

# *Toward Army 2040*



*Toward Army 2040:  
Exploring Key Dimensions  
of the Global Environment*

Lieutenant Colonel Michael Rostek  
Peter Gizewski  
Regan Reshke  
Lieutenant Colonel Ron Bell  
Major John Sheahan  
Lieutenant Colonel Steve Larouche

Defence Management Studies Program  
School of Policy Studies, Queen's University  
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# *The Claxton Papers*

The Queen's University Defence Management Studies Program, established with the support of the Canadian Department of National Defence (DND), is intended to engage the interest and support of scholars, members of the Canadian Forces, public servants, and participants in the defence industry in the examination and teaching of the management of national defence policy. The program has been carefully designed to focus on the development of theories, concepts, and skills required to manage and make decisions within the Canadian defence establishment.

The Chair of the Defence Management Studies Program is located within the School of Policy Studies at Queen's University and is built on the university's strengths in the fields of public policy and administration, strategic studies, management, and law. Among other aspects, the program offers an integrated package of teaching, research, and conferences, all of which are designed to build expertise in the field and to contribute to wider debates within the defence community. An important part of this initiative is to build strong links to DND, the Canadian Forces, industry, other universities, and non-governmental organizations in Canada and in other countries.

This series of studies, reports, and opinions on defence management in Canada is named for Brooke Claxton, Minister of National Defence from 1946 to 1954. Claxton, the first post-Second World War defence minister, was largely responsible for founding the structure, procedures, and strategies that built Canada's modern armed forces. As defence minister, Claxton unified the separate service ministries into the DND; revamped the *National Defence Act*; established the office of Chairman, Chiefs of Staff Committee—the first step toward a single Chief of Defence Staff; the Defence Research Board; and led defence policy through the great defence rebuilding program of the 1950s, the Korean War, the formation of NATO, and the deployment of forces overseas in peacetime. Claxton was unique in Canadian defence politics: he was active, inventive, competent, and wise.

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*Douglas L. Bland*  
*Chair, Defence Management Studies Program*  
*School of Policy Studies, Queen’s University*  
*Kingston, Canada*

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## *Introduction*

The future cannot be accurately predicted. Indeed, uncertainty is a predominant characteristic of the future security environment. Yet defence establishments around the world must continue to strive to understand and define how their national security policies will meet the challenges arising within this emerging paradigm. Indeed, state militaries routinely engage in forward planning for a variety of reasons ranging from defence procurement, to recruitment and retention of personnel, to assessment of emerging forms of warfare.

Preparation for future uncertainty is obviously a daunting task. To be sure, a vast amount of information exists which can usefully offer guidance for understanding the scope and magnitude of change. Nevertheless, making sense of that information and its military application is difficult. In this context, futuring<sup>1</sup> and foresight offer great value because these growing international disciplines are designed to “...critically examine the difficulties associated with making decisions with long term future consequences in conditions of uncertainty and to provide methods through which these difficulties can be minimised.”<sup>2</sup>

Employment of futures methodology offers a means for ensuring more systematic and rigorous future planning, (so as to hedge costs in future blood and treasure). Indeed, the purpose of futures methodology is to systematically explore, create, and test both possible and desirable futures in order to improve decision-making. It includes analysis of key dimensions of the global environment, how conditions may change as a result of major trends and drivers at work in the international system, and the implications of such changes for implementation of policies and actions. While not a science, the use of futuring methods can be used to provide a framework to better understand the present and expand mental horizons.

This is the case for the Army 2040 project—an ongoing investigation of the security environment and its implications for Canada’s Army in the years ahead. The project involves a multi-step futuring process in which Environment Scanning, Futures Wheel, and Alternative Futures methods<sup>3</sup>

are used in an effort to identify and highlight certain areas that could inform defence policy decisions today in order to more effectively meet expectations in the future.

These methods accord especially well with the demands and purposes of the project. All are characterized by simplicity of use and were well-suited to a team consisting of a small group of analysts with varying backgrounds, skill sets, time constraints and limited resources. Indeed, their “user-friendliness” expedited the team’s capacity to focus on the analytical phase of the inquiry. Beyond this, and more importantly, they were particularly well-suited to the project’s chief purposes—i.e., the investigation and determination of long term trends and drivers (an exercise which often involved qualitative data), and the investigation of the possible causal interactions that could occur among them.

This volume identifies the Environment Scan key focus areas—i.e., key dimensions of the security environment—upon which subsequent analysis proceeds, and presents the research and analysis conducted by the Army 2040 research team on key aspects of each. Results are presented in the form of short essays detailing the key parameters, current state, evolution (in light of identified trends and drivers), and shocks and uncertainties likely to determine the character and direction within each focus area in the years ahead.

The following seven dimensions of the global environment are identified and analyzed: scientific and technological, social, political, economic, international law, physical environment and security dimensions. Two final essays, one discussing changes in the human dimension likely to take place in the future environment, and a second discussing the issue of shocks and their potential impact on the character of the future, conclude the volume. The result is a foundation upon which to better appreciate the various forces and causal mechanisms that could arise as the future unfolds.

## *Environmental Scanning*

Environmental scanning is a process involving the acquisition and use of information about events, trends and relationships in an organization's internal and external environment. The knowledge and insights gained serve to assist in planning the organization's future course. The process typically focuses on a large number of areas—in effect covering every major sector of the environment that can assist management in planning for an organization's future.<sup>4</sup> It also involves the use of four basic techniques: undirected viewing, conditioned viewing, and both informal and formal search of both primary and/or secondary sources of information. All four are essential to effective use of the method. Indeed, as one observer explains:

Undirected viewing helps the organization to scan broadly and develop peripheral vision so that it can see and think outside the box. Conditioned viewing tracks trends and gives the organization early warning about emerging issues. Informal search draws a profile of an issue or development, allowing the organization to identify its main features and assess its potential impact. (And) formal search gathers all relevant information about an issue to enable intelligent decision-making.<sup>5</sup>

At the broadest level, environmental scanning examines where changes in the social, technological, economic, environmental, and political (STEEP) sectors affect organizations directly and indirectly.<sup>6</sup> The Environmental Scanning method was adapted to include eight focus areas considered to be key to the Army in the 2040 timeframe. All were then researched and studied in depth to gain a full appreciation of potentially important changes—drivers, trends and “weak signals.” Indeed, the method allowed for an analysis of what is constant, what changes and what constantly changes, in the areas under scrutiny. It also helped to provide team members with some general, wide-ranging hints as to the direction that the future may take.



# *The Physical Environment*

*Major John Sheahan*

## **Introduction**

Debate about the role that physical geography plays in the broad context of international security is increasing. Some have argued that the resources present in our natural environment (and the ways in which they are utilized) can contribute to the development of collective violence. This chapter describes the implications of physical geography in the context of global resource scarcities drawing on the examples of energy and water. It examines climate change issues briefly, and lastly considers implications of these topics in the specific instance of the Canadian Arctic.

## **Resource Scarcities**

Natural resources are extracted from our physical environment. One way to broadly classify the many resources that are essential to the health of a society is to divide them into two categories: renewable and non-renewable resources. Minerals and fossil fuels are prime examples of the latter. Some of the key categories of the former (considered particularly essential to the health of developing nations) include fresh water, croplands, forests, and fisheries. Thomas Homer-Dixon, a noted scholar in the field, has identified three primary causes of resource scarcity: supply-induced scarcity, demand-induced scarcity and structural scarcity.

Supply-induced scarcity occurs when the method or rate of harvesting of natural resources exceeds a certain level of depletion. If such magnitudes are particularly severe, a given resource may become not just temporarily unsustainable, but altogether extinct—regardless of subsequent efforts to regenerate the resource. Demand-induced scarcity can be the result of a

constant draw on a fixed resource base by either a growing population, or a growing appetite within a population. Lastly, structural scarcity results when one or more groups are excluded from equal access to a particular resource.

There is potential for resource scarcities to lead to violence.<sup>7</sup> It is important to note that this scarcity/violence relationship does NOT imply scarcity is a direct and sufficient cause for violence. In countries where expectations for economic growth are high, resource scarcities could become problematic. China and India, for example, are experiencing friction (internally, regionally, and even globally) regarding their appetites for a number of resources.

Non-renewable resources are by definition unsustainable. Unanswered trend questions in this context concern how soon depletion of such non-renewables will occur, the regional or global impacts they may produce, and what prospects—if any—exist for discovering or developing effective substitutes.

In the second half of the 20th century, world population more than doubled, from 2.6 to over 6 billion. Projections for the next fifty years include estimates that up to 95 percent of population growth will occur in developing nations, many of which, coincidentally, lie in the very regions containing significant shares of the world's natural resources, both renewable and non-renewable.<sup>8</sup>

## Energy

Energy in all of its forms, is the life-blood of the global economy. Conservative studies indicate that global reserves of crude oil and the current trajectory of economic and regulatory forces may result in a maximum level of global oil production in the time frame of 2025.<sup>9</sup> Much has been written on this subject, often abbreviated as *peak oil* and quite often from inflammatory, wrong-headed and/or melodramatic perspectives.<sup>10</sup> A number of options are afforded by choosing other fossil fuels<sup>11</sup> and/or alternative fuel and energy sources<sup>12</sup> but these options are not currently expected to solve the potential problems associated with liquid fuels shortages.<sup>13</sup> Clearly the assumptions used to develop these sorts of projections are absolutely critical to their accuracy. Expressed a different way, though, global reserves of crude oil could become problematic by 2025. This implies that (barring the discovery of significant new reserves, and barring the adequate adoption of substitute fossil fuels or alternative fuel and energy sources) critical energy shortages will develop in the time frame of (and perhaps prior to) 2025.

There can be little doubt that unrestricted access to reliable energy supplies is a global strategic issue, one for which, recently, numerous nations

have been willing to fight, and have done so. Thus the trend that envisions depletion of fossil fuels such as crude oil in coming decades may also contribute to international tensions, if not violent conflict.

## **Water**

“If the wars of [the 20th] century were fought over oil, the wars of the next century will be fought over water.”<sup>14</sup> Though one might suspect that this assessment is unrealistically pessimistic, conservative estimates for the year 2050 indicate that more than sixty countries, (representing a significant portion of the world’s population) will be categorized as water-scarce or water-stressed.<sup>15</sup> A subset of some twenty countries in the Near East and North Africa may become especially vulnerable. Thus it is possible that the capacity to control access to water in these and other areas (including Central and South Asia, and Latin America), may not only come to represent a key source of power—but it also could become a basis for future conflict.<sup>16</sup>

## **Climate Change**

One of the key drivers that will impact on both the supply and demand for resources is global climate change. Though there continues to be vigorous debate about the pace, cause, magnitude and implications of climate change, there can be no further debate that global climate change is occurring.<sup>17</sup> Even the sub-debate regarding the distinction between weather (short term noise) and climate change (long term trends), which is a subject still considered controversial by many, is becoming moot.

If, as many insist, human causes are at the root of our current instance of climate change and if those causes will not or cannot be halted, (or if the lag between behaviour change and climate change reversal takes decades), then the phenomenon of climate change could become a shock and not just a driver. Crop failures (or drastic yield changes) could result in mass migrations and/or starvation. Antarctic ice cap and glacial melts as well as other factors could cause sea level changes, predicted by some to be small and relatively slow (20 to 60 centimetres per century<sup>18</sup>) and predicted by others to be more abrupt (metres per century). Either way, these sorts of changes could lead to impacts resulting in the abandonment of large urban and cropland areas, further aggravating a broad range of existing resource scarcities. Some estimates envisage mass migrations on the order of one billion persons before 2050 of which up to a quarter may be the result of climate change impacts.<sup>19</sup>

## **The Arctic**

Resource scarcities combined with climate change impacts will heighten the strategic relevance of global arctic regions. Global warming could make the Northwest Passage (NWP) navigable for several months of the year before 2013.<sup>20</sup> Some suggest the passage might even become commercially viable within a decade.<sup>21</sup>

Use of the NWP could reduce some international shipping distances by 20 to 40 percent resulting in fuel savings of more than \$3M per vessel per voyage.<sup>22</sup> This development could pose new challenges for Canada since a number of nations (including the US) still refuse to recognize Canada's sovereignty within our Arctic archipelago.<sup>23</sup>

Unconfirmed data (including a report from the United States Geological Survey) suggests that energy and mineral reserves in the Arctic could be substantial, perhaps as much as 22 percent of the world's undiscovered fossil fuels<sup>24</sup>. Some suggest that Canada's portion of undiscovered natural gas reserves (much of which lie within our northern perimeter) could be as large as (or larger than) the sum of all her known reserves today.<sup>25</sup> And as the scarcity of some resources rises, so too will their prices, and hence the feasibility of developing sites previously considered awkward (such as remote arctic islands and the arctic seabed) will fall. This opportunity is also accompanied by challenges as a number of nations have conflicting sovereignty claims for the Arctic seabed.<sup>26</sup> In addition to the sovereignty issues pertaining to the NWP, Canada has three other bilateral Arctic boundary disputes: two with Denmark, one over Hans Island (less than one square mile in size situated in the extreme north between Greenland and northern Ellesmere), one with respect to small tracts of the Lincoln Sea north of Ellesmere Island, and one with the US over the offshore maritime boundary extending northward from the land boundary between Yukon and Alaska.<sup>27</sup>

## **Conclusions**

Resource scarcities are as old as civilization; they will continue into the distant future. Scarcities are caused by changes in supply, changes in demand and structural constraints enforced by influential groups within societies. In the coming decades, climate change along with other factors will have an impact on resource scarcities and their outcomes. One of these outcomes will be a rise in the strategic value of the resource-rich Arctic in general and the Canadian arctic archipelago in particular.



The short term impacts of resource scarcities *can* lead to violence, and that violence manifests itself as interstate war and/or as intrastate conflict (i.e., civil strife) but in all cases *the scarcity alone does not cause violence directly*. Indeed scarcity may or may not cause violence depending on the complex interaction of other political, economic, military and social factors.



# *Social Dimension*

*Peter Gizewski*

## **Introduction**

Social characteristics of importance in assessing the nature and dimensions of future threats and challenges typically include population growth, location, age, ethnicity, general health (i.e., mortality and fertility rates), literacy, socio-economic status, and/or religious characteristics. Additional indicators include individual views regarding key issues of importance in life (survival vs. self awareness/actualization) as well as attitudes and orientations toward the outside world (insular vs. cosmopolitan, religious vs. secular).<sup>28</sup>

## **Current State**

Overall, recent decades have witnessed a steady—but slowing—rise in aggregate world population as well as improvements in many of the social indicators mentioned above. Mortality rates have declined and literacy is generally on the rise. The number of people facing poverty has also decreased worldwide.<sup>29</sup>

Yet glaring disparities continue to characterize the developed and developing world on virtually all key indicators. Despite some evidence of progress, the present system remains marked by a stark contrast between the developed and developing worlds—with the former increasingly aging, urban, literate and affluent, while the latter is growing, young, rapidly urbanizing, and plagued by low literacy, high mortality and fertility rates, economic hardship, and disease.

Attitudinally, those in the developing world hold relatively insular outlooks, are chiefly focused on personal security and survival, and tend toward

more religious orientations to life. Those in developed regions meanwhile, reflect more secular orientations, more cosmopolitan world views and focus less on issues of survival than on achieving greater self-awareness and self actualization—a fact reflected in their support for environmental causes, women’s rights and multiculturalism.

The impacts of such trends are increasingly evident—with many regions of the developing world characterized by economic and societal instability, frequent and abrupt population movements, and conflict. In contrast, developed nations continue to enjoy stability and relative affluence. Yet many increasingly experience the growing economic and health care burdens of aging populations, and the social tensions and dislocations that often accompany immigration from the developing world.

### **Evolution and Future Challenges**

Such indicators will continue to shape societies in the decades ahead. Indeed, many of the societal trends witnessed today will intensify and broaden.

