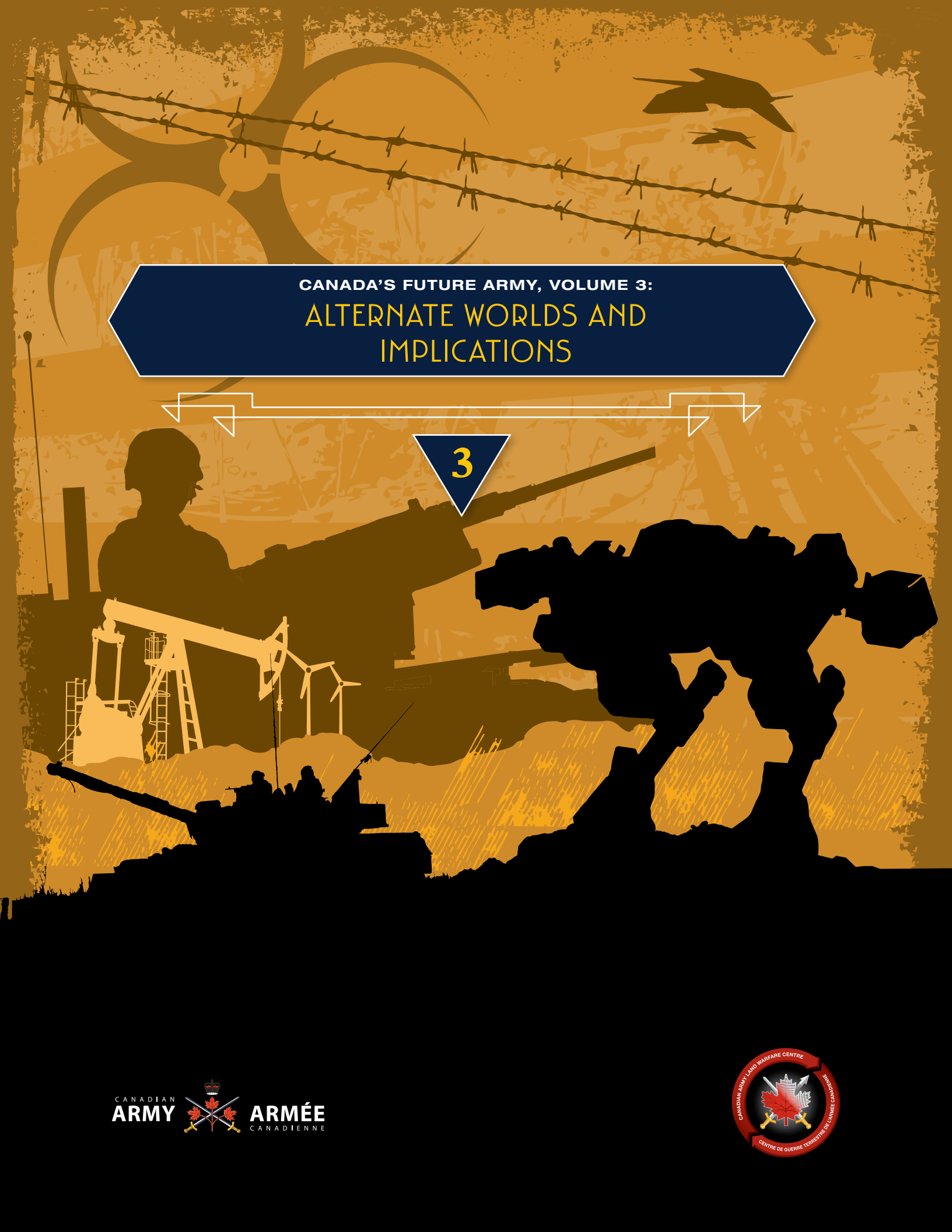

CANADA'S FUTURE ARMY, VOLUME 3:

ALTERNATE WORLDS AND IMPLICATIONS

3

CANADIAN ARMY ARMÉE CANADIENNE

CANADIAN ARMY LAND WARFARE CENTRE
CENTRE DE GUERRE TERRESTRE DE L'ARMÉE CANADIENNE

CANADA'S FUTURE ARMY,

Volume 3: Alternate Worlds and Implications

CANADIAN ARMY ARMÉE CANADIENNE

Canadian Army Land Warfare Centre
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PREFACE

AIM

The aim of this publication is to further explore the implications of the future security environment for the Future Army. Specifically, this volume examines the alternative futures developed in *Canada's Future Army, Volume 1: Methodology, Perspectives and Approaches*, and their implications for the concepts, capabilities and characteristics Canada's Army would require to be effective and successful in each of these futures. Along the way, and in an effort to provide concept and capability developers with a means of anticipating and adapting to future change, this volume also identifies a number of forces (signposts) likely to signal impending shifts toward each of the futures presented.

APPLICABILITY

This publication is primarily for use by the Canadian Army's capability development community and is focused on the development of the Future Army (beyond 25 years) and the Army of Tomorrow (10 to 15 years).

SCOPE

Canada's Future Army, Volume 3: Alternate Worlds and Implications, is the third and final volume in the Future Army project's three-volume series focusing on the use of foresight to conceive the Future Army. This volume articulates the results of each of the alternative futures developed by the Future Army project team, identifies signposts indicating possible shifts toward each of the alternate worlds described, and presents the concepts, capabilities, missions and tasks likely to be required by Canada's Future Army in each of these futures.

The study is divided into five main chapters.

» **Chapter 1** – describes the purpose and rationale of the study;

» **Chapter 2** – details the key characteristics of the four worlds and examines the relationship between each, comparing and contrasting them based on a number of key trend areas (e.g., social, science and technology, energy, environment);

» **Chapter 3** – identifies the key forces or signposts indicating change or movement toward each of the worlds described—an exercise which provides the basis for a warning system aimed at alerting decision makers to impending change and the need to address it;

» **Chapter 4** – examines the implications of the worlds described for the Future Army in terms of capability development—assessing what each world means in terms of the missions and tasks the Future Army would be expected to perform as well as the capabilities likely to be required in each world; and

» **Chapter 5** – describes the investment required to maintain the necessary agility to respond effectively to changes in the future security environment.

The volume concludes with a number of observations on and suggestions for the conduct of foresight work for future Army capability development.

The result is a work that provides not only a more detailed and nuanced appreciation of possible future capability development requirements but also guidance aimed at better preparing capability developers for anticipating future change in the international environment and adapting more effectively to the changes that ultimately occur.

