooperation with other environments (services).

· Examining the critical issues of combat casualty evacuation and medical support.

In the final analysis, no one can predict the future with any certainty, but it can be influenced by the actions taken today. As such, *Future Force* attempts to provide a portfolio of concepts of future Army capability requirements. It strives to articulate future force constructs and potential courses of action, as well as to foster a culture of innovation—one that is tolerant of new ideas, inquisitive, and willing to accept risks. This attitude, combined with a leadership that is imaginative and creative will ensure that the Army designs and controls its modernization, rather than just reacting to inevitable change. In the end, this will ensure that the Army of the future is knowledge-based, tactically decisive, sustainable, and strategically relevant.

LIST OF ABBREVIATIONS

9/11	11 September 2001, terrorist attack on the World Trade Center towers in New York.
ABCA	American, British, Canadian, Australian Armies' Standardization Program
AD	air defence
ADF	Australian Defence Force
AEF	aerospace expeditionary forces
AFV	armoured fighting vehicle
AI	artificial intelligence
AMD	air missile defence
AMRAAM	advanced medium-range air-to-air missile
AO	area of operations
ASC	all-source cell
ASEAN	Association of Southeast Asian Nations
ATLF	Army Tactical Lower Formation
ATOF	Army Training and Operational Framework
ATU	army tactical unit
Avn	aviation
BCT	brigade combat team
Bde	brigade
BG	battle group
BLOS	beyond line of sight
BMD	ballistic missile defence
C2	command and control
C3I	command, control, communications, and intelligence
C4ISR	command, control, computers, communications, intelligence, surveillance and reconnaissance
CBP	capability based planning
CCIR	commander's critical information requirements

CCIRM	collection,coordination, information requirements management
CDS	Chief of the Defence Staff
CF	Canadian Forces
CFEC	Canadian Forces Experimentation Centre
CIMIC	civil-military cooperation
CJTF	Combined Joint Task Force
CL	configured load
CMBG	Canadian Mechanized Brigade Group
CNA	computer network attack
COG	centre of gravity
COP	common operating picture
COTS	commercial off-the-shelf
CSS	combat service support
CT	counterterrorism
DARPA	Defense Advanced Research Projects Agency
DART	Disaster Assistance Response Team
DAU	direct action unit
DCDS	Deputy Chief of the Defence Staff
DERA	Defence Evaluation and Research Agency
DEW	directed energy weapons
DLSC	Directorate of Land Strategic Concepts
DND	Department of National Defence
DOC	Department of Commerce
DoD	Department of Defence (USA)
DPG	Defence Planning Guidance
ECM	electronic countermeasures
ELOC	essential level of training
EMP	electromagnetic Pulse
EU	European Union
EW	electronic warfare

FCS	future combat system
FIDO	Fundamental Investigation of Defence Objectives
FIST	Future Integrated Studies Technology
FOAS	Future Offensive Air System
FPS	force planning scenarios
FRES	Future Rapid Effect System
FSE	future security environment
FTTS	Future Tactical Track System
GPS	global positioning system
GUI	graphical user interface
HLVW	heavy lift vehicle wheeled
HQ	headquarters
HUMINT	human intelligence
IAVs	interim armoured vehicles
IFF	identification friend or foe
IMF	Internal Monetary Fund
INT	intelligence
info ops	information operations
IPB	intelligence preparation of the battlefield
IRU	immediate reaction unit
ISN	Institute for Soldier Nanotechnologies
ISO	International Standardization Organization
ISR	intelligence, surveillance, reconnaissance
ISTAR	intelligence, surveillance, target acquisition and reconnaissance
IT	information technology
JDCC	UK Joint Doctrine and Concepts Centre
JSF	joint strike fighter
JTF 2	Joint Task Force 2
LAV	light armoured vehicle
LCS	littoral combat ship

LO	liaison officer
LOC	lines of communication
LOS	line of sight
LPD	landing platform dock
LSVW	light support vehicle wheeled
LUVW	light utility vehicle wheeled
MHE	material handling equipment
MLOC	minimum level of training
MLVW	medium lift vehicle wheeled
MND	Minister of National Defence
MPH	mobile parts hospital
MRT	maintenance repair team
MSR	main supply route
MSSFS	mission self-sufficiency for sustainment
MTBF	mean time between failures
NBC	nuclear, biological, chemical
NBIC	nanotechnology, biotechnology, information technology and cognitive science
NCW	network centric warfare
NEO	non-combatant evacuation operations
NGO	non-governmental organization
NLW	non-lethal weapon
NORTHCOM	North American Continental Defence
NOS	non line of sight
NSF	National Science Foundation
NTM	National Technical Means
OODA	observe-orient-decide-act
Ops	operations
OPSEC	operations security
OTTW	operations other than war
P2P	peer-to-peer

PAC	Patriot Advanced Capability
PAff	Public Affairs
PDA	personal digital assistant
PGM	precision guided munition
PLS	palletized loading system
POL	petroleum, oil, lubricants
PRC	People's Republic of China
PSO	peace support operations
PSYOPS	psychological operations
PEGASYS	Precision and Extended Glide Airdrop System
QDR	Quadrennial Defence Review
R&D	research and development
RAF	Royal Air Force
RAR	Royal Australian Regiment
RMA	revolution in military affairs
RML	revolution in military logistics
RMS	rapid manufacturing systems
ROE	rules of engagement
RPG	rocket propelled grenade
SA	situational awareness
SAS	situational awareness system, or Special Air Service
SDR	Strategic Defence Review
SF	special forces
SIGINT	signals intelligence
SIMS	Sustainment Information Management System
SMP	standard military pattern
SOF	Special Operations Forces
Sp	Support
SPACECOM	United States Space Command
STRATCOM	United States Strategic Command
SSBN	ballistic missile submarine

SSGNs	guided missile boat
TAV	total asset visibility
TIA	terrorism information awareness
TSV	theatre support vehicles
TSSU	tactical self-sufficient unit
TTP	tactics, techniques and procedures
UAV	unmanned aerial vehicle
UCP	Unified Command Plan
UGS	unattended ground sensor
UGV	unmanned ground vehicle
UMS	Unit Medical Station
USECT	Understand, Shape, Engage, Consolidate, Transition
USMC	United States Marine Corps
VCDS	Vice Chief of the Defence Staff
WMD	weapons of mass destruction

Future Force
Concepts of Future Army Capabilities

To be so bold as to presume insight into the future is fraught with risk. However, armed with an understanding of the past, a comprehension of the present and a vision of future trends, it is possible to layout a strategy for moving forward with purpose. Future Force attempts to do exactly that. It provides a view to the future. It is a theoretical "think piece" that presents a conceptual framework designed to assist the Army leadership and those staffs working on the Army of Tomorrow constructs. It describes the outlook and trends that reach out to 2025 and it provides recommendations to allow the Army to transition itself to meet and conquer the challenges it will face in the future.