The key shifts will continue to be a slowing and in some regions—a decline—in population growth,<sup>30</sup> continued urbanization and a gradual aging of global population.<sup>31</sup> Aging population will be especially pronounced in the developed world.<sup>32</sup> Demands on health and welfare systems and the tax base will increase. In addition, the age of retirement, along with efforts to promote immigration from the developing world will rise as greying societies desperately move to address labour shortages, eroding tax bases and slow-downs in economic growth. Developed societies will be more diverse culturally and ethnically as a result. The presence of diaspora communities will rise, and visible minorities will comprise a greater proportion of the work force. Their demand for more input in, and access to, the political process will thus increase. Generational tensions may rise as younger, immigrant workers are forced to bear the economic burdens of funding the retirement benefits of elderly native-born populations. Moreover, increased refugee flows emanating from dire conditions in the developing world could serve as a further source of societal tension.

A number of currently developing countries will also experience a decline in population growth and an aging of populations. This, along with reductions in infant mortality, fertility and improvements in literacy and health, will offer some prospect of greater prosperity and stability. Yet negative impacts will also occur. In China for instance, the impacts of an aging population may trigger a slowing of economic growth and/or political

tensions in the decades ahead—particularly as demands on the state for social services and health care correspondingly rise.<sup>33</sup>

Certain developing countries will nevertheless continue to experience relatively steady population growth (i.e., exceeding replacement rates). In fact, over 70 percent of such growth between now and 2050 is expected to occur in twenty-four developing countries—all of which are classified by the World Bank as low income or lower middle income.<sup>34</sup> As high birthrates and exceptionally young populations strain the limited absorptive capacities of such states, chances for popular discontent and societal tension will likely rise, generating prospects for instability and turmoil both at home and abroad. Notably, of the forty-eight fastest growing countries today—in those with an annual population growth of 2 percent or more—twenty-eight are majority Muslim or have significant Muslim minorities. Should education and employment opportunities in such nations fail to improve, the result could well be evermore poverty, tension, and ideological radicalization.<sup>35</sup>

Connections both within and between societies will increase—as populations become even more mobile and advances in Internet communication and networking further broaden and deepen. In some cases, this may breed less insular outlooks, and greater societal openness to external values. Yet it may also work to highlight social inequities in a manner which generates increased tension and unrest.

Meanwhile, rapid urban growth and unchecked urbanization will continue to plague the developing world—leading to higher population densities, urban sprawl, and overburdened infrastructure and services. Urban decay, societal grievance and the prospect of instability and armed violence will be ever-present.

### **Drivers, Shocks and Uncertainties**

The drivers of such trends are numerous and complex. Yet key among them are economic conditions (i.e., economic development) and advances in science and technology (S&T). To the extent that economic fortunes improve and S&T spreads, it can be expected that population growth will subside, fertility and mortality rates will decline, and there will be an increase in literacy rates. Attitudes toward society and the outside world tend to follow suit—most notably in the form of a gradual shift from insularity and concern for basic survival to greater openness.

That said, other forces are likely to condition the societal impacts which economics and S&T generate. Political forces in particular can facilitate or obstruct the extent to which such fundamental drivers work to alter social

realities. Indeed, political determination of fiscal policy, legal frameworks, and which groups in society derive the benefits of change will ensure that the presence and impact of key drivers are never distributed evenly. As such, the intensity of social changes and challenges that will mark the world of 2040 will vary by region and country. And the fact that trends in national political spheres are difficult to predict will ensure that the degree of societal change evident in specific regions and countries will remain an area of considerable uncertainty.

Beyond this, a number of shocks may work to fundamentally alter such trends and their impacts. The onset of major war or the occurrence of a number of environmental catastrophes (e.g., global plague, major droughts and famines) could dramatically alter population projections and fundamentally disrupt regional and global economies to a point where projected social changes are not only nullified but reversed. Unexpected innovations in science and technology or novel applications of S&T may also alter the social calculus.

## **Conclusion**

Overall then, decades leading up to 2040 will be characterized by slowing population growth, a general aging of world populations and continued urban growth. Decreases in mortality and fertility rates, and increases in literacy will occur, and so too will a gradual shift to more cosmopolitan outlooks and mindsets.

That said, the extent and pace of change will remain highly uneven, and the challenges posed for nations will vary. In the developed world, challenges associated with aging populations and declining workforces will pose a central dilemma. And issues of immigration and its absorption into the host social fabric will raise key issues and demands. Developing nations, meanwhile, will continue to confront the long-standing challenges of unchecked urban growth, disease, and economic and environmental instability. Yet over time, economic progress and the globalization of science and technology may ultimately work to generate improved social conditions and lifestyles.

Notably, the specific social dilemmas and challenges confronting both the developed and developing world will generate an increased merging of populations—as each seeks to address the problems and opportunities that accompany change. Ultimately, the result will be a more complex reality in which individual countries mirror the social diversity of the world in general.

# *Political Dimension*

*Peter Gizewski*

## **Introduction**

Trends in the area of politics are numerous and can be tracked on a number of indices. Key indicators of importance include the overall configuration of power—or the basic structure—of the international system, the processes which characterize its ongoing development and character, the nature, diversity, stability and legitimacy of the political units or organizations that it comprises, and the basic issues which generate political action and competition.

## **Current State**

The current international system is characterized by unipolarity in the form of clear, and largely uncontested, US hegemony. While a number of states are clearly emerging as strong regional players who possess some extra-regional ambitions (e.g., Brazil, Russia, India, China), US power and influence—militarily, technologically, economically and culturally—dominates today's international scene. This has generated relative stability internationally. Indeed, notwithstanding growing ambivalence toward the ongoing “war on terror” and conflicts in Iraq and Afghanistan, prospects for system-wide armed conflict have been low.

States continue to represent the principle players in today's system. Their character varies considerably—with regime types ranging from democratic and authoritarian to monarchical and theocratic. Yet there has also been an increase in the number of weak and failed states—a phenomenon which continues to pose a source of persistent tension and conflict—particularly in the developing world.

In fact, a number of forces are working to complicate—and in some cases erode—the power and influence of the state. Globalization, the rapid spread of science and technology, resource scarcities and even natural disasters are working to increasingly limit the degree of control which individual nation states are capable of exercising over their environments.<sup>36</sup> These forces have generated growing scrutiny of state practice and the authority and legitimacy of governments. And, they have also helped to create—as well as empower—other types of political players both domestically and on the international stage. Most notably, an increase in non-state actors—ranging from international and regional institutions to non-governmental organizations, transnational corporations, citizen groups and even influential individuals—is evermore evident.

Such actors generally pursue relatively non-violent agendas and solutions to meet goals and challenges. Yet others are less benign—a fact most clearly evidenced by the actions of radical terrorist groups intent on limiting, if not eradicating, the spread of Western ideas and influence from Islam. In fact, while issues of climate change, resource scarcity, and global poverty loom increasingly large, the threat potential of these and other non-state entities, such as transnational criminal organizations, occupies a central place in contemporary security policy.

### **Evolution and Future Challenges**

A number of these trends will continue to mark the future. To be sure, states of varying types<sup>37</sup> will undoubtedly continue to represent the chief players in the international system—particularly in the areas of physical security, national economic and monetary policy, and immigration.

At the same time, ongoing globalization, advances in science and technology and problems such as resource scarcity and climate change will continue to generate dilemmas which will further challenge state sovereignty, authority and control. How the state reacts in the face of such issues will represent a fundamental challenge in the decades ahead.

Certainly, further growth in the number and importance of supra-national, and sub-national organizations and players (e.g., transnational corporations, non-profit organizations, citizen activist groups, etc.) will occur as well. Some of these organizations will focus on a broad range of issues that span a number of countries and regions. Still others will be local and “single issue” in orientation. Yet all will represent new and important vehicles of citizen interaction and empowerment in a system in which a



range of emerging forces continue to challenge the capacity of nation states to respond.

In some cases, this will prompt greater networking, cooperation and partnership between the state and non-governmental actors—with each increasingly recognizing the much needed capabilities offered by the other for achieving effective, legitimate solutions to problems.<sup>38</sup> In others, the result may simply be the creation of new centres of power and influence beyond the nation-state itself. Yet whatever the outcome, it is likely that norms and procedures governing the manner in which solutions to future problems are pursued, and the means employed to address them, will change.

Future decades will also see a gradual decline in US global influence relative to other nations, and a gradual shift from a unipolar to an increasingly multi-polar world.<sup>39</sup> Such a system may well feature a number of key state players forging tight alliances with or against one another to balance power and maintain security. Alternatively, it may take the form of loose alliance configurations—with players constantly shifting loyalties depending on the issues at stake.<sup>40</sup> Yet in either event, key state players will likely include the US, China, Brazil, Russia, Turkey, and India.

Meanwhile, areas of future political contention and concern will be numerous. Yet potential disputes over natural resources and the environment, sovereignty and territorial rights, state legitimacy and human rights will likely be paramount both internationally and nationally. Furthermore, possibilities for both state and sub-state conflict in many of these areas will continue to exist, particularly (although not exclusively)—in the developing world.

### **Drivers, Shocks and Uncertainties**

Both globalization and rapid scientific and technological innovation will represent major drivers of the political trends noted above. Often, the impacts of both will increasingly challenge the control, as well as the legitimacy and authority of traditional state actors and help create and empower new political entities (e.g., transnational organizations, citizen groups, etc.) to address major concerns. Yet demographic shifts, economic and environmental conditions and access to resources will propel emerging political trends as well—affecting the relative power and stability of states and societies as well as the rationales animating the agendas and actions of new political organizations and actors.

What the future political landscape consists of will also derive from past circumstances and events. For instance, the character of many states

will doubtless owe much to physical realities (e.g., geography, climate, etc.) and social composition (e.g., ethnic, religious, cultural characteristics). So while potential sources of conflict will often stem from emerging trends in other areas, they will also have roots in more long-standing realities (i.e., geopolitical realities, territorial disputes, historical ethno-religious rivalries).

To be sure, various shocks could clearly and fundamentally alter this future. A major systemic war involving weapons and means of mass destruction could conceivably work to reduce considerably the power of key actors to a point where the structure of the international system (and thus the behaviour of those within it) is quite different than that projected. Major environmental shocks arising from forces such as climate change may produce similar effects.<sup>41</sup>

Beyond this lies the fact that the fruition of such trends will be heavily contingent on the interaction of a broad range of forces and a wide array of leaders and personalities.<sup>42</sup> Accordingly, both the speed with which they unfold as well as the degree to which they impact on particular regions and states, will often involve considerable uncertainty.

## **Conclusion**

The future will see greater fruition of a number of political trends just now becoming evident. While the state will remain an important political force in the international arena, it will increasingly compete with other forms of political organization as an effective means of addressing popular needs and goals. In fact, a crisis in state legitimacy and authority may represent a key challenge for governments in the decades ahead. And the ability of states to interact effectively with new organizations and actors may be crucial, not only to their future status and well-being, but to that of the international system as a whole.

The period of uncontested US hegemony—and system unipolarity—that currently exists will gradually give way to an evermore multi-polar configuration of power and influence. This will add still further complexity to the national security equation—increasing the potential for miscalculation and inadvertent conflict along the way. Meanwhile, the international landscape will feature a range of issues over which political organizations and actors will contend, as access to resources (both physical and human), questions of state legitimacy, sovereignty, and human rights become increasingly salient and important in the years ahead.

# *Science and Technology (S&T)*

*Regan Reshke*

## **Introduction**

Technology is ubiquitous and is born of innovation—innovation that is shaped by the social, political, legal, moral, economic, and technical environment that surrounds the innovator. Thus, technology is shaped by human society—but ironically, society is itself altered by technology. Indeed, the entwined nature of socio-technological change

... is in large part responsible for the evolution of such basic parameters of the human condition as the size of the world population, life expectancy, education levels, material standards of living, the nature of work, communication, health care, war, and the effects of human activities on the natural environment. Other aspects of society and our individual lives are also influenced by technology in many direct and indirect ways, including governance, entertainment, human relationships, and our views on morality, cosmology, and human nature.<sup>43</sup>

Although its benefits are not shared equally, the exponential growth in science and technology has led to unprecedented global prosperity and an enrichment of the quality of life for humankind. Yet while so many aspects of human health and welfare are dependent upon continued progress in science and technology, the very survival of the species is imperilled by its potential destructive power.

Although the future remains unknowable, identifiable drivers and trends within the S&T domain are not only shaping societies, but the very fabric of life on earth.

## **Drivers, Trends, Shocks and Uncertainties**

Despite its exalted position as the most intelligent species on the planet, humans have a long and sordid history of conflict and war. Sadly, it seems inevitable that war and conflict will continue into the future. A confluence of S&T trends and drivers, however, makes this prospect particularly worrisome. Although humankind's increasingly powerful technologies offer hope for greater global prosperity and superior global quality of life, if placed in the wrong hands or mismanaged, S&T advances present a mounting number of possible catastrophic future scenarios. In fact, globalization and advanced technology allow fewer people to do more in less time than ever before.

Given the nature of human needs, a key driver that will continue to shape the future of S&T development is the quest for safety and security—a quest that leads societies to develop and improve offensive and defensive military capabilities. Such capabilities often are enabled through advances in science and technology. Ironically, when advanced capabilities are combined with national policies and strategies, they frequently cause external societies to view them as threatening. Predictably, the response of these other societies is to seek similar or superior defensive capabilities or strategies, which then completes a positive feedback loop.<sup>44</sup> History offers many examples of this “security dilemma”<sup>45</sup>—a dilemma that is invariably characterized by rapid developments in military S&T. The Cold War-era arms race between the US and the Soviet Union is a characteristic contemporary example of such runaway cycles. Paradoxically, we are witness to the fact that even the sense of safety and security of the society with the greatest military infrastructure that has ever existed can be assaulted. The 9/11 attacks on the US, predictably, resulted in increased, and in fact unprecedented, military expenditures, with a significant portion being directed towards research and development of new and novel techniques and technologies to mitigate the perceived threat. These disproportionate expenditures, and their spinoff S&T advancements combined with revised national strategies, threaten to have a destabilizing effect, due in large measure to the fear-based feedback loops that result.

A positive feedback loop also exists between national capacity in creativity, innovation, science, technology and engineering, and national economic well-being. This unstable equilibrium<sup>46</sup> is acknowledged by most, if not all states, as a desirable condition. Yet as national economic well-being improves, so, too, do concerns about protecting it. Nations with strong economies can afford to—and do—invest in new and improved military offensive and defensive capabilities, which then entangle this and the aforementioned safety and security feedback loops.

Given this highly simplified model, the growing complexity of modern global civilization is clearly evident. Moreover, recent insights from fields such as complexity theory suggest that once a society develops beyond a certain level of complexity, it becomes increasingly fragile and eventually a tipping point is possible<sup>47</sup> when all the energy and resources available to a society are required just to maintain its existing level of complexity. If a significant event occurs, overstretched institutions break down and civil order collapses, aggravated by tightly coupled networks that create the potential for propagating failures across many critical industries.<sup>48</sup>

An ongoing global diffusion of S&T expertise and governance driven by substantial investment in broad S&T domains by both developed and emerging nations, is adding to global complexity. Control over S&T policy decisions are not made by a unified body of rational human representatives intent on attaining a particular objective. Instead, there are countless agents, pursuing different and often opposing objectives, influencing various aspects of our S&T activities including national and regional governments, corporations, private philanthropic foundations, special interest lobbies, journal editors, research councils, media organizations, university presidents, prize committees, consumers, voters, scientists, public intellectuals, etc.<sup>49</sup>

Yet another layer of global complexity is being added by Internet technologies. “Web 2.0” innovations, for example, are focusing on connecting people, rather than just information. Moreover, global media and technology convergence—press, television, Internet, cell phone—is providing extraordinary propaganda reach, which facilitates the shaping of public opinion. The resulting global social networks pursue specific goals and objectives ranging from benign collective interests to anti-government activism. A concomitant worldwide increase in e-crime and cyber attacks, coupled with the personal and economic imperatives to protect data privacy and intellectual property, is driving a growing demand to bolster cyber security through biometrics, cryptography and other technologies.