RELATIONSHIP TO OTHER CAPABILITY DEVELOPMENT PUBLICATIONS

This publication should be read in conjunction with B-GL-007-000/JP-007, *Canada's Future Army, Volume 1: Methodology, Perspectives, and Approaches*, and B-GL-007-000/JP-009, *Canada's Future Army, Volume 2: Force Employment Implications*.

A NOTE ON ARMY TERMINOLOGY

Throughout this publication, the word army appears many times, and as in many different formats and contexts that may prove confusing for some readers to follow. Therefore, when reading the document please keep in mind that the word(s) 'army' and 'future army' are employed as a common noun, whereas 'Canadian Army' and 'Future Army' are a reference to the current and future institutions respectively. Of these, depending on the context the latter may also be used in reference to the CALWC project.

INTRODUCTION

PURPOSE

Canada's Future Army, Volume 3: Alternate Worlds and Implications is the final volume in the *Canada's Future Army* series. This study marks the culmination of the Future Army strategic foresight and alternative futures seminar wargame process cycle. To this point the process has involved an in-depth examination of the future land operating environment in the context of four possible worlds, identifying missions, characteristics and capabilities required for the Canadian Army to operate effectively and successfully in each of the four alternative futures examined.[1]

Volume 3 extends the analysis of the four alternative futures by exploring forces and events that have the potential to offer indications as to whether and when one of the four worlds examined is indeed emerging.[2] More precisely, Volume 3 attempts to identify signposts, signals and trends which could allow for timely and relevant recognition of each emerging world. Such recognition is essential for ensuring that the process of concept and capability development is sensitive and attuned to changing conditions in the security environment. Moreover, it enables the Army to be proactive by providing the means to anticipate and adapt effectively when change occurs. Simply put, Volume 3 provides an outline of those signals, signposts and trends that allow for differentiation between emerging futures so as to better prepare capability developers to anticipate future change and thus adapt more effectively to the changes that eventually occur.

"WE NOW LIVE IN A WORLD WHERE KNOWLEDGE TRANSFER AND INFORMATION EXCHANGE ARE TREMENDOUSLY EFFICIENT, AND WHERE THERE ARE NUMEROUS ORGANIZATIONS IN THE BUSINESS OF COLLECTING AND TRANSFERRING BEST PRACTICES."

1. The four alternative future scenarios (known as Materialism Gone Mad, High-Octane Green, Global Quagmire and Recyclable Society) are fully elaborated in *Canada's Future Army, Volume 1: Methodology, Perspectives and Approaches* (Kingston: Canadian Army Land Warfare Centre, 2015).

2. It is important to note that none of the four alternative futures articulated is likely to emerge exactly as described and that there is potential for some combination to manifest, including some other type of future that has not yet been considered. The four worlds identified do offer sufficient scope to enable capability development for Canada's Army to effectively address the challenges associated with any other likely world.

Signposts, signals and trends form the basis for early warning systems which, to be effective, require not only monitoring, but also periodic updates to re-establish their relevance. This volume provides the basis for a systemized framework for understanding trends, signals and signposts in an early warning system. This is perhaps the most dramatic contribution of Volume 3: it provides early warning through signposts regarding the emergence of specific future operating environment trends, and at the same time provokes reflection about the implications of those signposts for the capability development activities required to meet those future challenges in an informed and realistic manner.

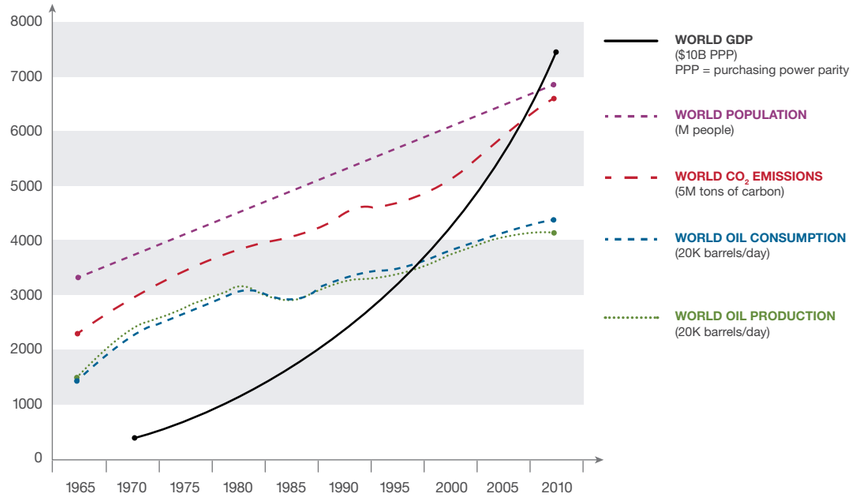


FIGURE 1: WORLD GROWTH EXAMPLES (1965 to 2010)[3]

UNDERSTANDING TRENDS, SIGNALS AND SIGNPOSTS

We now live in a world where knowledge transfer and information exchange are tremendously efficient, and where there are numerous organizations in the business of collecting and transferring best practices. So, there are fewer and smaller differences in what firms know than in their ability to act on that knowledge.[4]

3. Source: https://www.elsevier.com/connect/economic-growth-and-sustainability-are-they-mutually-exclusive

4. Jeffrey Pfeffer and Robert Sutton, *The Knowing–Doing Gap: How Smart Companies Turn Knowledge into Action* (Boston: Harvard Business School Press, 1999).

Understanding how and when an alternative world is emerging requires a process that describes what causes that particular world to emerge. If one thinks of the emergence of the most likely future operating environment as a specific pathway from present to future, one must also consider and identify what potential events, behaviours or developments are likely to force a shift off that pathway and onto another. This process involves the use of alternative futures and trend analysis. The alternative futures analysis (including the preliminary horizon scanning) determined the four alternative worlds and described them in considerable detail (see Volume 1). The present volume provides the trend analysis specific to each of the four alternative futures developed.