An increasingly profound understanding of the human genome, driven by advances in information technologies and coupled with inexpensive tools to read and rewrite genetic code, is leading to the ability to manipulate biology (intra- as well as inter-species) at the level of DNA. This offers the ability to re-engineer existing life (for repair or enhancement) and even the creation of new life forms for specific purposes. This ability to manipulate the code of life promises to offer profound capabilities that could be directed towards the solution of humankind’s grand challenges<sup>50</sup>—provided that the moral, ethical and legal repercussions, and indeed the growing fear of these technologies, can be managed.

Some researchers suggest that the future technologies that will matter the most are those that impact upon intelligence and the human mind: brain imaging, cognitive science, neurotechnology, brain-computer interfacing, and artificial intelligence (AI).<sup>51</sup> The aggregation of biological intelligence and machine intelligence promises to grant humankind the power to solve any problem in its path.<sup>52</sup> This merger of man and machine continues to drive another positive feedback loop; the self-sustaining nature of S&T development, whereby each new round of innovation creates still better tools to feed subsequent rounds of innovation. Moreover, the resulting performance/cost, performance/size and performance/power-consumption ratios for the products derived from ensuing rounds of innovation continue to improve exponentially. Just as yesterday's supercomputer has become today's laptop, today's laptop will be tomorrow's smart-phone. Thus the pace of change witnessed in the early part of the 21st century is unlikely to abate, and indeed it is likely to accelerate.

Self-sustaining S&T development is feeding a continuing trend to automate more and more jobs and functions. This is due largely to economic imperatives, i.e., more capability for the same or lower cost. Robots can also function 24/7 and when they are retired, they do not need health care or receive severance pay or a pension. Economics (and not necessarily military requirements) therefore, will continue to push these technologies ahead. It seems inevitable, however, that their dual-use nature will see robotic and automation technologies being increasingly adapted for military use—particularly given the casualty aversion (and fear of terrorist threats) which appears to permeate western societies.

Within the framework of the aforementioned drivers, there are numerous identifiable trends within the S&T domain that will shape human societies well into the future (see Annex). Key among these trends is the growing pervasiveness of information and communication technologies (ICT), which has already changed the nature of communication, collaboration, education, entertainment, leisure, privacy, and surveillance to name but a few areas. Similarly, the convergence of nanotechnologies, biotechnologies, information technologies and cognitive science (NBIC technologies) is a trend that promises to reshape our perception of size and power. Harnessing the unique properties of both biological and non-biological material at the nano-scale promises to dwarf the mega-projects of the 20th century. Indeed, the power of NBIC technologies threatens to eclipse that of nuclear weapons. Therefore, as these technologies mature and continue to converge over the course of the next thirty years, humankind may unwittingly augment its arsenal of global life-terminating technologies—threatening to kick off

yet another destabilizing positive feedback loop; unfortunately, one with potentially catastrophic and irreversible results.

There are many friction points and uncertainties that will modify the direction and outcomes of these trends. However, human choices, driven in part by fear of certain S&T outcomes and shocks, will undoubtedly be a primary source of friction that will shape the direction that these trends follow. That there is no hegemonic power governing global S&T policy decision-making, however, makes it impossible to predict where human innovation will take us, or how fast it will progress. Furthermore, there is an increasing likelihood that even well-intentioned policy decisions will have multiple adverse, unintended consequences due to the growing complexity of globalization.

### **Conclusion**

Creativity, innovation, science, technology and engineering, all shaped by human and increasingly by machine intelligence, will factor prominently in determining the character of human society out to 2040 and beyond. The trajectory that these advances follow remain within the control of societies; however, such control is diminishing in direct proportion to the increase in the complexity of human and national interrelationships resulting from globalization. Collective human wisdom and judgment will be crucial in shaping S&T progress and developments in ways that deliver the greatest benefit to humanity while avoiding conceivable catastrophes.





# *Legal Dimension*

*LCol Michael Rostek*

## **Introduction**

The legal line of investigation encompasses the legal profession, domestic law, international law, supranational law, cyber law and space law.<sup>53</sup> Key to emergent legal issues are the enforcement mechanisms used to garner compliance. While enforcement is well established and articulated within domestic law, mechanisms in international law, supranational law and cyber law are substantially weaker. While progress is being made in each of these areas, mechanisms to garner compliance are anticipated to evolve at a slower rate. This rate of progress is perhaps best exemplified by the increasingly permissive nature of international law sanctioning the use of force to intervene in state affairs based on humanitarian grounds.

## **Broadening Agenda**

International law consists of a discrete body of legal rules and institutions designed to govern relations between sovereign states, and to an increasing extent, between sovereign states and non-state entities. International law is formally defined as:

...the body of law which governs relations between sovereign states. It is a system of rules and principles created primarily by states, which cover almost every facet of inter-state activity. It is the vital mechanism without which an increasingly interdependent world could not function. International law deals with issues such as nationality, the use of armed force and the human rights of individuals. The practice of International Law is directly related to diplomacy, politics and the conduct of foreign relations.<sup>54</sup>

This body of law reflects the principles of sovereignty, under which states have the right to be left alone, to exclude, to be free from any external meddling or interference as well as being recognized as an autonomous agent in the international system.<sup>55</sup> However, today, rules, norms and principles of international law are no longer solely focussed on maintaining order.<sup>56</sup> Minimum standards of global justice are now considered to be the same as those implied by UN Security Council resolutions warranting international interventions where gross violations of human rights by states are seen as threats to international peace and security (e.g., UN operations in East Timor).<sup>57</sup>

Human rights expectations will continue to challenge legal institutions as well as domestic and international laws. Global civil society<sup>58</sup>—the convergence of publics, information technology, and economic prosperity—has become a key player in the evolution of international law, and human rights are high on the agenda. A human rights revolution has been underway since the end of WWII (1945–49 Nuremberg War Crimes trials, 1948 Universal Declaration of Human Rights, 1998 International Criminal Court) where the absolute freedom of states to regulate their internal affairs has been continually eroded to a point where today, the International Criminal Court (ICC) can punish the worst crimes committed by governments or state militaries wherever they may have taken place.<sup>59</sup> Further, this has been codified in customary international law<sup>60</sup> with near universal acceptance by states today. However, the ability to enforce a warrant of an international court remains an uncertain proposition and is frequently contingent on the goodwill of a state or states.

Challenges facing states and the international community—cross-border pollution, terrorist training camps, weapons proliferation and international organized crime—have domestic roots where international law often remains powerless.<sup>61</sup> Perhaps more significantly, state boundaries are being breached by international rules regulating how states should behave within their territories thereby advocating standards of global justice (e.g., Responsibility to Protect).<sup>62</sup>

### **Deepening Agenda**

While sovereign states remain the focus of international law today, international law increasingly recognizes individuals, groups, organizations, and non-state actors [e.g., human rights law, holding individuals criminally responsible for violations of those rights (Rwanda); creation of ICC and arrest of Pinochet—former Chilean dictator—in London].<sup>63</sup> International law

remains incapable of resolving many issues of conflict and confrontation today. Yet it is important to acknowledge that it is evolving (e.g., International Criminal Court). From pursuit of global governance to individuals establishing their status as both subjects and agents under international law to the increasing importance of non-governmental actors in the development and codification of international legal norms, it can be argued that international law is transforming into a system of supranational law—laws above the state—where legal scholars are looking afresh at the role of legal norms in shaping world politics.<sup>64</sup>

*Cyber Law:* Cyber law is a generic term which refers to all the legal and regulatory aspects of the Internet and the World Wide Web. It is concerned with, related to, or emanates from any legal aspects pertaining to the activities of “netizens.” Interestingly, the law of the Internet has no history to fall back on and as such, cyber law is being developed by judges who must do their best to fit legal disputes on the Internet into pre-existing legal frameworks; that is, map state-based laws to non-state space.<sup>65</sup> Cyberspace continues to be a domain of increasing concern where global responses are sporadic and/or non-existent.<sup>66</sup> As a result, the legal principles governing conduct and commerce in cyberspace remain in a state of flux and must be carefully monitored.

*International Space Law:* Space continues to grow in importance due to the increased number of states and non-state entities involved in space-related activities. Space is considered a global commons in international law.<sup>67</sup> This increased emphasis on space (i.e., economic advantage and global communications) has driven the need for effective laws and policies regarding space at both the national and international levels. Continued engagement in the evolution of international law in regards to space given the increasing ability of Canada to operate in this environment is essential.

## **Conclusion**

Sovereign states are no longer the sole agents of international law. Where issues of justice are being considered there is an increasing focus on non-state entities in the international quest to maintain order. Emergent cyber law is in a state of flux due to its lack of history and its application of state laws to non-state spaces. Further, as international humanitarian law evolves, issues of global justice begin to penetrate the state. This seeming quest for global governance is pushing international law into new areas, raising questions about whether international law is transforming to supranational law. While many of the issues identified above have yet to prompt a

re-writing of international law, it is prudent to stay abreast of this realm due to developments which are challenging the state's privileged position within international society. International law has played a vital part in shaping the character of internal society, and by all accounts, it will continue to have this impact into the future.

# *The Economy*

*LCol Michael Rostek*

## **Introduction**

Today, and perhaps more so in the future, a key step in understanding one's national economy is to understand the global economy. This is perhaps best illustrated by globalization and the divergence between prosperity in developed states and disparity in developing states. While prospects for global markets, partnerships and alliances contribute to international co-operation and peace through increased mutual-dependence in the North, poverty and subjugation of human rights in the South create conditions for increased global insecurity. This dichotomy and its global impact singularly highlight the necessity to first understand the global economy prior to any study of a national economy.

## **Global Economy**

While the global economy was deeply affected by the recent global economic recession, economic growth has once again turned positive although mid term recovery is expected to be slow.<sup>68</sup> However, long term growth of the global economy is still expected through to 2040 with increasing internationalization of markets for goods, capital, services and labour.<sup>69</sup> This economic growth will be driven by population growth (8.0 billion by 2030 and more than 97 percent of this growth will take place in developing countries)<sup>70</sup>, improvements in productivity (the output of the global economy will rise from US\$35 trillion in 2005 to US\$72 trillion 2030)<sup>71</sup>, and greater integration of the global economy (global trade in goods and services is

likely to rise more than threefold to US\$27 trillion in 2030 and roughly half that increase will come from developing countries).<sup>72</sup>

However, major structural changes are foreseen: aging North; rise of the BRIC states (Brazil, Russia, India, and China);<sup>73</sup> and shifting patterns of global capital flows (resultant of huge US current account deficit being financed by developing countries—most notably, Russia, India and China).<sup>74</sup>

Energy concerns, mostly over fossil fuels, will continue where global consumers will outpace global producers. Global oil markets are expected to remain tight (high global demand out to 2030) over the long term as additions to global supply are expected to just satisfy anticipated growth in demand. Energy firms continue to invest heavily in hydrocarbons (e.g., Alberta oil sands) vice the more potentially economically feasible investment in lower carbon energy systems (wind, solar). Rising global energy demand poses a real and growing threat to the world's energy security where China and India will account for close to 60 percent of demand.<sup>75</sup>

By 2030, 60 percent of the global population is expected to live in urban areas.<sup>76</sup> This will create “mega-cities” and will mostly exist in the developing world. Urbanization is also expected to continue as a trend in Canada and population growth is fuelled by immigration to Canada's urban centres. This trend puts pressure on social services and exposes persons to disease, criminal predation and lack of opportunity.

While it is forecast that global food production potential will be able to cope with demand, a combination of record oil prices, farmers switching out of cereals to grow biofuel crops, extreme weather and growing demand in China and India could converge to create a food security issue.

In sum, as the world becomes more connected, several challenges will remain.

### **Canadian Economy**

The Canadian economic forecast is good although there are some trouble spots. The labour market, resultant of the aging of the Canadian population, will stress the health care system and in turn, public finances. While immigration has been the source of more than half of Canada's population growth, it will not be sufficient to offset the aging of baby-boomers thereby constraining the labour force. And finally, as baby-boomers exit the labour force, competition for talented labour will intensify and ultimately weaken GDP growth. Even with optimistic immigration assumptions, this will result in a sharp slowdown in labour force growth—a slowdown that will weaken growth of GDP.<sup>77</sup>

While Alberta's oil sands production is expected to generate over \$100 billion in investment by 2030, the long term outlook looks cloudy due to possible restrictions on the oil industry due to the Kyoto Protocol. Canada is expected to remain a net exporter of oil until 2030. Investment in other primary energy is dominated by the development of the oil sands. Quebec will lead the country in hydroelectric power development with the Lower Churchill River development costing about \$4B despite financial, technical and environmental issues. Pipeline projects will also form a significant part of the energy investment out to 2030.<sup>78</sup>

Canada will remain a trading nation with the United States being its most important trading partner until 2030.<sup>79</sup> Trade with the US is made up of 80 percent export and 65 percent imports and as such, the US will remain key to Canada's long-term economic performance. The US is the only country where we have a trade surplus and with US growth expected to slow, it is reasonable to assume that this trend will impact on Canada.<sup>80</sup>

The huge US current account deficit is being funded by developing nations and has led to a shift in global capital flows. It is expected that this deficit will decline in an orderly fashion signalling continued growth for Canada in the long-term. Rise of BRIC countries means that exports will shift to those countries vice traditional markets of the United States and the United Kingdom thereby placing greater emphasis on western infrastructure.

Notable Conference Board of Canada forecasts suggest that the Canadian economy will prosper:

- Unemployment is expected to rise until 2015 but decrease from 2015–2030.
- Changing consumption patterns will occur due to a decreasing labour force (retirees draw down savings), and the savings rate will approach zero by 2030. (Savings and investment, e.g., RRSPs, encourage economic growth).
- Residential investment is forecast to decline from 1 percent to 0.3 percent by 2030.
- Demand for retail space is expected to decline due to purchases over the Internet.
- Total federal expenditure is expected to stabilize and only slightly rise by 2030.
- Canadian dollar is expected to average around US\$0.86 out to 2030.<sup>81</sup>
- Potential diversification is likely in Canadian exports to BRIC countries to help offset economic downturn in the United States.

## **Conclusion**

Globalization will continue to offer both promise and peril for economies out to 2040. Barring any shocks, disruptions or cyclical slowdowns, the global economy is expected to grow through to 2030. However, Canada faces both opportunities and risks on our path to 2040. Population growth, improvements in productivity and greater global integration will have to be tempered with energy security issues stemming mostly from decreasing non-renewable energy sources. While the developed world faces an aging demographic and a resultant slowing of economic growth, the rise of the BRIC countries portends a shift in the centre of global economic power. Each of these issues has the potential to affect the future of the Army either directly or indirectly and as such vigilance is required.



# *Security and Defence*

*LCol Ron Bell*

## **Introduction**

Uncertainty, volatility and rapid change will continue to dominate the international security environment. Events will unfold at alarming rates and this will directly challenge the ability of decision-makers to effectively react. Nowhere is this more evident and perhaps more consequential than in the field of security.

In fact, an examination of the unfolding security environment reveals the existence of a range of threats from a number of sources, including regional hegemons, failed and failing states, trans-national criminal organizations and terrorist groups, natural disasters, the proliferation of weapons of mass destruction and the impact of climate change to name but a few. Accordingly, it is essential that military forces retain and increase their capacity to be flexible and agile in order to effectively meet the challenges that this exceedingly complex environment will raise.

## **Ongoing Developments**

The number of countries with direct involvement in armed conflict has risen slowly since the end of the Second World War. Yet annual totals for battle deaths have been declining steadily.<sup>82</sup> This indicates that the conduct of war is changing, and the real changes in the evolution of warfare are, presumably in part, the result of a decline in the conventional type of warfare between states. This decline is attributable to the emergence of a globalized community of states and efforts—both societal and technological<sup>83</sup>—enabling greater discrimination in the application of force. As a result, although clashes of conventionally trained and equipped forces may still

take place in this new environment,<sup>84</sup> the use of other forms of military power—information and special operations, and interventions focussing on reconstruction and stability—are becoming more prominent.<sup>85</sup>

The very same developments in technology, economics and culture that are enabling ongoing globalization are also enabling non-state actors to achieve a more visible and at times destructive role in the world. The task at hand for states is to find an appropriate balance between a force structure optimized for future versions of conventional warfare and one capable of dealing adequately with the emerging and future challenges that focus less overtly on state-on-state war. Achieving this balance, in order to deal with likely threats, will require a recasting of strategies, organizations, equipment priorities, doctrine and attitudes.

The human dimension is increasingly viewed as a key component of military capability. Societal and personal values will have increasing impact upon the attributes and motivations of those recruited as well as their potential decision-making competencies. Personal and collective aspirations will need to be considered in shaping a balanced professional culture that includes added consideration of families and connection with community, recognition of individuality, a postmodern soldier ethos,<sup>86</sup> and the necessary mental and physical resilience.<sup>87</sup>

Meanwhile, both the threats and vulnerabilities confronting Western armies are increasing in scope and danger. The challenges include the growing potential for the militarization of space, increasing reliance on the information network and the threat of cyber-attack, criminal enterprise as a danger to the fabric of societies, and the collective psychological impact of ideological extremism. There is an increased blurring of the line previously drawn between public safety concerns and those of a military or national security nature. It certainly does not help that the age-old dragons of inter-state belligerence and economic interests as motivations for encouraging conflict show little sign of abating.

### **Operating Environment 2040**

Such trends in conflict and its conduct will likely continue—if not increase—in the decades ahead. The global operating environment will be predominantly complex (e.g., highly networked, interdependent, increasingly urban), and it will be evermore stressed by challenges such as epidemics, poverty, food and water scarcity, desertification, deforestation and erosion, storms, flooding, and poor governance. These features have considerable potential to trigger mass migrations of groups of people, which in turn will

increase the complexity, uncertainty, instability and volatility of the operating environment.

Operations will be increasingly characterized by the presence and involvement of a far wider range of parties than ever before. Particularly in regions marked by state failure, weak governance and ungoverned spaces, the quest for security will be intense, will often be marked by self-help and by an increased privatization of military force. Furthermore, battle spaces will become increasingly crowded, as other government departments (OGDs), non-governmental organizations (NGOs),<sup>88</sup> private military companies (PMCs) and a host of other players will actively manoeuvre to address the dilemmas associated with the stabilization and reconstruction of conflict-torn societies. As such, the need to coordinate resources will be high and the dilemmas associated with successfully doing so will be both exceedingly important and complex.<sup>89</sup>

### **Shocks, Drivers and Uncertainties**

A number of forces are likely to drive insecurity in the decades ahead. Poverty and poverty-related insecurities such as access to reliable food supplies, safe drinking water, adequate health care, and modern energy supplies will continue to feed tensions and the prospects for armed conflict (particularly, although not exclusively, in developing regions). So too, will the lack of good governance in many nations, and the sense of injustice and grievance generated from the material imbalances which will continue to exist between the “haves” and “have-nots” of the world. Beyond this, the ever-present reality of religious and ethnic differences may fuel grievances, feelings of injustice and the prospects for armed conflict still further.

Uncertainties will doubtless be pervasive. For instance, important questions will continue to surround the dynamics likely to characterize future world-wide communications networks and their potential impacts on defence and security. The implications of an emerging multi-polar balance of power will be of considerable concern as well—particularly from the standpoint of the future of coalitions and national security interests. So too, will be the potential impacts, which growing scarcities in fossil fuels may have on the prospects for, and the conduct of, future conflict.

The onset of shocks within the global environment will also be an ever-present possibility, and some would clearly have the ability to significantly alter future trends and developments. In the military realm, the employment of nuclear weapons, a devastating use of biological arms and/or the prospect of a threatening peer competitor quickly gaining meaningful military

superiority (e.g., through technological innovation in the military realm) would each be of great significance. A number of non-military shocks could have similarly profound impacts. For instance, as global finances become more integrated and interconnected, and thus more vulnerable to external influences, the potential for economic crises to spiral out of control into military crises will be significant. Beyond this, globalized travel, rising urbanization, environmental degradation and climate change could combine to substantially increase the prospect for the onset of disease and epidemics.

## **Conclusion**

Military capabilities will need to respond to an increasingly dangerous future security environment. Militaries will continue to represent the predominant tool for intervention in security operations and will focus more on robust policing-type and counter-insurgency-type activities while retaining a core of more traditional combat capacity to respond in the event of state-on-state warfare.

Furthermore, security in the post-modern, globalized, international system will increasingly equate with human security. This includes rights-based and expectation-based issues. Future intervention will continue to be in the national, collective, moral and security interests of the international community. It will be selective, targeted at those problems which actually present a possible credible solution, and increasingly robust and holistic.

A wide array of national power resources will be brought to bear on defence and security problems in an increasingly coordinated manner. Political, diplomatic and social resources will increasingly be harnessed in support of intervention opportunities, and will, in fact, eventually lead intervention policy. As state influence declines, relative to other centres of influence (e.g., commercial, cultural, faith-based, environmental), there will be an increasing requirement for states to leverage legitimate international organizations, alliances and coalitions to ensure a coordinated military, diplomatic, economic and political response for the purpose of either building or rehabilitating a failed state or containing the negative implications of state failure. The ultimate goal of intervention will often be to bring about sufficient improvement in the governance of a specific geographic territory so that it can assume more normalized relations in its local, regional and global contexts, assist in providing for its own security, and effectively engage in economic and social development over the longer term.

# *Human Dimension*

*LCol Steve Larouche*

## **Introduction**

As we approach 2040, humans will continue to form the moral, intellectual, social, and emotional foundation upon which the Army<sup>90</sup> is established. Although advances in science and technology will enable and enhance soldier capabilities in both the cognitive and physical realms, the success of the Army will ultimately be measured in terms of human creativity, innovation, ingenuity and adaptability. Six major themes best articulate the human dimension in 2040: attributes and competencies; professionalism and ethics; culture; morale, cohesion and trust; decision-making; and, resilience and human enhancement.

## **Soldier Attributes and Competencies**

Current social and technological trends are likely to radically alter 20th century human attributes and necessitate the development of new competencies in order to be effective through 2040. Indeed, the present trend and perceived pressures to improve personal aesthetics and performance will likely prevail. Although future generations may not be as inclined to participate in traditional physical fitness activities, learn basic survival skills or practice healthy living habits, their use of technology, medical advances, supplements and/or enhancers may well compensate for deficiencies. Future generations will continue to become better educated<sup>91</sup> and technology will be more prominent as an enabler to assist, facilitate and accelerate cognition, knowledge and understanding. Emotional stability and mental resiliency will also benefit from technological advances thus enabling soldiers to be adaptable and flexible of body, mind and spirit (emotions).

As the operating environment increases in complexity and technology becomes evermore pervasive and essential, information and communication systems, as well as equipment and robotics, must not only become an integral part of the soldier's tool set, but an integral part of the soldier's self. Future soldiers may require specific, refined, enhanced or simply different attributes and competencies in order to function within this new operational reality. New classes of soldiers, capabilities and specialists necessary to meet future challenges, will create pressure for professional soldiers and the Land Staff to keep apace. Consequently, selection processes and assessment methods must vary throughout a soldier's career. While traditional manual skills will remain important, it is anticipated that demographic trends will shrink the available recruiting pool. It will, therefore, be necessary to automate the dull, dirty and dangerous jobs in order to allow humans to focus on those tasks where creativity, innovation and ingenuity can be optimized.

Maintaining the correct balance and combination of attributes and competencies will also be critical for soldier success in 2040. These provide the foundational material for an effective military personnel generation system and should be balanced, and based on current job analysis and future job requirements. Available research in the area of future soldier attributes,<sup>92</sup> and analyses of emerging trends,<sup>93</sup> suggests that the following attributes and competencies will be crucial for soldiers to be effective in 2040: stronger cognitive abilities to enable decentralized decision-making in complex operating environments; greater capacity to learn from experience in order to facilitate individual soldier adaptability; emotional stability to promote soldier resilience; conscientiousness to enable trust and allow greater soldier autonomy; cultural competencies to operate effectively in diverse cultures; and moral character to maintain public support and facilitate the development of trusting relationships with Joint, Interagency, Multinational, Public (JIMP) partners and local civilians. Additionally, given the anticipated increase of conflicts grounded in issues of identity, ethnicity, and culture<sup>94</sup>, it is expected that knowledge—and sometimes embedded expertise—in the areas of history, religion, sociology, anthropology, and psychology will provide the Army with a decisive advantage on the future battlefield.

### **Professionalism and Ethics**

Canadian soldiers at home and abroad will continue to reflect Canadian values and beliefs and will be expected to maintain exemplary professionalism and ethical standards. Popular support for the Army will remain directly linked to its credibility, which will hinge on the level of trust and

confidence the Army's leadership, and its soldiers, command within the public sphere.

Information and communications technology will become more pervasive in the future. Government(s), the media, and the general population, will have an increased capacity to scrutinize how operations develop and are performed, how they impact on the troops, and how *their* soldiers behave. Families and friends will also want to ensure that their loved ones are safe and will expect a level of connectivity. The strategic impact of a soldier's tactical actions will gain in importance. To counter false information concerning soldiers' behaviours, the utmost adherence to a comprehensive ethos through impeccable professional behaviour, solid doctrine and the adherence to the highest ethical values will be essential to maintain the public's trust. Technological applications may also be developed to assist soldiers in making professional and/or ethical decisions.

Properly preparing the soldier for the moral challenges of the complex operational environment and providing tools to do so, will permit a better shielding of the soldier's *psyche*. Transparency will become an operational imperative and any infringement of core professional and ethical values will be exposed quickly to the public and will require immediate and appropriate action from the Army leadership.

## **Culture**

Culture is an expression of the values and principles of an organization or group. It brings cohesion and efficiency to the organization and facilitates integration of new members. It is of vital importance that the Army's culture(s) be coherent and resonate with Canadian culture. It is expected that respect for democracy, the rule of law, human rights and freedom will remain the principles that define what it is to be Canadian. Loss of trust from the Canadian population could have major detrimental effects on the Army's credibility.<sup>95</sup> The Army must, therefore, closely monitor and shape its culture(s) and its soldiers' behaviours to ensure they are reflective of the population's expectations.

As the population diversifies, so too will the Army's human resource pool. The next generation of soldiers will be recruited from a more demographically diverse environment, influencing the Army's culture(s) and improving the CF/Army's ability to better understand other cultures and values. Other cultural priorities and concerns (economical, environmental, health, social, etc.) will impact and shape the Army's culture(s). Operational considerations such as threats and risks (political, sovereignty, human,

equipment, etc.) or collateral damage (human, physical, infrastructures, etc.) could also influence and impact the Army culture and affect how soldiers operate, interact, and perform their tasks.

Soldiers in the 2040 timeframe will be more technologically inclined and more dependant on technology than those of today. They will be comfortable with the prominence and pervasiveness of technology in their lives as evidenced by their increased and creative use of social networking (RSS, Twitter™, Facebook™, etc.). Constant connectivity to their peers, both within and outside the organization, will be an expectation. As a result, control measures and restriction of information and communication norms will require re-examination. The defence network must be pervasive, and permit the soldier to remain continuously connected and updated. Soldiers in 2040 may have fewer direct face-to-face interactions than their predecessors, but their relationships with their circle of cyber contacts will feel just as important and real.

Converging trends are shaping Army culture in ways that we are just beginning to understand. Responding to ongoing change will require flexibility and continuous adaptation while at the same time acknowledging that soldiers, and the culture they embody, will remain our most valued asset.

### **Morale, Cohesion and Trust**

Morale, cohesion and trust are critical psychosocial contributors to an Army's operational effectiveness.<sup>96</sup> Indeed, they are fundamental components of soldiering and will remain so in 2040. Soldiers will cover greater distances through a diversity of sense, act, and shield<sup>97</sup> enablers. Physical distances bridged by secure communications between teams and team-members will impact the morale of the soldiers, their cohesion within operations, and the trust towards technology and leadership. The challenges of integrating soldiers into a team will continue to evolve and will require new tools and techniques (e.g., social networking, wikis, blogs). Technology must be leveraged to enable the development of faster and more tangible, trusting relationships.

The intensity and resilience of soldier's bonds are well known. However, these must be expanded to become more holistic, cooperative and/or complementary. Indeed, the Army must move towards greater interaction with other organizations (e.g., comprehensive approach). Exposure and inculcation to a more inclusive operational environment early in a soldier's career will be essential. The importance of operating within such an environment must be reinforced throughout a soldier's career. It will be essential that leadership



ensure that the fundamentals of morale, cohesion and trust are developed and strengthened in the 2040 timeframe.

### **Decision-making**

Information overload and the pervasiveness of information and communication systems will increase the complexity of the 2040 timeframe, and challenge decision-making at all levels.<sup>98</sup> Automated pre-screening, filtering, and analysis of information will be necessary. Artificial intelligence will become increasingly ubiquitous, and will likely be capable of rendering automated and/or autonomous decisions, even in combat or other lethal engagement situations. Nonetheless, human oversight will be essential at all times.

A greater integration of human resources, doctrine, and technology will be required to assist the soldier in making sound and timely decisions. This will necessitate the development of more effective, reliable, and pervasive information technologies and systems. To these ends, the Army culture must be tolerant and even encourage soldiers to be innovative regarding information management and networking.

Secure communications will be harder to preserve given the pervasiveness of commercial technology. Soldiers will be expected to make decisions in a context in which each and every action they take is recorded, scrutinized, analyzed, and criticized—not only by the chain of command—but also by the media and general population. The Army must be cognizant of such possibilities and prepare soldiers through proper doctrine and training. It must also protect its personnel through refinements in policies, programmes and procedures so as to empower the soldier with the necessary authority to make decisions.

### **Resilience and Human Enhancement**

Human enhancement technologies—both cognitive and physical—are becoming more prevalent within society. In 2040, human potential and capabilities will differ from those of today. Technological, medical, and pharmaceutical research and development will continue to provide ways to render the human more resilient through enhancement. Ultimately, societal concerns over the ethical dilemmas of such upgrades will require formal debate within and outside of the Army. Long-term second and third order effects, side-effects, and impacts on the soldier's life will require monitoring and measurement. Doctrine, policies and programs will need to be reviewed

and revised accordingly. This in turn may impact on the Army's selection process as "enhanced" individuals may form the basis of the new recruitable cohort. As this phenomenon becomes more widespread and normative, CF policies, such as those relating to drugs and universality of service<sup>99</sup>, will require revision.

Increasing complexity in 2040 will require increased resilience in soldiers. Resilience or mental toughness is defined as "...the ability to grow and thrive in the face of challenges and bounce back from adversity."<sup>100</sup> Resilience is a function of physical, emotional, social, spiritual and family dimensions and has recently been coined within the United States Army as "comprehensive soldier fitness."<sup>101</sup> It is likely that programs such as comprehensive soldier fitness will increase in importance as Canada's Army enters into an age of greater complexity and uncertainty.

## **Conclusion**

Continued technological advances will enhance the effectiveness of tomorrow's soldier. Yet success on the future battlefield will depend in large part on creativity, innovation, ingenuity and adaptability. Attending to these attributes will ultimately result in greater internal organizational coherence and an increased capacity to integrate within the broader operational environment.

A principal attribute of a higher functioning soldier will be the capability to identify, network, and in some instances, partner with credible stakeholders as they move among indigenous populations within the operational environment. For the soldier, the development of learned *trust* within the organization will ultimately translate into greater opportunities for authentic engagement among the leaders and people of local communities. An increased capacity in this regard will serve to disarm potential spoilers as the establishment of a *fragile trust* among the people facilitates a gradual, yet perceptible, shift in allegiances. In this sense, an aspect of Army culture will not only be the ability to adapt to organizational change at the micro and macro levels but also to examine ways and means to integrate with local cultures within areas of operation.

# *Shocks*

*Peter Gizewski and Regan Reshke*

## **Introduction**

References to shocks imply the onset of extraordinary developments and events which have major consequences for individuals, groups and/or communities. Such phenomena can dramatically alter the trajectory of subsequent events and generally prompt a fundamental reconsideration of one's outlooks, approaches and options. Shocks are—in essence—unforeseen events that change the expected direction of planning and policy.

Consideration of such events and their possible occurrence provides useful means for challenging conventional thinking. A focus on the emergence of shocks demonstrates how radical changes to the world as we know it are not impossible—encouraging greater flexibility of mind in considering potential futures as a result. In fact, engaging in careful consideration of such phenomena can serve as a crucial step in the construction of alternative future scenarios to more fully inform sound planning and policy development.