Trends, signals and signposts are related concepts. Trends are discernible patterns of change.[5] Those patterns can be found in specific behaviours, in societal or technological developments, or in attitudes held by leaders or societies generally. Signposts are discrete events or thresholds that mark the way between the present and a plausible future. They can be seen as navigational waypoints along a projected course which, if identified in time, may allow course direction for the purpose of influencing, or preparing for, that future probability. Their importance in foresight analysis has been summarized as follows:

> In the context of foresight work, signposts help to gauge the extent to which a particular scenario has materialised. In this, they can help to update decision-makers' thinking as new information becomes available and keep the organisation responsive to changes in the environment.[6]

Signals are best understood as small or local innovations or disruptions that have the potential to grow in scale and geographic dispersion. Grouped with other signals, they have the potential to identify impending shifts in trends. Signals present a challenge, however, because of relative signal strength and the constant presence of noise. Indeed, signals, though omnipresent, may be too sporadic, too quiet or, more likely, too incomplete and imprecise to be recognized. Weak signals are constantly lost amidst the noise of a myriad of background signs and facts. Success in the form of proactive behaviour often depends on an organization's ability to separate signals from noise.

5. A trend is defined more broadly as either a general tendency or a direction. Because of the influence of attitudinal shifts, it is important to remember that trends also play a role in opinion.

6. Centre for Strategic Futures & Civil Service College (Singapore), *Foresight: A Glossary,* 41. Online at http://www.csf.gov.sg/docs/default-source/default-document-library/csf-csc_foresight--a-glossary.pdf.

Further, while weak signals may firm up and become stronger and more concrete as time progresses, such progression cannot be taken as a given. Too often, weak signals are lost and only recognized after the fact, allowing neither their consideration in early warning nor their use in terms of response.

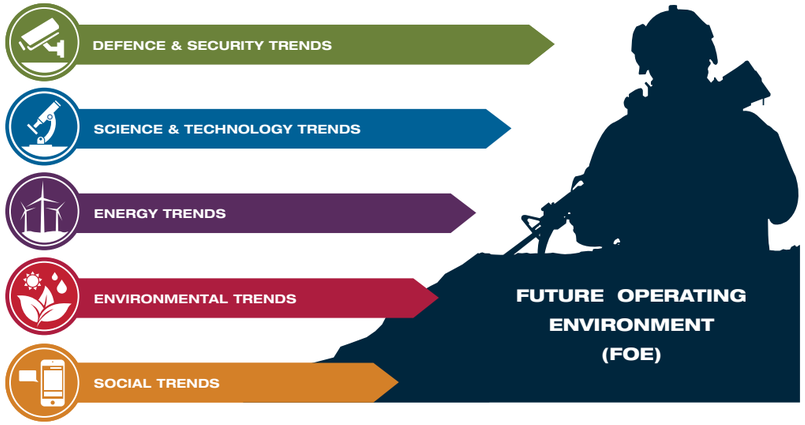
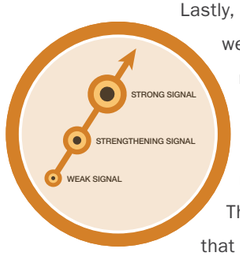


FIGURE 2: TREND LINES SHAPING THE FUTURE OPERATING ENVIRONMENT (FOE)



Lastly, it is important to remember that signal strength, whether weak or strong, does not necessarily indicate the importance or relevance of the signal in question. Signals of impending change in the security environment, radical or otherwise, are ubiquitous. To be sure, an organization such as the Canadian Army is rarely surprised by changing directions or dramatic shifts in policy. The Army has a host of formal and informal networks available that provide a myriad of indicators from traditional and non-traditional sources. Those networks supply a wealth of information which requires processing and analysis to help identify useful indicators and signals of impending change.

Yet, too often, organizational biases and filters influence the recognition and development of trends, signposts and signals. There are always organizational filters in place, and understanding their impact requires recognizing which are present and why. *Surveillance filters* affect signal reception because of organizational gaps, a situation which can result in an organization missing signals entirely. *Mental filters* can block signals which fail to conform to an organization's expectations or the frame of reference assumed when seeking signals. Lastly, *power filters* can tend to block signals that are not viewed as being in the best interest of the organization itself. All three types of filters underline the need for an organization to conduct an honest evaluation of incoming information and understand and recognize the embedded biases which may not only influence signal development, but also prevent or impair recognition of signals or emerging trends that may indicate change.

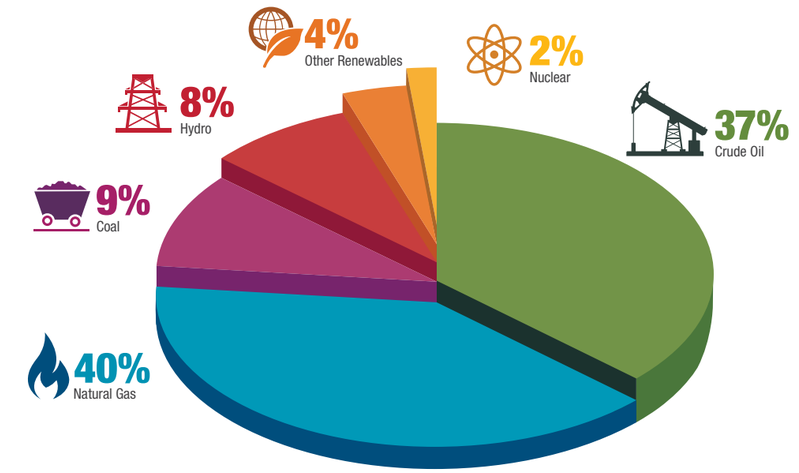


FIGURE 3: CANADA'S PRIMARY ENERGY PRODUCTION[7]

7. All numbers refer to 2010 production. (Source: Natural Resources Canada, 2012e: Cited in F.J. Warren and D.S. Lemmen, editors (2014), *Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation* (Ottawa: Government of Canada), 286.

CHAPTER 1

UNDERSTANDING THE FOUR WORLDS: A SHORT RECAP[8]

The four worlds employed in the Future Army seminar wargame series were the result of a process known as alternative futures development, which is employed for risk management and policy planning.[9] It identifies probable outcomes (ie, alternative worlds) that may result from a combination of factors or planning variables and their associated uncertainties. It then allows for the articulation of a common future narrative that allows for collective and coordinated planning. It does not predict the future; rather, it allows planners to prepare for possible future outcomes and identify the capabilities likely to be required to deal with those potentialities. In effect, alternative futures analysis embraces uncertainty and allows the user to map out the boundaries of uncertainty in the context of the alternative worlds developed.

"IN EFFECT, ALTERNATIVE FUTURES ANALYSIS EMBRACES UNCERTAINTY AND ALLOWS THE USER TO MAP OUT THE BOUNDARIES OF UNCERTAINTY IN THE CONTEXT OF THE ALTERNATIVE WORLDS DEVELOPED."

Four potential future worlds were identified through the Future Army team's foresight exercises. Each world is fully elaborated in *Canada's Future Army, Volume 1: Methodology, Perpectives and Approache*s. Key characteristics of each alternative world can be summarized as follows:

8. The following section offers a short recap of the four worlds. For a fuller discussion of the methodology underlying the worlds' development and the findings gained from their examination, see *Canada's Future Army, Volume 1: Methodology, Perspectives and Approaches* (Kingston: Canadian Army Land Warfare Centre, 2016).

9. All choices involve risk. For the Army the risk lies in major investment decisions that involve long timeframes and uncertain outcomes. Scenario planning is intended to help mitigate that investment risk by pointing the way, through signposts, toward investments which support necessary capabilities.

MATERIALISM GONE MAD

Materialism Gone Mad offers a vision of an energy-rich world suffering from significant environmental damage. International cooperation continues, but social responsibility has taken a back seat to the drive for greater consumption and material comfort. This world features competition, which breeds conflict, particularly on the North–South axis between "have" and "have-not" nations. There is definitely a downward spiral in this world, with the fossil fuel energy supply likely to decline steadily over time and environmental damage increasing significantly. The will to change course is largely absent.

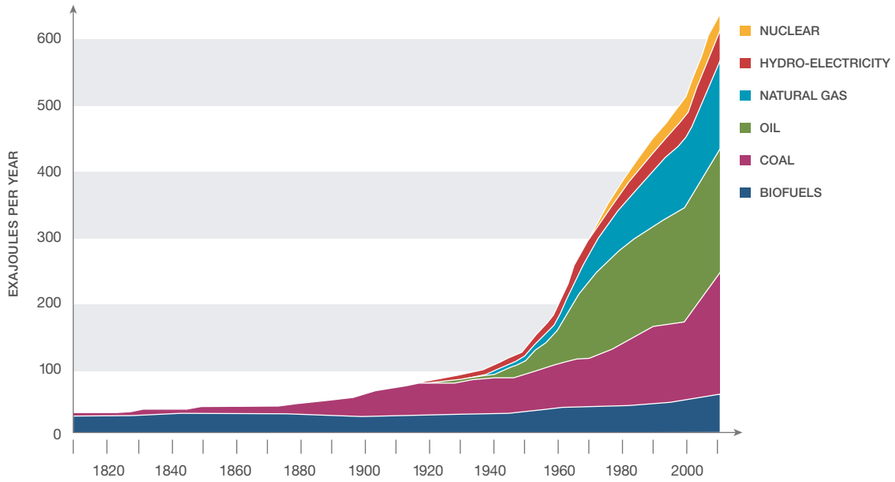


FIGURE 4: WORLD ENERGY CONSUMPTION[10]

10. Source: Vlachogianni, Thomais, and Athanasios Valavanidis. "Energy and Environmental Impact on the Biosphere Energy Flow, Storage and Conversion in Human Civilization." *American Journal of Educational Research* 1.3 (2013): 68-78.

KEY CHARACTERISTICS OF MATERIALIM GONE MAD

- fragmentation of international organizations;
- protectionism;
- deepening of the North–South divide and increasing fundamentalism;
- increasing competition between and within states and societies for habitable space and resources (largely in the developing world);
- growing limitations on international legal regimes (resulting in failed global regulation and enforcement);
- increasing militarization;
- increasing crime;
- use of industrial espionage in pursuit of commercial advantage;
- Canada as a destination of choice for immigrants (resulting in an increased labour pool);
- immigration backlashes in developed nations and a rise in illegal immigration;
- unstable markets, higher commodity prices and increasing economic stagnation;
- environmental exploitation at the expense of long-term sustainability and economic growth;
- accelerating global migration, urban squalor and a rise in the spread of disease (regionally);
- a rise in humanitarian crises and a consequent increase in issues involving state capacity and the responsibility to protect (R2P); and
- reliance on "dirty" energy as a large part of global supply (particularly in developing countries).

HIGH-OCTANE GREEN WORLD

The High-Octane Green world features a plentiful and sustainable energy supply, with societies and states taking an increasingly proactive stance on the environment. Security concerns are more universal in nature and broader in terms of support. In fact, state security has become more closely identified with global security (i.e., when others are made safe and secure, we all win). Overall, this is a world in which the majority of societies experience greater prosperity, but not at the expense of the environment, as technology and societal mindsets combine to work toward ensuring a more liveable planet.

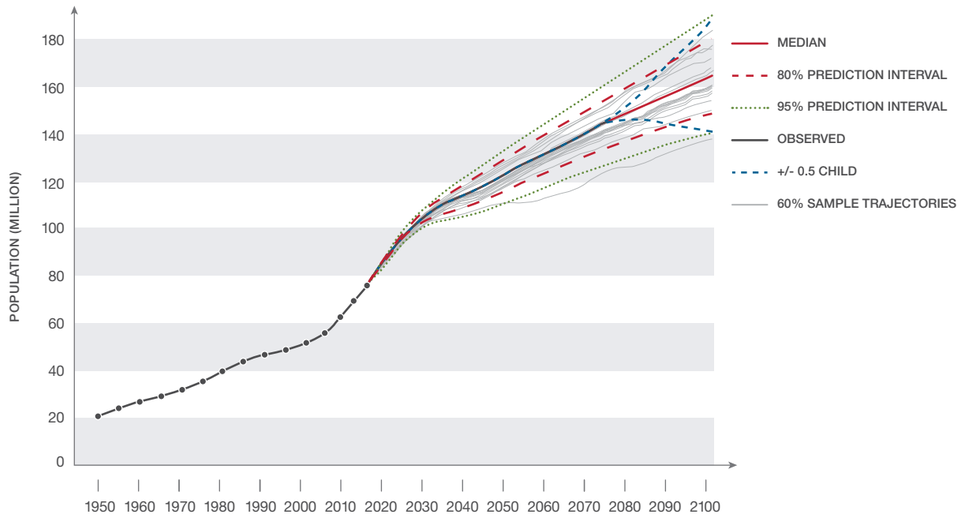


FIGURE 5: NORTHERN AMERICA — POPULATION (AGE 60+)[11]

11. Source: United Nations, Department of Economic and Socical Affairs, Population Division (2015). *World Population Prospects: The 2015 Revision.* http://esa.un.org/unpd/wpp/.