## **Types of Shocks**

Shocks can be wide ranging in character and can include developments and events stemming from purely natural processes, from human volition, or due to some combination of both. Nevertheless, their classification is to some extent a matter of probability, context, and perspective, with the severity or enormity of the incident at issue often dependent on a range of factors, including the likelihood of adverse outcomes, the numbers of people affected, past history, and public perceptions. What often qualifies as a shock may in fact vary from person to person, place to place and community to community.

Yet some shocks may carry existential risks which are universally catastrophic—threatening in effect the very existence of the human species. A comet or asteroid impact of sufficient size for instance, would not only be species destroying, but unavoidable given current limitations on human capacities to respond. Yet human intelligence and ingenuity can directly augment the presence of existential threats facing the planet as well—a fact evidenced in the development and proliferation of nuclear weapons. The consequences flowing from the convergence of nanotechnology, biotechnology, information technology and cognitive science may be more alarming still—raising the prospect of weaponry eclipsing nuclear arms in power and destructiveness.

Still, shocks may also be positive. The sudden discovery and swift provision of widely accessible, low cost forms of energy, foodstuffs, life saving and life enhancing medical treatments, and military technologies that offer increased national security while avoiding the creation of “security dilemmas”<sup>102</sup> are just some illustrations of developments capable of yielding substantial—indeed potentially momentous—benefit both to states and to humanity as a whole.<sup>103</sup>

### **Shocks: Past, Present, Future**

Such incidents and events have occurred throughout history—with early recorded examples including events such as the San Francisco earthquake of 1906—an incident that generated changes in the lifestyles and practices of those living in that city which continue to endure, the influenza pandemic of 1918-1919—which spread throughout most of the civilized world and resulted in an estimated forty million casualties worldwide, and the Second World War—a conflict prompting not only a fundamental change in the structure of the international system, (i.e., distribution of power) but a bi-polar superpower rivalry lasting for over four decades.<sup>104</sup>

More recent incidents have been somewhat less devastating in terms of their cost to human life—yet still significant for many. While claiming only a fraction of casualties incurred as a result of the events mentioned above, the terrorist attacks both on and following 9/11, 2001 have nevertheless had notable impacts—shaking the global financial system, generating marked changes in the military strategies, foreign policies and domestic security arrangements of many nations, and prompting Western military intervention in both Afghanistan and Iraq. Meanwhile, natural disasters such as the 2004 tsunami in Thailand, and hurricane Katrina in the southern US just

one year later—have generated their own social, economic and political challenges—both nationally and regionally.

A number of ongoing trends in fact suggest that conditions favouring the occurrence of future shocks may well be on the rise. In particular, the growing interconnectedness, which ongoing processes of globalization and rapid scientific and technological innovation (i.e., spread of communications and information technologies, international travel) are generating, suggest that major events occurring in one area or part of the world will have increasingly significant consequences elsewhere. The evermore salient impacts generated as a result of human interactions with the ecosystem and the biosphere will likely compound the dilemma further. In short, a *tighter coupling* of political, economic, commercial, social and environmental systems worldwide now increases the prospect that local events—both negative and positive—will have national—if not global—repercussions.

The complexity that such trends tend to create through their development and interaction also raises prospects for the emergence of entirely new varieties of shocks in the years ahead. Increased complexity tends to heighten system vulnerability to breakdowns and perturbations that are not only hard to identify but may well be highly consequential in their ultimate effects (e.g., cyber-attacks).<sup>105</sup>

A prospective rise in the frequency of shocks will clearly raise numerous challenges. Yet perhaps greatest among them will be ensuring that, as such incidents increase in number, policymakers and analysts maintain a sense of balance and perspective in addressing them. This will demand careful risk assessment and prioritization of effort on the part of decision-makers. It will require development of sensitivity to the fact that even potential solutions may—given the nature of complex systems—have unintended and possibly negative, consequences. It will require the development of a capacity for adaptation in both thought and action capable of ensuring that the challenges which shocks inevitably present are effectively addressed. And in some cases—such as those involving human-induced existential threats—it will demand concerted efforts aimed at prevention—since reactive approaches may well be futile were such threats to materialize.

## Conclusion

Much concerning the specific character and impact of future shocks remains uncertain. Yet if current trends offer any indication, prospects for their emergence are on the rise. In particular, the quickening pace of globalization,

the exponential growth of scientific and technological innovation and human interaction with the physical environment are creating forces that have added immeasurably to the interconnectedness of the international system and its complexities. Increasingly, we live in an age in which local crises are likely to have major—even global—implications. Accordingly, prospects for the emergence of future shocks are considerable.

As time passes, careful and sustained attention to the dangers and opportunities, which interaction of ongoing trends can produce, will doubtless generate a number of safeguards that better ensure that certain types of uncertainty and complexity are effectively managed. Accordingly, the future is likely to see the development of a greater capacity to anticipate and address some categories of shocks than is currently the case. Yet the availability of such capacities will vary widely—ensuring that effective responses will be far from universal. Beyond this lies the likelihood that new varieties of such phenomena will arise to ensure that the challenges posed will not only continue but may well increase in the decades ahead.

## *Conclusion—Towards Army 2040*

The future is uncertain and defies prediction. Indeed, uncertainty is a predominant characteristic of the 21st century global security environment. Yet defence establishments around the world must continue to strive to understand and define how their national security policies fit within this paradigm. Arguably, the increasing pace of change and resultant complexity of the world offers little prospect for complete understanding. As such, organizations must learn to operate within uncertainty—the Army is not excluded from this reality.

To cope with uncertainty, futuring and foresight are gaining international recognition as disciplines which can improve our understanding of an increasingly complex world. Perhaps the greatest benefit is to be found not in the results of this new discipline but rather in the process itself. As Jerome Glenn notes:

The value of futures research is less in forecasting accuracy, than in its usefulness in planning and opening minds to consider new possibilities and changing the policy agenda. Its purpose is not to know the future but to help us make better decisions today via its methods which force us to anticipate opportunities and threats and consider how to address them. And strategically it is better to anticipate, rather than just respond to change.<sup>106</sup>

Reactive planning by militaries can result in high costs of blood and/or treasure. Adoption of a futuring research agenda and use of futuring methods offers a more proactive approach, allowing analysts the capacity to better anticipate and possibly highlight certain areas that require policy decisions today—in order to meet future expectations. The essays presented in this volume represent a key first step in this process.<sup>107</sup>





# *Annex*

## **Physical Environment**

### *Drivers*

- Rates and distribution of population growth.
- Rates and magnitudes of impacts from global climate change.
- Rates of change of expectations (i.e., improved standards of living in the developing world, wasteful consumption practices in the developed world and/or increased conservation practices globally).
- Nature of resource substitutions and other innovations developed.
- The impact of scarcities (i.e., whether or not the scarcities lead to violence, and the form of that violence: intra-state versus inter-state conflict) including the complex environment that accompanies the development of scarcities, which itself includes a broad range of political, economic, military and social factors.

### *Trends*

The resource situation faced by the growing world population is subject to a number of trends. Specifically:

- Renewable resources can and will remain sustainable, except where pressures exceed the rate at which they can be sustained.
- Non-renewable resources will deplete and eventually disappear; the uncertainties here are rates of depletion, the timing and magnitude of scarcities, and our ability to substitute wise and effective alternative resources in sufficient quantity, quality and time.

### *Key Uncertainties*

- Rate and distribution of mass migrations.

- Innovations and adaptations in response to global resource scarcities.
- New and/or newly adapted technologies creating new pressures on resources.
- Complex political, economic, military, and social factors accompanying all the above.

### *Shocks*

- Climate change impacts such as crop failures, drought, desertification, sea level changes causing mass migrations, etc.
- Arbitrary resource impediments such as embargoes placed on oil or other energy resources, or on strategic minerals.
- Development of radical new and unforeseen technologies which could dramatically change the demand for resources. (That is, a technology that could take the world *off oil* or a technology that could significantly alter the demand for a mineral which is currently present in adequate supply).
- The management (or mismanagement) of bio-fuels.
- Catastrophic impacts from general pollution and/or regional contamination, particularly in high population regions and/or involving the supply of fresh water, croplands, forests and/or fisheries.

## **Social Dimension**

### *Drivers*

- Spread of science and technology.
- Economic conditions (influences population growth, health and welfare, state stability).
- Environment and resources (impacts on work, health and welfare, economy).
- Political realities (i.e., regime type and character, government policies).
- Legal frameworks and provisions (block/facilitate empowerment of key societal groups).
- Historical/cultural realities (e.g., affects outlook on lifestyles, policy directions).

### *Trends*

- World population will increase but less dramatically than in the past (est. approximately 9.15 billion by 2050).
- Developed nations (especially those in Western Europe, along with Russia and Japan) will generally experience a decline and aging of native-born populations.
- Developed nations will experience increased immigration and thus greater ethnic heterogeneity.
- There will be greater urbanization worldwide (particularly in the developing world).
- Populations will experience improvements in health (declining mortality rates, particularly in the developed world).
- Populations will be better educated, more technologically informed and enabled and increasingly networked.
- Developed countries will be more “post-modern” in outlook (more women in positions of power and influence, greater cosmopolitanism, people more globally aware).
- Issues of the environment and social security will represent key areas of social concern.
- Population growth in developing nations will slow somewhat, but will continue to exceed replacement rates (especially in Africa and parts of Asia).
- The developing world will continue to experience rapid and often unsustainable urban growth (i.e., urban sprawl, shantytowns, high population densities, lack of key services). Lower income countries in Asia and Africa will experience especially rapid urbanization.
- Developing nations will continue to be primarily male dominated (some inroads for women but still far behind developed world).
- Parts of the developing world will continue to be characterized by pre-modern (e.g., agrarian) and modern (industrializing) economies and societies.

### *Canadian Trends*

- Canada will possess a highly and increasingly educated, networked society.

- Health, nutrition and lifestyle of average Canadians will improve. (Life expectancy 80+ for men; 86+ for women—2040 period.)
- Political allegiances will increasingly shift from traditional to new political parties and movements (e.g., growth in Green Party and others—possible growth in single issue movements).
- Canada's population will experience modest growth (total of 45 million by 2040).
- The percentage of the population over 65 years of age will increase to approximately 20–25 percent of total population.
- Immigration will ensure increasing heterogeneity of the population (prime sources: Asia, Africa and Latin America).
- The Canadian mosaic will endure (multiculturalism will remain a strong force).
- There will be an increase of visible minorities in the Canadian workforce and in society generally (visible minorities will represent the majority of the workforce by 2040).
- Northern aboriginal communities will experience modest growth and may pose problems in terms of assimilating into the broader social fabric.
- Canada's population will be increasingly urban in character (Urban densities increasing).
- Issues of national unity and identity will represent key areas of concern.
- Issues of the environment, energy efficiency and conservation, and social welfare will represent key areas of social concern.

### *Key Uncertainties*

- Speed with which certain trends occur (e.g., science and technology).
- Unforeseen interaction and effects of ongoing trends (generating unforeseen positive and negative social impacts).
- Role of key personalities and organizations (the madman factor).
- New unforeseen developments in science and technology (generating opportunities e.g., exponential economic growth or dangers—deadly weapons).

### *Shocks*

- Global conflict involving two or more major powers.
- Global/regional environmental catastrophe (natural or man-made—earthquakes, floods, famines, plagues).
- Worldwide economic and fiscal crisis.

### **Political Dimension**

#### *Drivers*

- Spread of science and technology.
- Economic growth (particularly in Asia-Pacific region).
- Aging and immigration (social composition of states).
- Historical disputes/rivalries over territory, resources etc.
- Energy/resource scarcities.

#### *Trends*

- There will be an increasing shift from a unipolar to a multipolar international system (i.e., a move from a system in which one power is overwhelmingly predominant to one featuring multiple centres of power and influence).
- The international system will be marked by forces of both integration and disintegration.
- States will experience an erosion of their sovereignty and authority over activities occurring within their borders.
- Popular trust and allegiance to national governments will continue to weaken.
- Both supranational/transnational and subnational organizations and movements will increase in number, diversity, power and authority.
- National governments will increasingly engage other political organizations and movements in seeking solutions to issues of concern.
- Partnerships between governmental and non-governmental entities will generate changes in both the means used to achieve solutions to challenges and how solutions are pursued.
- The proliferation of new centres of power and influence throughout the international system will increase its complexity and as a

result, the chances for both international and intra-state disputes and conflict.

- Sources of political dispute both between and within nations will continue to vary. Yet natural resources and the environment, energy, territorial issues, and human rights will be particularly salient sources of dispute—both between and within nations.
- The Asia-Pacific region will experience particular growth in power and political influence.
- Canada's existing international partnerships and alliances will continue to exist (e.g., US, NATO, NORAD).
- Canada will continue to participate in current international and regional organizations (e.g., UN, OAS, NAFTA-revised).
- The Canadian nation will experience increased regionalism as certain regions grow in strength and influence (e.g., due to shifts in economy, population flows).
- Canada's federal government will face increased difficulties in coping with the national challenges posed by both internal and external forces and influences.
- The Canadian political system will experience an erosion of power at the federal level, with consequent increases in power at regional and local levels.
- Political allegiances will increasingly shift from traditional to new political parties, organizations and movements (e.g., growth in Green Party and others—possible single issue movements).
- Partnerships between government and non-governmental agencies, organizations and movements will expand—impacting upon the approaches and means used to address key policy issues and concerns.
- Canadian foreign policy will be marked by increased interest and activity in the Asia-Pacific region.

### *Key Uncertainties*

- Speed with which certain trends occur (e.g., science and technology).
- Unforeseen interaction and effects of ongoing trends (generating unforeseen positive and negative impacts).
- Role of key personalities and organizations (influential individuals and groups).

- New unforeseen developments in science and technology (generating opportunities e.g., exponential economic growth and/or dangers—deadly weapons).

### *Shocks*

- Global conflict involving two or more major powers (use of WMDs/WMEs).
- Global environmental catastrophe (natural or man-made—earthquakes, floods, famines, plagues).
- Worldwide economic and fiscal crisis.

## **Science and Technology (S&T)**

### *Drivers*

- Geographic diffusion of S&T. The long US dominance of a wide range of fields in science and technology will diminish as the global scientific playing field becomes flatter and more diverse.
- Large investment in broad S&T domains by both developed and emerging nations as a means to improve global economic competitiveness is increasing.
- Proliferation of defence-related science and technologies due to security-related fear-based positive feedback loops.
- Proliferation of S&T-enabled commercial innovations resulting from positive S&T-economy feedback loops.
- Developments in brain imaging will continue to provide new insights into relationships between brain and mind states, and into psychological processes that can be quantified objectively and used to provide other measures of brain output besides overt behaviour and inferences from psychology experiments. Given the importance of intelligence to humankind, this domain of research and development (R&D) is likely to offer some of the most profound changes.
- Self-sustaining exponential growth and acceleration of S&T resulting from a positive feedback loop whereby the tools from a previous round of innovation are used to make still better tools for the next.
- Aging populations (and heightened health awareness) will drive greater research into technologies designed specifically for the elderly (including personalized medicine) which will create another

positive feedback loop as these technologies extend life expectancy even further.