KEY CHARACTERISTICS OF HIGH-OCTANE GREEN WORLD

- stronger international organizations;
- increased global awareness/consciousness;
- stronger international laws, better regulation and enforcement (especially in the areas of energy sustainability and environmental protection);
- an increase in nanotechnology and biotechnology solutions to energy and environmental challenges;
- a Canadian northern enforcement regime;
- more responsible multinational corporations;
- a market focus on green solutions to societal problems;
- a growth in renewable and sustainable energy sources and supplies;
- accelerating but deliberate and environmentally sustainable urbanization;
- science and technology offsets to projected labour shortages (despite immigration); and
- the rise of Canada as a leader in alternative energy development.

GLOBAL QUAGMIRE

The Global Quagmire provides a sharp contrast to High-Octane Green. In the Global Quagmire, energy supply is increasingly scarce and unsustainable, and global behaviour regarding the environment can best be described as reactive. The world is experiencing an energy crisis and growing international competition for what is left. Even if the will to deal with environmental and energy issues was manifested, the lack of resources makes effective implementation of solutions nearly impossible. The result is a struggle for survival; international affairs are largely viewed as a zero-sum game (i.e., one society's gain is another's loss). Accordingly, Global Quagmire reflects pessimistic, short-term views of security and how it is achieved. Cooperation is muted; conflict, both armed and otherwise, is widespread.

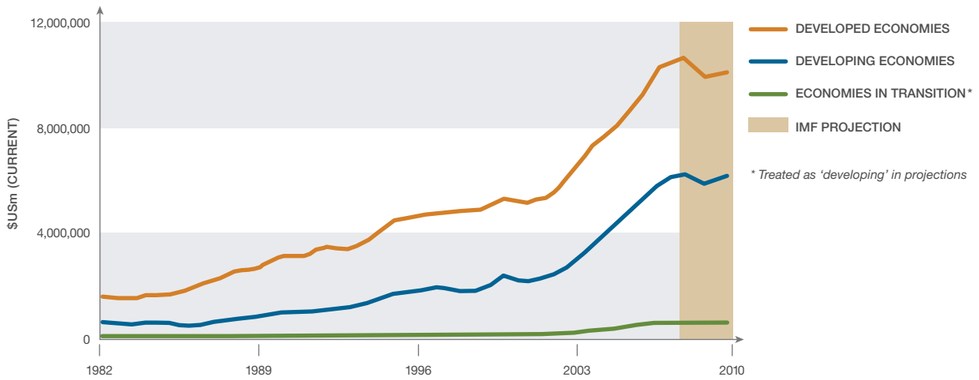


FIGURE 6: EXPORTS OF GOODS AND SERVICES[12]

12. Source: UNCTAD handbook of statistics, IMF World Economic Outlook.

KEY CHARACTERISTICS OF GLOBAL QUAGMIRE

- » increasing fragmentation of international organizations (and a rise in protectionism);
- » intense global competition for access to energy (often leading to conflict and chaos);
- » failure of international regulatory and enforcement regimes (particularly in the areas of energy and the environment);
- » increasing militarization of states and societies;
- » increases in societal crime;
- » increased fundamentalism;
- » state and industrial espionage aimed at gaining advantage in the international competition for survival;
- » increase in the strategic importance of Canada's oil sands;
- » strong emphasis in Canada on the protection of its North (primarily for its resources);
- » unstable markets, higher commodity prices and economic stagnation;
- » intense exploitation of available resources;
- » accelerating global migration, urban squalor and the spread of disease; and
- » increasing emphasis on human labour versus automation.

RECYCLABLE SOCIETY

The Recyclable Society is an alternative world characterized by energy scarcity and environmental damage and at the same time cooperation and a proactive stance on the environment (i.e., proactive conservation versus mere environmental cleanup). In Recyclable Society, there is recognition that changing behaviour and increasing cooperation are the only means of solving global problems, as significant advances in technology are exceedingly unlikely. Human labour and recycling and reuse of existing technologies have become more important. Both global migration and urban growth slow considerably, the pace of life is slower, and armed conflict, while still present, tends to be more muted as a result. When conflict does occur, it is more likely to be localized and short-term than global and protracted.

KEY CHARACTERISTICS OF RECYCLABLE SOCIETY

- strong international organizations and legal regimes (especially in the areas of energy and the environment);
- radicalized green focus;
- dedication of energy surpluses to environmental correction and protection;
- increased societal cooperation and an intentional abandonment of luxury living (often resulting in lower quality of life);
- growing military emphasis on constabulary forces;
- increases in localized crime and e-crime;
- greater reliance on cyberspace;
- reduced and slower resource extraction due to prohibitive economic costs (e.g., it is less economical to extract Canadian northern resources);
- unstable markets and higher commodity prices;
- growing virtualization of national economies;
- continuous recessions;
- greater recycling and reuse of materials;
- decreasing global migration;
- continued urban growth;
- the spread of disease (more local); and
- increased emphasis on human labour versus automation.

CHAPTER 2

UNDERSTANDING THE RELATIONSHIP BETWEEN THE FOUR ALTERNATIVE WORLDS

The future the Canadian Armed Forces (CAF) posits as most likely to emerge has been described in the *Future Security Environment 2013–2040* (FSE) publication.[13] The FSE identified a number of emerging trends that were judged highly likely to continue into the future and were expected to have significant impacts (both positive and negative). Those trends and their expected impacts provide the basis for the development of what the CAF saw as the world most likely to emerge. That expected world closely resembles what the Future Army project has termed the Materialism Gone Mad alternative world, which was developed and examined during the seminar wargame series.

"WHAT THE ARMY AS AN ORGANIZATION IS SEEKING TO AVOID ARE SURPRISES THAT REQUIRE DRAMATIC AND REACTIVE COURSE CORRECTIONS TO ADAPT TO THE ACTUAL FUTURE."