- Convergence of scientific knowledge and understanding of phenomenon at the nano-scale (e.g., the confluence of IT, biomedical and materials science) is facilitating interdisciplinary R&D, which is providing rapid advances in practically all S&T domains.
- Internet “Web 2.0” development focusing on connecting people, rather than just information, is leading to new global social networks—often with specific goals and objectives (open collaboration epitomized by Wikipedia being a prime example).
- An increasingly profound understanding of the human genome (intra- as well as inter-species) and an ability to manipulate it for specific purposes.
- Exponential growth in computing capacity (i.e., continuation of Moore’s Law) and communications speed in increasingly small form factors that consume less energy leading to a global ICT proliferation—i.e., pervasive computing.
- Increasing complexity of the global network and its exponentially growing volumes of information will generate greater need (and therefore progress) in advanced artificial intelligence systems.
- Global media convergence—press, television, Internet, cell phone—provides an extraordinary propaganda reach and facilitates manipulation of public opinion.
- Worldwide increases in e-crime and cyber attacks coupled with the personal and economic imperatives to protect data privacy and intellectual property is driving a growing demand to bolster cyber security through biometrics, cryptography and other technologies.
- Reduction in global reserves of fossil fuels (coupled with the climate impact caused by the burning of fossil fuels) will generate significant demand for R&D into new alternative energy technologies—so called “green” or “clean” technologies.
- A concern over labour shortages (resulting from shifting demographics) is generating significant investment in robotics and automation.
- Robotics and automation will change the nature of work, particularly in developed nations.
- The very same developments in technology, economics, culture, and communications that are enabling the rapid pace of globalization, are also enabling so-called “non-state” actors to assume a more



visible—and potentially more deadly—role on the world stage than was possible for them to achieve in the past.

- Increase in societal affluence and available leisure time coupled with the falling cost of advanced equipment is driving a renaissance of serious amateur science in areas such as astronomy and field biology among others.
- The current revolution in science and technology has led to the concern that unbridled scientific progress is not always ethically acceptable. The need to establish common values and benchmarks, and to promote ethical principles and standards to guide scientific progress and technological development, is becoming increasingly acute.

### *Trends*

- Globalization, technological complexity, interdependence, terrorism, climate and energy volatility, and pandemic potential are increasing the level of risk that societies and organizations now face. Risks also are increasingly interrelated; disruptions in one area can cascade in multiple directions.
- New technologies for cooperation and a better understanding of cooperative strategies (Web-enabled social networking) are creating a new global capacity for rapid, ad hoc, and distributed decision-making and innovation.
- Brazil, South Korea, Taiwan and Israel are emerging as considerable scientific powers, as measured by global patenting. Spending on research and development is increasing in many smaller or developing countries.
- Technological evolution of defence capabilities continues to be a Darwinian contest between offensive capability advances and defensive countermeasures. The balance of power continues to lie on the side of offensive capabilities.
- Continuing development of the Internet leading to pervasive computing, connecting anyone, anything, anywhere, anytime.
- Increasing number of Open Source development projects indicating that talented people do not need traditional career structures to be creative.
- The distributed networks that are appearing as a result of new light-weight infrastructures are leading to the processing of materials

and services much closer to their point of production or distribution (analogous to desktop printing of books and manuals for example), reducing transmission and transportation inefficiencies.

- Continuing transition of the workforce (particularly in developed nations) towards being knowledge workers (rather than dealing with physical objects).
- Increasing shift in knowledge workplace arrangements whereby more flexible work arrangements (i.e., working from home) are being given to knowledge workers from their employers.
- The meaning of privacy will continue to change in the Web 2.0 environment wherein information-sharing is becoming standard practice.
- Military use and adaptation of commercial innovations and services is increasing. Aside from the obligation to comply with government policy, economic pressures alone will continue to drive DND toward the use of COTS rather than custom military-specified systems and components.
- The worldwide market for nanotechnologies is predicted to be US\$1 trillion by 2015.
- Increasing removal of the human factor from operations as the military (and commercial enterprise) replace humans with robots in many of their “dull, dirty and dangerous” tasks.
- Digitization of the soldier made possible by miniaturization of sensors, computers, portable power and intelligent textiles.
- Commercialization of space, most notably in GPS and satellite communication capabilities, but also increasingly in space tourism.
- Rising demand for an R&D labour force in China and India.
- Open-access scientific publishing continuing to flourish.
- Increased use of simulation for advanced problem-solving, training and education.
- Proliferation of pervasive and invisible surveillance and tracking technologies (including RFID).
- Growing percentage of GDP dedicated to health, broadly defined, including not only health care but such areas as food, cosmetics, and leisure (i.e., all needs in Maslow’s hierarchy).
- Increasing use of net-enabled data-mining for legitimate business purposes, public decision-making, activist initiatives and criminal activities.

- Proliferation of NGOs, global news media, and self-organizing Internet blogs offering new forces for transparency, providing some checks on the abuse of power.
- Biotechnological re-engineering of living organisms.
- Carbon nanotube composites offering lighter and stronger products including vehicles.
- Proliferation of smart materials—engineered for special qualities and capable of interacting with the larger environment—derived from sciences as diverse as genetic engineering, polymer chemistry and nanoscience.
- NBIC technology convergence leading to a power shift, where the most powerful technologies will be those that are the smallest (i.e., sub-microscopic).
- Increase in the number and variety of “treatable” conditions leading to increasing human health and longevity.

### *Key Uncertainties*

- Whether fears about the danger to human and animal health of nanoparticles prove correct, the result would generate public rejection of other controversial nano-issues leading to their termination.
- Increasing likelihood that well intentioned policy decisions will have multiple adverse unintended consequences due to the growing complexity of globalization.
- Whether cyber security efforts will remain ahead of cyber attack proliferation.
- Whether (when?) anti-ageing related technologies begin to be adopted not simply as prophylactics but rather as enhancements.
- Whether the continuing increase in the number of treatments for a growing variety of conditions (including mental health) will lead to a narrowing in what is considered *normal* human performance.
- Whether the challenging multidisciplinary research that is increasingly required to advance many S&T domains will continue to converge.
- Whether current trends, tending towards rejecting certain science and technologies, continue to increase. For example, will there be a public backlash against certain biotechnologies that are seen to be tinkering with nature?

- How today's powerful elite will respond to the ongoing democratization of information and knowledge that is being facilitated by the expanding globalized network.
- The extent to which identity crime will create a backlash against an expansion of pervasive computing environments based on invasion of privacy grounds.
- To what extent the digital divide will be minimized.
- Whether the continued growth and expansion of modern globalized society will become so complex that it reaches a point where it collapses due to cascading failures initiated by an otherwise minor disruption.
- Whether full scale molecular manufacturing will become possible by 2040. Alternatively, whether personal fabrication technologies (possibly based on ink-jet printing technology) become viable, thus providing individuals with the power to manufacture most of their own products.
- The extent to which concerns over the climate and energy supply will lead to different national S&T policies and strategies.
- Whether fusion reactors will become viable thus providing an ample and clean source of energy, solving most of the world's energy problems.
- Whether artificial systems become complex enough to have unexpected emergent properties of their own. The Internet, for example, is a system that involves millions of computers, each with its own memory and processing capacity, with powerful connections among them, arrays of sensors to feed them with data and perhaps machines/robots to control on the basis of the computer system's knowledge—which may lead to emergent behaviour that we currently cannot predict.
- What potential consequences can arise due to continuing efforts to automate more and more daily functions under the control of artificial intelligence systems—e.g., software agents that will run utility and financial systems may develop unexpected emergent behaviour. Will we continue to bet our heat, light and money that they will behave? What about military robotics with lethal capabilities?
- Whether a “theory of everything” (a theory unifying quantum mechanics and general relativity) will be discovered which could drastically change our current understanding of the theoretical limits of information processing and many other physical phenomena.

- Is a “singularity” possible? That is, a point in time where technological change is so fast and significant that today we are incapable of conceiving what life might be like beyond this point? Could it occur before 2040?

### *Shocks*

- Nuclear holocaust.
- Badly programmed super-intelligence.
- Genetically engineered biological agent.
- Nanotechnology used by humans in warfare or terrorism.
- Accidental misuse of nanotechnology (“grey goo”).
- Pollution spill from a nanoparticle production facility.
- Nanoparticles leach from products to accumulate in the environment.
- Accidental misuse of biotechnology (“green goo”).
- Physics disasters (such as a malfunction at the Large Hadron Collider).
- Run-away global warming.
- Naturally occurring disease pandemic.
- Asteroid or comet impact.

### **Legal Dimension**

#### *Drivers*

- Globalization.
- Media—24/7 coverage.
- NGOs—eyes and ears of international community.
- Global civil society.

#### *Trends*

- Increased use of military lawyers in operations mainly driven by the rise in the world community’s expectations of human rights issues.
- Military lawyers will remain a specialty under the JAG.
- Challenges to state sovereignty—states’ right to regulate internal affairs challenged by human rights and emerging conventional and customary international law.

- National courts borrowing from other jurisdictions on human rights.
- Increased impact of international law on national law.
- NGOs and international organizations occasionally powerful enough to influence state policy through international law.
- Order and justice are now being considered by international law.
- Concern over applying territorially based law in cyber law enforcement.
- Human rights norms challenging the legal profession as well as all forms of law.
- United Nations Security Council continues to be recognized as main body sanctioning war and intervention.

### *Key Uncertainties*

- Impact of human rights on states' ability to regulate their internal affairs.
- Constitutional law no longer sufficient within the traditional nation state.
- What is the impact of cyber law?

### *Shocks*

- Army commander tried for war crimes.
- Large scale cyber attack taking down either private or public sector organization ... or both.

## **The Economy**

### *Drivers*

- Globalization.
- The US economy.
- Demographics—aging population and immigration.
- Energy security.

### *Trends*

- Globalization will intensify increasing interdependency between states yet the gap between the haves and have-nots will remain if not widen.

- The US will retain its economic dominance out to 2030–2040.
- The rise of the BRIC states (Brazil, Russia, India, and China) will tax global economic systems while exhibiting high growth potential and growing economic clout representing a fundamental shift in global economic power and political influence.
- The Earth’s current population of some 6.5 billion is expected to rise to 8.0 billion by 2030, an average increase of 60 million annually. More than 97 percent of this growth will take place in developing countries.
- Global trade in goods and services is likely to rise more than three-fold to US\$27 trillion in 2030. Roughly half that increase will come from developing countries.
- Global oil markets are expected to remain tight (high global demand out to 2030) over the long term as additions to global supply are expected to just satisfy anticipated growth in demand.
- Energy firms continue to invest heavily in hydrocarbons (Alberta oil sands) vice the more economically feasible investment in lower carbon energy systems (wind, solar).
- By 2030, 60 percent of the global population is expected to live in urban areas. Many of the “mega-cities” will be in the developing world.
- While immigration has been the source of more than half of Canada’s population growth, it will not be sufficient to offset the aging of the baby-boom thereby constraining the labour force.
- Urbanization is also expected to continue as a trend in Canada and population growth is fuelled by immigration to Canada’s urban centres.
- Aging population will stress the health care system and, in turn, public finances.
- As baby-boomers exit the labour force, competition for talented labour will intensify and ultimately weaken GDP growth. Even with optimistic immigration assumptions, this will result in a sharp slowdown in labour force growth—a slowdown that will weaken growth of GDP. (Conference Board of Canada).
- While Alberta’s oil sands production is expected to generate over \$100 billion in investment by 2030, the long term outlook looks cloudy due to possible restrictions on the oil industry due to the Kyoto Protocol.

- Canada expected to remain a net exporter of oil until 2030.
- Investment in other primary energy is dominated by the development of the oil sands.
- Quebec will lead the country in hydroelectric power development.
- Lower Churchill River is expected to be developed for its hydro power at a cost of \$4 billion despite financial, technical and environmental issues.
- Pipeline projects will also form a significant part of the energy investment out to 2030.
- Trade with the United States comprises 80 percent of our exports and 65 percent of our imports and, as such, the US will remain key to Canada's long-term economic performance. The US is the only country where we have a trade surplus and US growth is expected to slow.
- The huge US current account deficit is being funded by developing nations and has led to a shift in global capital flows. It is expected that this deficit will decline in an orderly fashion signalling continued growth for Canada in the long-term.
- Rise of BRIC countries means that exports will shift to those countries vice traditional markets of the US and the UK placing greater emphasis on western infrastructure. However, this is not a realistic alternative to the US and balance will need to be struck between the US and other markets.
- Unemployment to rise until 2015 but decrease from 2015–2030.
- Changing consumption patterns due to decreasing labour force (as retirees draw down savings), means the savings rate will approach zero by 2030. (Savings and investment, e.g., RRSPs, encourage economic growth).
- Residential investment forecast to decline from 1 percent to 0.3 percent by 2030.
- Demand for retail space to decline due to purchases over the Internet.
- Total federal expenditures to stabilize and only slightly rise by 2030.
- Canadian dollar expected to remain stable around US\$.85 out to 2030.
- Potential diversification likely in Canadian exports to BRIC countries to help offset economic downturn in the US.



### *Key Uncertainties*

- Risk associated with increased concentration of remaining oil reserves in a small group of countries—Middle East members of OPEC and Russia will increase their market dominance and put at risk investment in production capacity.
- Oil and gas extraction industry is notorious for exhibiting boom or bust activity.
- Establishment of a common NAFTA currency—most likely based on the US dollar.
- While it is forecast that global food production potential will be able to cope with demand, a combination of record oil prices, US farmers switching out of cereals to grow biofuel crops, extreme weather and growing demand in China and India could converge to create a food security issue.

### *Shocks*

- Alternative energy source to displace fossil fuels.
- Attack or collapse of our financial system undermining consumer confidence.
- New “oil shocks” emerge from a concentration of oil reserves in Russia and Middle Eastern OPEC countries.
- US unable to “unwind” their deficit in an orderly fashion.

## **Security and Defence**

### *Drivers*

- Poverty and poverty-related insecurities (e.g., inadequate access to reliable food supplies, safe drinking water, adequate health care, and modern energy supplies).
- Absence of good governance.
- Distributional inequities (material imbalances between the “haves” and “have-nots” of the world).
- Religious and/or ethnic differences.
- Issues of justice and human rights.

### *Trends*

- Uncertainty, volatility and rapid change will continue to dominate the international security environment.
- Events will unfold at alarming rates and this will directly challenge the ability of decision-makers to effectively react.
- While conventional-type warfare will remain a potential threat, the use of other forms of military power—information and special operations, and interventions focussing on reconstruction and stability—will become more prominent.
- The human dimension will increasingly represent a key component of military capability.
- Threats and vulnerabilities confronting Western armies will increase in scope and danger.
- Future defence and security challenges will include the growing potential for the militarization of space, increasing reliance on the information network and the threat of cyber-attack, criminal enterprise as a danger to the fabric of societies, and the collective psychological impact of ideological extremism.
- The lines between public safety concerns and those of a military or national security nature will continue to blur.
- The global operating environment will be predominantly complex (e.g., highly networked, interdependent, evermore urban).
- Challenges such as epidemics, poverty, food and water scarcity, desertification, deforestation and erosion, storms, flooding, and poor governance will increasingly stress the operating environment.
- Operations will be increasingly characterized by the presence and involvement of a far wider range of parties than ever before.
- The need to coordinate resources in order to address security challenges will be high, and the dilemmas associated with successfully doing so will be complex.
- Security in the post-modern globalized international system will increasingly equate with human security.

### *Key Uncertainties*

- The impacts of a growing world-wide communications network on defence and security.

- The security implications/impacts of the emerging multi-polar balance of power.
- The consequences of growing scarcities in fossil fuels on prospects for, and conduct of, armed conflict.

### *Shocks*

- Use of nuclear weapons.
- Use of biological weapons.
- A sudden shift in the military balance in favour of peer competitor(s) (e.g., owing to groundbreaking innovation in military technology).
- Global economic crisis.
- Global pandemic.

## **Human Dimension**

### *Drivers*

- The technology-enabled human social environment.
- Future soldiers will have a requirement to be resilient and cognizant of basic survival skills as technology and enhancements may not always be available.
- Aggregation/disaggregation will impact on morale, cohesion and trust.

### *Trends*

- Future soldiers will be better educated than the previous generations and more knowledge will be required of them.
- The soldier's operational environment will be very complex and he/she will be required to perform throughout the full spectrum of operation, with little to no notice. Physical, social, cognitive, psychological adaptability and flexibility will be of the essence.
- More specialists will be required, but will need to be balanced with the generalists' requirements.
- The future operational environment will not only entail military factors, but require a comprehensive approach and should involve many of the JIMP components.

- The pervasiveness of technology and its importance in a soldier's everyday life will affect his or her view of the world and how to socialize and behave.
- Technology and robots will continue to influence and affect all of the six Human Dimension themes.
- Professionalism and ethics will gain in importance and remain an operational imperative.
- Interface with technology will be frequent and necessary.
- Technology will be integral to social networking.
- The Canadian soldiers, like the Canadian demographics, will be diversified.
- Capability enhancements will also be very present in the soldier's environment; it could be a matter of survivability.
- Time and exposure are required to build morale, cohesion and trust.
- The time for decision-making will be greatly reduced and the data and components evermore complex.
- Human enhancements will be pervasive in society, as the quest for aesthetics spurs self-improvement.

#### *Key Uncertainties*

- Population support to its Army and soldiers.

#### *Shocks*

- Changed human and/or humanity.

# *Glossary*

**Comprehensive Approach:** Derives heavily from “whole of government” and 3D+C (i.e., defence, diplomacy, development and commerce) philosophies, which call for bringing previously separate agencies into closer collaboration in achieving policy objectives. In fact, a comprehensive approach aims to operationalize the goal that these philosophies identify. Indeed, it involves developing a capacity to interact with such players in a cooperative, constructive manner.

**Driver:** A driver is a factor that directly influences or causes change.

**Forecasting:** Is the process of making statements about events whose actual outcomes have not yet been observed. A commonplace example might be estimation of the expected value for some variable of interest at some specified future date.

**Foresight:** The ability to foresee or prepare wisely for the future.

**FSE:** Speculation about the nature of the Future Security Environment.

**Futuring:** Practiced by futurists, futuring is a systematic analysis of what is likely to continue, what is likely to change, and what is novel, aimed at understanding likely future consequences and the options we have for achieving our goals.

**Futurist:** Futurists, or futurologists, are those who speculate about the future, aiming to make it better.

**JIMP:** Joint, Interagency, Multi-national and Public is a descriptor that identifies the various categories of players (i.e., organizations, interest groups, institutions) that inhabit the broad environment in which military operations take place. Yet the concept of JIMP and being “JIMP-enabled” entails the adoption of an approach to operations—both domestic and international, that allows such players to effectively interact. Most importantly, it entails a belief in the requirement to adopt a more multidisciplinary approach to

problem solving that involves the holistic consideration and ideally, the coordination and cooperation of all relevant players.

**Netizen:** Netizen, (a portmanteau of Internet and citizen) or cybercitizen, is a person actively involved in online communities.

**Shock:** A shock is a low probability event with high impact that results in a discontinuity or an abrupt alteration in the expected direction of planning and policy.

**Trend:** A trend is a discernable pattern of change.

**Uncertainty:** In any attempt at theorizing about the future, a given amount of uncertainty exists; and as the theory becomes more specific or forecasts further into the future, that amount of uncertainty increases. Certainties and uncertainties come mainly through analysis of current trends, laws of society, and laws of nature.

**Warsaw Pact:** The Warsaw Treaty (1955–91) is the informal name for the mutual defence “Treaty of Friendship, Cooperation and Mutual Assistance” commonly known as the Warsaw Pact. Signed in 1955, it included eight countries: People’s Republic of Albania, People’s Republic of Bulgaria, Czechoslovak Republic, German Democratic Republic, Hungarian People’s Republic, Polish People’s Republic, Romanian People’s Republic, and the Union of Soviet Socialist Republics.

**Weak signal:** An early warning indicator of change, which typically becomes stronger by combining with other signals. For example, current commercial attempts to elicit input from the general public in order to guide product development, which is commonly referred to as crowd sourcing, is a weak signal pointing towards broader social transformation.

**Web 2.0:** A term used to describe a new generation of Web services and applications with an increasing emphasis on human collaboration.

## Notes

<sup>1</sup> Cornish, Edward. 2004. *Futuring: The Exploration of the Future*. Bethesda, Maryland: World Future Society.

<sup>2</sup> Philosophy, Aims and Objectives of the MA Foresight and Futures Studies, Leeds Metropolitan University (10 May 1999).

<sup>3</sup> For more details on the Army 2040 methodology, see LCol Michael Rostek, Peter Gizewski, and Regan Reshke, *Conceiving an Army for the 21st Century*, DRDC CORA TM 2010-264, December 2010.

<sup>4</sup> Choo, Chun Wei. 1999. "The Art of Scanning the Environment." *Bulletin of the American Society for Information Science*. Vol. 25 No. 3, pp. 13-19.

<sup>5</sup> *Ibid.*, p. 14.

<sup>6</sup> Morrison, J. L. 1992. "Environmental scanning," in M. A. Whitely, J. D. Porter, and R. H. Fenske (eds.), *A primer for new institutional researchers*. (Tallahassee, Florida: The Association for Institutional Research), pp. 86-99.

<sup>7</sup> Homer-Dixon, Thomas F. "Environmental Scarcities and Violent Conflict: Evidence from Cases," *International Security*, Vol. 19, No 1, Summer, 1994, pp. 5-40. Homer-Dixon expands upon the illustration by saying, "... scarcity is not sufficient, by itself, to cause violence; when it does contribute to violence, research shows, it always interacts with other political, economic, and social factors." Though Homer-Dixon uses the term "environmental scarcity," a term which is not perfectly interchangeable with resource scarcity, the differences are not germane to the current discussion.

<sup>8</sup> Demographers anticipate that a peak in the global population will occur between 2050 and 2100, at levels near nine billion, followed by a global population decline—all resultant from declining fertility rates. United Nations, Department of Economic and Social Affairs, Population Division (2009). "World Population Prospects: The 2008 Revision: Volume I: Comprehensive Tables" and from (2004) "World Population to 2300."

<sup>9</sup> Hirsch, Robert L., Roger Bezdek, Robert Wendling, (Feb 2005) "Peaking of World Oil Production: Impacts, Mitigation, & Risk Management," also known as "The Hirsch Report" p. 13. SAIC at [http://www.netl.doe.gov/publications/others/pdf/Oil\\_Peaking\\_NETL.pdf](http://www.netl.doe.gov/publications/others/pdf/Oil_Peaking_NETL.pdf) (accessed 20 July 2010).

<sup>10</sup> Graefe, Laurel, (2009) “The Peak Oil Debate,” *Economic Review*, Vol. 94, No. 2, Federal Reserve Bank of Atlanta, p. 1.

<sup>11</sup> Other fossil fuels include natural gas, coal, and, if the technology matures, gas hydrates. Hydrates are a combination of natural gas and water, found in vast reserves around the world, usually at very high pressure and very low temperatures.

<sup>12</sup> Alternative fuel and energy sources include solar, wind, tidal, nuclear, bio-fuel etc.

<sup>13</sup> The impacts of liquid fuels shortages are expected to be most severe in the transportation and agriculture sectors. The current bio-fuel effort is but one example of an alternative fuel adaptation. In an effort to substitute a renewable resource for a non-renewable one, (a partial substitution of ethanol for crude oil) some governments have enacted legislation and incentives to encourage ethanol production from croplands previously used for food. Though a well-intended initiative, an unforeseen impact of bio-fuel is an extreme spike in pressures on food supplies. That said, ongoing and future instances of innovation may yet, in the fullness of time, overcome most of the levels of friction caused by resource scarcities.

<sup>14</sup> Serageldin, Ismail, former VP, World Bank, *Newsweek*, 1995. As quoted in *Backbone* magazine, published by Publimedia Communications Inc. by Jim Harris, “Water is the Oil of the 21st Century,” January 2007.

<sup>15</sup> As cited in Vaclav Smil, “Global Catastrophes and Trends: The Next Fifty Years,” (Cambridge: MIT Press; 2008), p. 199.

<sup>16</sup> Gizewski, Peter J. Army 2040, “The Global Security Environment: Emerging Trends And Potential Challenges.” Prepared for the Annual Meeting of the Canadian Political Science Association, Carleton University, Ottawa, Canada, 27 May 2009. p. 7.

<sup>17</sup> Compare the diametrically opposed positions of Dyer and Michaels for example in Gwynne Dyer, (28 October 2008) “Climate Wars” Random House Canada, pp. 288, versus Patrick J. Michaels, (25 October 2005), “Meltdown: The Predictable Distortion of Global Warming by Scientists, Politicians, and the Media,” *Climate Wars* (Cato Institute: Washington, DC). pp. 280.

<sup>18</sup> Meehl, G. A., T. F. Stocker, W. D. Collins, P. Friedlingstein, A. T. Gaye, J. M. Gregory, A. Kitoh, R. Knutti, J. M. Murphy, A. Noda, S. C. B. Raper, I. G. Watterson, A. J. Weaver and Z.-C. Zhao, (2007). In “Climate Change 2007: The Physical Science Basis,” *Global Climate Projections*. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [S. Solomon, D. Qin, M. Manning, Z. Chen, M. Marquis, K. B. Averyt, M. Tignor and H. L. Miller (eds.)]. (Cambridge University Press: Cambridge, United Kingdom and New York, NY, USA). Also known as IPCC 2007) at <http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-chapter10.pdf> (accessed 22 July 2010).



<sup>19</sup> Baird, R., K. Migiro, and J. Melby, "The forced migration crisis" in "Human tide: the real migration crisis." A Christian Aid Report (May 2007) London, UK. p. 5. At <http://www.christianaid.org.uk/Images/human-tide.pdf> (accessed 22 July 2010).

<sup>20</sup> Borgerson, Scott G. "Arctic Meltdown," *Foreign Affairs*, Mar/Apr 2008, Vol. 87 Issue 2, pp. 63-77.

<sup>21</sup> Ibid. Despite predictions of NWP navigability in the near term, the more important routes from a global perspective are the polar route (over the north pole) and the North Sea Route (across the north coast of Russia) both of which are expected to be open before the NWP and both of which are expected to be more lucrative to world shippers than the NWP.

<sup>22</sup> Ibid.

<sup>23</sup> Byers, Michael. "Unfrozen Sea: Sailing the Northwest Passage." *Policy Options (Options Politiques)* May 2007, p. 30.

<sup>24</sup> USGS, "90 Billion Barrels of Oil and 1,670 Trillion Cubic Feet of Natural Gas Assessed in the Arctic." 23 July 2008. At [www.usgs.gov/newsroom/article.asp?ID=1980&from=rss\\_home](http://www.usgs.gov/newsroom/article.asp?ID=1980&from=rss_home) (accessed 19 July 2010).

<sup>25</sup> Majorowicz, J. A. and K. G. Osadetz. "Gas hydrate distribution and volume in Canada." *AAPG Bulletin*, 2001, Vol. 85, No. 7, ISSN 0149-1423 [American Association of Petroleum Geologists, Tulsa, OK], pp. 1211-1230 (2 p.).

<sup>26</sup> Scientific research into continental shelves and the Alpha Ridge and the Lomonosov Ridge on the arctic seabed and ongoing political-legal developments associated with the UN Convention on the Law of the Sea, are seeking to resolve conflicting arctic sovereignty claims (involving as a minimum Canada, Russia, Denmark, Norway and the US) within about a decade. However, given the complexities involved and given that the US signature on UNCLOS III remains un-ratified by the US Senate, timelines remain uncertain.

<sup>27</sup> RCMP. "Canadian Sovereignty in the Arctic: Challenges for the RCMP" (5 June 2007), p. 4. At <http://www.rcmp-grc.gc.ca/ci-rc/reports-rapports/cs-sc/cs-sc-eng.pdf> (accessed 19 July 2010).

<sup>28</sup> See for instance, Ronald Inglehart, *Modernization and Postmodernization: Cultural, Economic and Political Change in 43 Societies*, (Princeton: Princeton University Press; 1997) and Ronald Inglehart and Chris Welzel, *Modernization, Cultural Change and Democracy: The Human Development Sequence*, (Cambridge: Cambridge University Press; 2005).

<sup>29</sup> According to the World Bank, people living below the international poverty line (i.e., US \$1.25 per day in 2005) declined from 52 percent in 1981 to 42 percent in 1990 and 25 percent in 2005. That proportion is expected to be 15 percent by 2015. See "World Bank, Global Economic Prospects 2010: Crisis, Finance, and Growth," (Washington: International Bank for reconstruction and Development/The World Bank; 2010). See also Maxim Pinkovsky and Xavier Sala-i-Martin,

“Parametric Estimation of the World Distribution of Income,” at <http://www.voxeu.org/index.php?q=node/4508> (accessed 22 January 2010).

<sup>30</sup>United Nations Population Division estimates indicate that countries facing especially profound declines in population include Japan, Russia, and a number of countries in Western Europe—most notably Germany, Italy and Spain. Meanwhile, in the developing world, China is expected to face a greying of its population by the 2020s. Indeed, its coming age wave indicates that by 2030, it will be an older country than the United States. See Neil Howe and Richard Jackson, “The World Won’t be Aging Gracefully,” *Washington Post*, 4 January 2009, at <http://www.washingtonpost.com/wp-dyn/content/article/2009/01/02/AR2009010202231.html> (accessed 24 February 2011).

<sup>31</sup>According to the United Nation’s 2007 Report on global aging, the gray-ing of the world’s population is “...unprecedented, a process without parallel in the history of humanity.” The report notes that if current trends continue “...the number of older persons is expected to exceed the number of children for the first time in 2047” at the world level. See United Nations, *World Population Aging 2007*, (New York: United Nations Department of Economic and Social Affairs, Population Division; 2007), p. xxvi.

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

<sup>33</sup>Neil Howe and Richard Jackson, “The World Won’t be Aging Gracefully.”

<sup>34</sup>See Jack Goldstone, “The New Population Bomb: The Four Megatrends that will Change the World,” *Foreign Affairs*, Vol. 89, No. 1 (January-February 2010), pp. 31-43.

<sup>35</sup>See *ibid.*, pp. 37-38.

<sup>36</sup>For a particularly ominous view of such developments, see Phil Williams, *From the New Middle Ages to a New Dark Age: The Decline of the State and US Strategy*, (Washington DC: US Army War College, Strategic Studies Institute, June 2008). At <http://www.strategicstudiesinstitute.army.mil/pubs/display.cfm?PubID=867> (accessed 24 February 2011).

<sup>37</sup>While the second half of the 20th century can be credited with the emergence of a number of democratic states within the international system, a continuation of this trend remains unclear. Indeed, some have noted signs that the system is currently witnessing a move to new—decidedly authoritarian—forms of governance—most notably in Russia and China. Even here however, assertions that such developments will continue into mid-century would be premature.

<sup>38</sup>That said, such partnerships are likely to remain limited and confined to specific states, organizations, issues and circumstances.

<sup>39</sup>For the classic statement predicting the impending shift from unipolarity to multipolarity, see Kenneth Waltz, “The Emerging Structure of International Politics,” *International Security*, Vol. 18, No. 2 (Fall 1993). See also Kenneth

Waltz, “Structural Realism after the Cold War, *International Security*, Vol. 25, No. 1 (Summer 2000).

<sup>40</sup> Some analysts dispute whether such a system would even equate with past cases of multi-polarity. In fact, Richard Haas suggests that the future international system may best be described as “non-polar”—a condition in which power will be exceedingly diffuse and the influence of nation-states will decline as that on non-state actors increases. See Richard N. Haas, “The Age of Non-Polarity: What Will Follow US Dominance?” *Foreign Affairs*, (May-June 2008).

<sup>41</sup> According to Vaclav Smil, there are essentially three categories of event that would have major, i.e., “earth altering,” long-term consequences: 1) natural catastrophes, 2) pandemic illness and 3) transformational wars. See Vaclav Smil, “The Next 50 Years: Fatal Discontinuities” *Population and Development Review*, (June 2006), pp. 201-36.

<sup>42</sup> In this regard, one should note that shifts in the future distribution of power in the international system may crucially turn as much on the policy preferences and decisions of the leadership of major powers as on other factors. Indeed, policy choices may well work to hasten or arrest decline relative to other powers.

<sup>43</sup> Bostrom, N. “Technological Revolutions: Ethics and Policy in the Dark.” (2006), p. 2. At <http://www.nickbostrom.com/revolutions.pdf> (accessed 17 April 2008).

<sup>44</sup> The effect of a positive feedback loop is not necessarily “positive” in the sense of being desirable. The name refers to the nature of change rather than the desirability of the outcome. A negative feedback loop tends to slow down a process, while the positive feedback loop tends to speed it up.