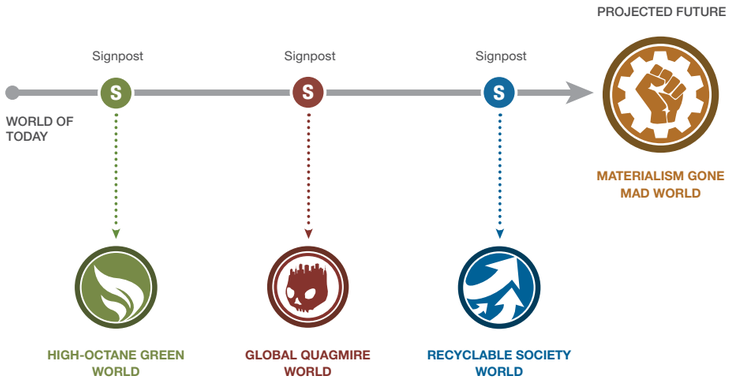


FIGURE 7: UNDERSTANDING THE RELATIONSHIP OF THE FOUR WORLDS

13. See Chief of Force Development, *The Future Security Environment 2012–2040* (Ottawa: Chief of Force Development, 2013).

The Future Army project analysis therefore selected the Materialism Gone Mad world as a useful baseline. If the Materialism Gone Mad world is viewed as the most likely destination along a route from the present, the other three alternative worlds can be seen as deviations from that route (ie, the result of changes in the direction and intensity of the key trends that are expected to emerge). The other three alternative worlds represent new destinations along modified routes from the present. When a route to the future may be changing or deviating from the expected path, that can be discerned through signals and signposts along that route. Such signals and signposts in turn should provide the Army with warning as to when (and guidance on how) to reorient future Army capability development to effectively meet the challenges posed by each of the four alternative futures.

What the Army as an organization is seeking to avoid are surprises that require dramatic and reactive course corrections to adapt to the actual future. Gradual changes allow for better anticipation and the ability to adapt proactively in operating concepts, procurement, training and recruiting.

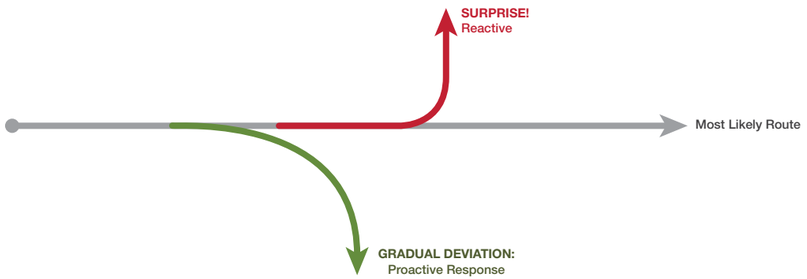


FIGURE 8: UNDERSTANDING WARNING AND SURPRISE

Key trends associated with the Materialism Gone Mad world can be found in Annex A. This section includes a short analysis of each of five trend categories (social; science and technology; energy; environment; and defence and security) to provide more clarity on what form deviation from the Materialism Gone Mad "norm" will take.[14]

14. Annex B presents this analysis in tabular form. The tables provide a comparison of the trends identified as best defining the differences between the four alternative worlds under consideration. As noted earlier, the world of Materialism Gone Mad provides the most likely future trajectory, and accordingly the tables show, in each trend area, where key trends are likely to deviate from the "baseline or expected" (Materialism Gone Mad) future and move toward each of the other alternative worlds identified.

SOCIAL ANALYSIS

Key social trends reflect attitudinal shifts on the part of national governments and their citizens. Shifts away from the short-term thinking, materialism and consumerist outlook characteristic of the Materialism Gone Mad world may be especially pertinent harbingers of change. This is particularly so for the High-Octane Green and Recyclable Society worlds: the former reflects societies which accord greater value to environmentalism than to self-satisfaction and consumer comfort, and the latter reflects move away from consumerism as a primary concern and toward the need to cooperate on a regional or global level—particularly in the areas of energy and the environment—to survive.

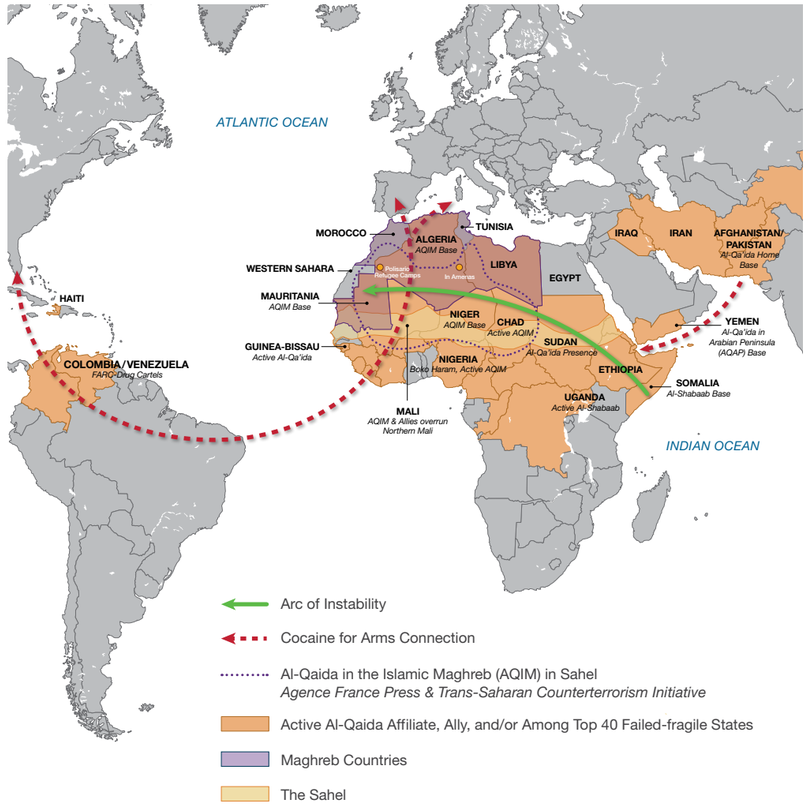


FIGURE 9: NEW TERRORISM HOT SPOT: AFRICA'S SAHEL[15]

15. Source: ICTS — International Center for Terrorism Studies, Potomac Institute for Policy Studies — January 2012.

A second key trend concerns attitudes toward migration, which in turn will be tied to ongoing increases in global poverty rates. In the worst-case world (Global Quagmire) such attitudes would entail growing support for extreme right-wing parties disseminating xenophobic messages against migrants, with a corresponding increase in violence against such groups in some developed nations.

For the Recyclable Society world, anti-immigrant attitudes will become less of an issue, largely because the resources necessary to migrate from problem areas in the developing world will be less available. With the approach of a High-Octane Green world, the expectation would be that the problems of migration are mitigated by developed nations' allocation of significant resources to target the underlying causes of poverty and instability in the developing world. Alternatively, developed nations may decide to increase the numbers of immigrants they accept.