<sup>45</sup> See R. Jervis, “Was the Cold War a Security Dilemma?” *Journal of Cold War Studies* Vol. 3, No. 1, Winter 2001.

<sup>46</sup> A system in which there is positive feedback to any change in its current state is said to be in an unstable equilibrium, whereas one with negative feedback is said to be in stable equilibrium.

<sup>47</sup> The historical record would suggest that such tipping points are not only possible, but inevitable, since every advanced society up to the present day has collapsed.

<sup>48</sup> See NewScientist.com at <http://www.newscientist.com/channel/being-human/mg19826501.500-why-the-demise-of-civilisation-may-be-inevitable.html> (accessed 21 April 2008).

<sup>49</sup> See Bostrom, N. “Technological Revolutions: Ethics and Policy in the Dark.” At <http://www.nickbostrom.com/revolutions.pdf> (accessed 21 April 2008).

<sup>50</sup> Although there are numerous domain-specific grand challenges, the World Federation of UN Associations Millennium Project maintains a list of fifteen

global challenges for humanity. At <http://www.millennium-project.org/millennium/challeng.html> (accessed 25 April 2008).

<sup>51</sup> See “Future Current Perspectives on Emerging Technologies; The Human Importance of the Intelligence Explosion.” At <http://www.acceleratingfuture.com/people-blog/?p=185> (accessed 21 April 2008).

<sup>52</sup> Humans invariably turn to S&T and engineering to find solutions to problems. Examples include, among others, birth control and in-vitro fertilization for fertility issues, vaccines and antibiotics for disease-related problems and robotics for labour shortages.

<sup>53</sup> United Nations Office for Outer Space Affairs, “International Space Law,” at <http://www.oosa.unvienna.org/oosa/SpaceLaw/index.html> (accessed 14 June 2010).

<sup>54</sup> Government of Canada, *Law of Armed Conflict at the Operational and Tactical Levels*, (Ottawa: Office of the Judge Advocate General, 2001): 1-1; Christian Reus-Smit, “International Law” in John Baylis and Steve Smith, eds., *The Globalization of World Politics*, Third Edition, (Oxford: Oxford University Press, 2006), p. 350.

<sup>55</sup> Slaughter, Anne-Marie and William Burke-White, “The Future of International Law is Domestic (or, The European Way of Law),” *Harvard International Law Journal*, Vol. 47, No. 2, Summer 2006.

<sup>56</sup> Christian Reus-Smit, “International Law” in John Baylis and Steve Smith, eds., *The Globalization of World Politics*, p. 359.

<sup>57</sup> *Ibid*, p. 358.

<sup>58</sup> For a detailed discussion see Mary Kaldor, “The idea of global civil society,” *International Affairs*, 79, 3, (2003), pp. 583-593.

<sup>59</sup> Department of Foreign Affairs and Trade, “International Criminal Court,” at [http://www.international.gc.ca/court-cour/index.aspx?lang=eng&menu\\_id=55&menu=R](http://www.international.gc.ca/court-cour/index.aspx?lang=eng&menu_id=55&menu=R) (accessed 4 June 2010).

<sup>60</sup> Government of Canada, *Law of Armed Conflict at the Operational and Tactical Levels*: 1-2.

<sup>61</sup> Slaughter, Anne-Marie and William Burke-White, “The Future of International Law is Domestic (or, The European Way of Law),” p. 328.

<sup>62</sup> See Global Centre for the Responsibility to Protect, at <http://globalr2p.org/> and Department of Foreign Affairs and Trade, “Responsibility to Protect,” at <http://www.international.gc.ca/glynberry/protect-resp-protoger.aspx?lang=eng> (both accessed 4 June 2010).

<sup>63</sup> Christian Reus-Smit, “International Law” in John Baylis and Steve Smith, eds., *The Globalization of World Politics*, p. 358.

<sup>64</sup> *Ibid*. p. 359.

<sup>65</sup>For a comprehensive overview of cyber law, see Amhad Kamal, *The Law of Cyberspace*, (Geneva: United Nations Institute for Training and Research, 2005).

<sup>66</sup>Cyber space and space are global commons—an area that no one country has sovereignty over and its resources can be used by all, or, at least by those who have the technological capabilities to explore those resources. Centre for Strategic and International Studies, “Space and The Global Commons,” at <http://csis.org/blog/space-and-global-commons> (accessed 14 June 2010).

<sup>67</sup>Ibid.

<sup>68</sup>The International Bank for Reconstruction and Development / The World Bank, “Global Economic Prospects: Managing the Next Wave of Globalization,” (Washington, DC: The World Bank, 2010), p. xi.

<sup>69</sup>Ibid, p. 2.

<sup>70</sup>The International Bank for Reconstruction and Development / The World Bank, “Global Economic Prospects: Managing the Next Wave of Globalization,” (Washington, DC: The World Bank, 2007), p. xii.

<sup>71</sup>Ibid, p. 39.

<sup>72</sup>Ibid, p. 46.

<sup>73</sup>Conference Board of Canada, “Canadian Outlook: Long Term Economic Forecast 2009,” (Ottawa: The Conference Board of Canada, 2009), p. 3. See also Goldman Sachs Global Economics Group, “BRICS and Beyond,” (The Global Investment Research Division of Goldman Sachs, London, 2007).

<sup>74</sup>Conference Board of Canada, “Canadian Outlook Long Term Forecast 2009: Economic Forecast,” p. 13. For a more detailed look at the US Current Account Deficit, see Petersen Institute for International Economics, “US Current Account Deficit,” at <http://www.iie.com/research/topics/hottopic.cfm?HotTopicID=9> (accessed 2 June 2009).

<sup>75</sup>Conference Board of Canada, “Canadian Outlook Long Term Forecast 2009: Economic Forecast,” (Ottawa: Conference Board of Canada, 2009), p. 38.

<sup>76</sup>United Nations Population Fund, “State of World Population 2007,” at <http://www.unfpa.org/swp/2007/english/introduction.html> (accessed 26 April 2010).

<sup>77</sup>Conference Board of Canada, “Canadian Outlook Long Term Forecast 2009: Economic Forecast,” (Ottawa: Conference Board of Canada, 2009), p. 43.

<sup>78</sup>Ibid., p. 39-42.

<sup>79</sup>Ibid, p. 37.

<sup>80</sup>Ibid, p. xi.

<sup>81</sup>Ibid, p. 8.

<sup>82</sup> See “Human Security Report Project,” *Human Security Report 2009; Part II, “The Shrinking Costs of War,”* (Vancouver, BC: Simon Fraser University; 2009), pp. 1-8.

<sup>83</sup> Technological impacts such as the increasing precision, range and power of weaponry, knowledge proliferation, and a steeply rising inclination to invest in force protection, will continue to fuel military spending at record levels.

<sup>84</sup> Compelling arguments underlining the possibilities for a future featuring still more instances of conventional-type warfare can be found in Colin Gray, *Another Bloody Century: Future Warfare*, (London: Phoenix Press; 2006).

<sup>85</sup> On this point, see, for instance, Herfried Munkler, *The New Wars*, (Cambridge: Polity Press; 2005).

<sup>86</sup> See Charles C. Moskos, John Allen Williams and David R. Segal (eds.) *The Postmodern Military: Armed Forces After the Cold War*, (Oxford: Oxford University Press; 2000).

<sup>87</sup> Resilience is defined as the ability to cope in the face of significant adversity or risk. For a more complete discussion see the chapter on the human dimension in this volume.

<sup>88</sup> The rise of NGOs may be especially noteworthy—particularly if existing trends continue. In this regard, Joshua Ramo notes that, “more than 90 percent of all non-governmental organizations” in the world have been created in the past ten years. See Joshua Cooper Ramo, *The Age of the Unthinkable*, (New York: Little and Brown; 2009), p. 35.

<sup>89</sup> Efforts to develop approaches better suited to addressing the challenges posed by environments featuring a range of diverse actors are already underway. For a useful discussion of such efforts, see, Ministry of Defence, *Comprehensive Approach: Trends, Challenges and Possibilities for Cooperation in Crisis Prevention and Management*, (Ministry of Defence: Helsinki, Finland, 2008).

<sup>90</sup> The Army defines human domain as: the physical, intellectual, psychological and social dimensions that influence the soldier’s ability to perform effectively across the moral, physical and informational planes of conflict.

<sup>91</sup> The phrase *better educated* is derived from several source documents concerning positive trends in persons enrolling and remaining in elementary, secondary and tertiary schools, increased national literacy rates and increased gender parity in academic enrolment. For statistics concerning these global education trends and others, see [http://www.uis.unesco.org/ev.php?URL\\_ID=3753&URL\\_DO=DO\\_TOPIC&URL\\_SECTION=201](http://www.uis.unesco.org/ev.php?URL_ID=3753&URL_DO=DO_TOPIC&URL_SECTION=201) (accessed 24 February 2011).

<sup>92</sup> Sager, C. E., T. L. Russell, R. C. Campbell, and L. A. Ford, (September 2005). “Future soldiers: Analysis of Entry-Level Performance Requirements and their Predictors.” US Army Research Institute for the Behavioural and Social Sciences.

<sup>93</sup>Gizewski, P. J. (May 2009). Army 2040. “The Global Security Environment: Emerging Trends And Potential Challenges.” Prepared for the Annual Meeting of the Canadian Political Science Association, Carleton University Ottawa, Canada.

<sup>94</sup>Ibid.

<sup>95</sup>“The Army centre of gravity is institutional credibility, which is defined as recognition of the Army as a valued national institution and trusted partner and ally.” It comprises: Legitimacy with the Canadian public, Relevance to National Leadership, Trust within CF/DND, Identity (Reputation), and Expertise sought by allies. Army Strategy, Land Force Command, Ottawa, March 2009, pp. 24-25.

<sup>96</sup>Campise, R. L., S. K. Geller, and M. E. Campise. (2006). “Combat Stress.” In C. H. Kennedy and E. A. Zillmer (eds.), *Military Psychology: Clinical and Operational Applications*. (New York, NY, US: Guilford Press), pp. 215-240.

<sup>97</sup>These Army Operational functions are defined as: Sense—The operational function that provides the commander with knowledge; Act—The operational function that integrates manoeuvre, firepower and offensive information operations to achieve the desired effects; Shield—The operational function that provides for the protection of a force’s survivability and freedom of action. See “Land Operations 2021: Adaptive Dispersed Operations” at [http://www.army.forces.gc.ca/DLCD-DCSFT/pubs/landops2021/Land\\_Ops\\_2021\\_eng.pdf](http://www.army.forces.gc.ca/DLCD-DCSFT/pubs/landops2021/Land_Ops_2021_eng.pdf) (accessed 1 March 2011).

<sup>98</sup>Speier, C., J. S. Valacich, and I. Vessey. (1999). “The Influence of Task Interruption on Individual Decision Making: an Information Overload Perspective.” *Decision Sciences*, 30(2):337-360.

<sup>99</sup>“The principle of universality of service or *soldier first* principle holds that CF members are liable to perform general military duties and common defence and security duties, not just the duties of their military occupation or occupational specification. This may include, but is not limited to, the requirement to be physically fit, employable and deployable for general operational duties.” Defence Administrative Orders and Directives (DAOD) 5023-0 (19 May 2006), ADM (Fin) CS, <http://www.admfnscs.forces.gc.ca/dao-doa/5000/5023-0-eng.asp> (accessed 1 March 2011).

<sup>100</sup>United States Army, “Comprehensive Soldier Fitness,” at <http://www.army.mil/csf/> (accessed 29 June 2010).

<sup>101</sup>United States Army, “Comprehensive Soldier Fitness,” Brochure Update Version 3, (Arlington: US Army, 2009).

<sup>102</sup>The security dilemma refers to a situation whereby actions taken to ensure one’s own security inadvertently and often unexpectedly decrease or threaten the security of others—a condition that increases the prospects for tension and armed conflict. For the classic statement, see John Herz, *Political Realism and Political Idealism*, (Chicago: University of Chicago Press; 1951). For a more recent elaboration involving military technology, see Robert Jervis, “Cooperation Under the Security Dilemma,” *World Politics*, Vol. 30, No. 2 (January 1978), pp. 167-214.

<sup>103</sup> Once again however, assessing the positive and negative impacts of such events is often highly contingent. The onset of negative shocks in some parts of the world may well generate positive consequences in others and vice versa. Beyond this lies the fact that in general, people tend to demonstrate a certain hesitancy to view any sudden shock or incident classified as a wild card as beneficial. This may be due in part to a general and instinctive human distrust of radical change. See Edward Cornish, *Futuring: The Exploration of the Future*, (Maryland: World Future Society; 2005), p. 120.

<sup>104</sup> As Cornish observes, wild cards are, by definition, unexpected but not necessarily uncommon. In fact, over the course of a century, there are probably several thousand events that might be viewed as wild cards in the global area, and many hundreds in the lives of individuals and organizations. See Cornish, *Futuring: The Exploration of the Future*, p. 112.

<sup>105</sup> Though system complexity can also be accompanied by greater system resilience and thus an ability to contain or manage the impacts of unforeseen events and occurrences, still, it is unlikely that such safeguards will be capable of ensuring that such events are entirely avoided. Nor is it likely that all interested parties will have the capacity to provide such safeguards when needed. Moreover, effective adaptation to the uncertainties and potential dangers of system complexity is generally a learning process in which lessons and solutions tend to emerge gradually at best and only after a number of marked setbacks occur.

<sup>106</sup> Glenn, Jerome C. "Chapter 1: Introduction to The Futures Research Methods Series," AC/UNU Millennium Project Futures Research Methodology—V2.0:4.

<sup>107</sup> Publications detailing additional results of the project include Director Land Concepts and Designs, *Army 2040: First Look, Trends, Challenges and Implications for Canada's Army*, (Kingston: DLCDC: 2011) and in the forthcoming work *Crisis in Urdia*, a fictional scenario derived from the projects' initial findings and intended to facilitate capability development.



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## *About the Authors*

**LCol Mike Rostek**, CD, PhD, is the leader of the DLCDC Concepts Team. He holds a Masters of Arts in Defence Management and Policy from Royal Military College (RMC) and a Masters of Management in Defence Studies from the University of Canberra, Australia. He is a recent doctoral graduate from the War Studies program at RMC where he examined global normative change and associated implications for state militaries.

**Peter J. Gizewski** is a Senior Defence Scientist with the Centre for Operational Research and Analysis (DRDC-CORA), Department of National Defence, and is currently serving as the Strategic Analyst to the Land Operational Research Team (LCDORT) in Kingston, Ontario. Gizewski was educated at the University of Toronto (Trinity College) and Columbia University where he was a Canadian Department of National Defence Fellow in Military and Strategic Studies and a MacArthur Fellow in Conflict, Peace and Security.

**Regan G. Reshke**, CD, PEng, OLS/OLIP, is Director Science & Technology Land 7 at Defence Research and Development Canada and the Scientific Advisor to the Chief of Staff Land Strategy. He has been a member of the DLCDC Concepts team since 2002 and holds a Bachelor of Engineering degree in Civil Engineering from RMC, a graduate diploma in Mapping, Charting and Geodesy from University of New Brunswick, and a Master of Engineering degree in Structural Engineering, RMC.

**LCol Ron Bell**, CD, has been a member of DLCDC since 2006 where he has worked in both the Concepts and Design Teams. He holds a Bachelor of Arts degree from Providence College, Manitoba, and a Master of Arts degree from Providence Theological Seminary, Manitoba. He currently serves as Deputy DLCDC.

**LCol Steve Larouche**, CD, served with the DLCDC Concepts Team from 2007 to 2009. A graduate of the Canadian Forces Command and Staff Col-

lege in Toronto, he is currently senior administration officer at Canadian Forces Support Unit (Ottawa).

**Major John Sheahan, CD**, an Army Engineer, has been employed with the DLCDC Concepts Team since 2008. He was among Canada's first to deploy to the Western Sahara in 1991 and to Kosovo in 1998. A graduate of CLFCSC, and RMC (BSc) he also obtained an MBA from Webster University in 2003.

## *Contributors*

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- Col John Crosman
- LCol Brad Boswell
- LCol Brendan Dwyer
- LCol Yvon Martineau
- Maj Sebastien Blanc
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