Economic growth, or a lack thereof, may also be a significant signal of change. For the Global Quagmire world, the trend would be marked by a radical decline in economic growth and an increasing reluctance to devote financial resources to proactively resolving energy or environmental problems. The Recyclable Society world will likewise see growth decline, though not as sharply or severely. In contrast, an increase in economic growth could be a sign of the emergence of the High-Octane Green world.

SCIENCE AND TECHNOLOGY ANALYSIS

Key trend areas in science and technology signalling shifts toward alternative worlds are the amount of investment in research and development (R&D) and the reactivity or proactivity of R&D efforts related to the environment and energy. A shift toward the High-Octane Green world would be accompanied by positive trends in both areas, with significant investment in science and technology R&D, much of it devoted to proactive innovation. In both the Recyclable Society and Global Quagmire worlds, science and technology investment would decline—very dramatically in Global Quagmire. Counter-intuitively, should major conflict break out in the Global Quagmire world, science and technology research and innovation in certain areas (eg, cognitive and physical) could be expected to increase due to the need to maintain an advantage over potential adversaries. Beyond the onset of major conflict, however, investment in science and technology in Recyclable Society and Global Quagmire should decline and become more reactive. Research and development in the environmental sector would be largely absent in Global Quagmire. In Recyclable Society it would be seen as, at best, secondary and would more likely be undertaken in energy than in the environmental sector.

FIGURE 10: ZONES OF INSTABILITY[16]

16. Source: USMC Gazette Blog entry, "Sequestration – Not Necessarily the End of the World," 04 December 2012.

ENERGY ANALYSIS

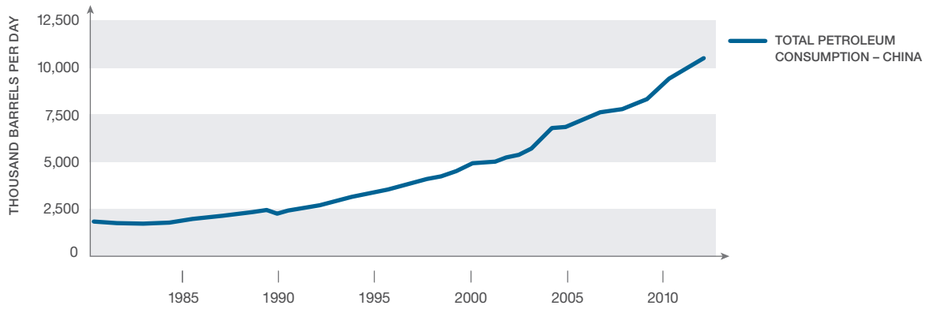


FIGURE 11: TOTAL PETROLEUM CONSUMPTION – CHINA[17]

In the energy realm, key trends will be based on the sources of energy supply and type (dirty versus clean) and on energy demand. For both the Recyclable Society and High-Octane Green worlds, the emphasis will be on clean and alternative energy exploitation (the High-Octane Green world will see significant sums devoted to research and development in this area). While energy demand in both worlds will continue to rise, R&D money spent in the energy field will allow that growth to be offset by gains in alternative energy development. In any movement toward the High-Octane Green world, the expectation would be that while oil and gas production will continue to rise, sources will become more varied and innovative and will reduce reliance on production from unstable regions.

The Recyclable Society world will also experience more innovation, though largely in traditional energy extraction. For example, science and technology breakthroughs such as new fracking techniques would be expected, rather than moves into more innovative energy sources. In contrast, the Global Quagmire world will remain an aggressive exploiter of any energy source and type, with increasing reliance on traditional, dirty energy given growing economic constraints. One trend may be a return to coal. As movement toward Global Quagmire proceeds, protection of the environment would become an ever more distant thought. Meanwhile, national energy security would become ever more dominant.

In the energy sector there is a strong need to prepre for "black swan" or "wild card" events (e.g., a major breakthrough in an alternative energy source that spawns a new energy age). Currently, the most likely candidate is low-cost hydrogen cracking and fuel cells. A breakthrough in nuclear fusion may also be possible. Both deserve sustained attention and planning.

17. Source: U.S. Energy Information Administration (EIA)

ENVIRONMENT ANALYSIS

Key trends in the environmental area continue to centre on attitudes, behaviour and approaches (e.g., local versus global, proactive versus reactive). In the case of the Recyclable Society, the focus is on local solutions to environmental problems; any global institutional emphasis has, out of necessity, been marginalized. Conversely, in the High-Octane Green world there is less need to rely on global institutions such as the United Nations (UN) for influence, as environmentalism remains an important priority for maintaining a competitive edge within a cooperative framework. In High-Octane Green, the activities of international environmental agencies generate prestige and well-paying employment. In the Global Quagmire world, the use of developing nations as environmental dumping grounds is expected to accelerate.

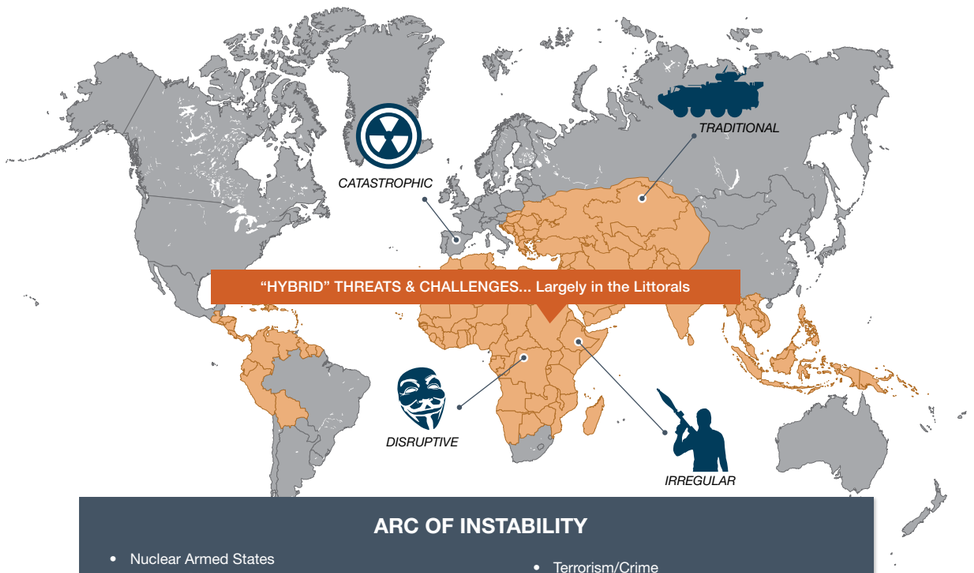
The High-Octane Green world is expected to become highly proactive in terms of approaches to the environment, perhaps even more so than the Recyclable Society world, which, given severe limits on budgets and on science and technology, will deal with environmental challenges more reactively than proactively. Both worlds feature a more global view of the environment and the pursuit of cooperative approaches to their challenges (although, out of necessity, the Recyclable Society world tends to prioritize local and regional concerns over global initiatives). In contrast, actors in the Global Quagmire world approach the environment as one of many areas for competition and exploitation. In this world, the environment is only a concern when it impacts national interests.

DEFENCE AND SECURITY ANALYSIS

In defence and security, key trends centre on the type, degree and location of armed conflict. In the Global Quagmire world, conflict is expected to be intense but, by and large, regionally based. Major conflict that spreads beyond specific regions is not expected, although larger wars are more likely in Global Quagmire than in any of the other alternative futures. The use of terror tactics is expected to rise dramatically and spread as well. Notably, a key wild card in the Global Quagmire would be the acquisition of nuclear weapons by a non-state actor such as a terrorist group.

For the High-Octane Green world, the expectation is that conflict will remain isolated within specific regions and is more likely to occur within states. The developed world's involvement will centre on humanitarian assistance and disaster relief activities within a broader peacebuilding framework.The threat of terrorism is expected to decline significantly.

The Recyclable Society world will continue to face a terror threat, but that threat will be less significant than in the High-Octane Green world scenario. Instead, regional conflict is more likely to occur over energy or environmental issues, and developed nations will be called upon to mediate and conduct limited peace support operations.



ARC OF INSTABILITY

- Nuclear Armed States
- Top Ten Oil Reserves
- Significant Drug Regions
- Anti-West Attitudes
- Increasing Global Interdependence
- Urbanization
- Terrorism/Crime
- High Earthquake Risk Areas
- Famine and Disease
- Emerging Global Powers
- Improved Anti-access Weapons
- "Haves" vs "Have Nots"

The "asymmetrical kind of war" we face today will last at least two decades...

FIGURE 12: THE FUTURE SECURITY ENVIRONMENT

In both the Recyclable Society and Global Quagmire worlds, energy security is a major factor in defence and security policy. For Recyclable Society, security is seen as being attained cooperatively and for the benefit of all. For Global Quagmire, it is heavily based on short-term and selfish interests.

CHAPTER 3

WHICH WORLD? SIGNPOSTS OF CHANGE

Whether and precisely how each of the alternative futures described above may arrive cannot be fully known or described in advance. But, given the various characteristics and trends associated with each, it is possible to identify some of the signposts that would indicate movement toward each of the futures outlined. Signposts can be understood as thresholds indicating that change is in the offing. Viewed as navigational waypoints, signposts should be treated as opportunities for action and exploited as such, either through proactive measures that seek to influence the future's direction and impact, or through reactive measures that seek to ensure that the Army is sufficiently prepared to meet the future in question.

"THE DEGREE TO WHICH SUCH MOVEMENT ACTUALLY OCCURS WILL UNDOUBTEDLY VARY DEPENDING ON FACTORS SUCH AS THE NUMBER OF SIGNPOSTS PRESENT AND THE INTENSITY WITH WHICH TRENDS INDICATED BY THOSE SIGNPOSTS IDENTIFIED ACTUALLY MANIFEST OVER TIME."

Signposts likely to indicate potential movement toward each of the alternative worlds are identified below. This is by no means an exhaustive list of the signposts that may arise in each case, but it does represent the best judgments that could indicate movement away from the Materialism Gone Mad world and toward one of the three other alternative futures identified. The degree to which such movement actually occurs will undoubtedly vary depending on factors such as the number of signposts present and the intensity with which trends indicated by those signposts identified actually manifest over time.

HIGH-OCTANE GREEN WORLD

In general, signposts indicating movement toward the High-Octane Green world tend to reflect a growing belief in the importance of the environment for security; a growing belief that security must be increasingly global and indivisible; strong support for and evidence of greater international cooperation and technological innovation, particularly in the areas of energy and the environment, rising living standards and steady economic growth worldwide; and a decline in major and inter-state conflict and a corresponding increase in international efforts to address the challenges posed by humanitarian disasters and state instability.

SOCIAL SIGNPOSTS

» Public and elite recognition that efforts by one state alone are insufficient to effectively address environmental and energy problems: recognition that solutions require more international cooperation to ensure their effectiveness (e.g., states push for development of more international organizations and partnerships).

» Increase in societal concerns over energy depletion and environmental deterioration (occurring pre-signpost) due to misuse, accidents, and signs of climate change: in the developed world, increased attention to such issues (e.g., more media coverage, more voices speaking out), and in the developing world, more protest (at times violent) against unsafe and irresponsible practices (more armed conflict triggered at least in part by unequal access to, or lack of, resources, at times due to unsustainable environmental practices).

» Increasing tendency to see human-induced environmental damage as a punishable act (i.e., an offence or crime against the international community as expressed in public opinion, demonstrations and media content).

» Gradual rise in living standards.

SCIENCE AND TECHNOLOGY SIGNPOSTS

» Gradual and steady increase in science and technology R&D budgets (particularly those focusing on improvements in energy and environment).

» Technological developments and innovations suggesting potential breakthroughs in clean energy (e.g., fusion; breakthroughs in hydrogen fuel production; inexpensive renewable hydrogen; efficient photovoltaic cells; new ways to recycle waste; heat generated by machines into energy; use of nanotechnology for lighter batteries; breakthroughs in renewable solar power technology such as photovoltaics; grid scale energy storage such as liquid metal grid storage batteries; biotechnology energy management to reduce carbon usage and reliance on fossil fuels; breakthroughs in clean energy such as tidal and wind capture).

» Increased science and technology innovation aimed at renewable energy and energy efficiency (e.g., clean coal; better, more efficient use of traditional sources; improved capacity; and adoption of alternative energy sources).

» Greatly expanded bandwidth and much cheaper communications.

» New strides in genome engineering.

» New generation of radar and stealth technology.

» Innovations in various areas which would complement and facilitate breakthroughs in transportation, and urban planning for more sustainable cities and communities.

ENERGY SIGNPOSTS

» Shifting popular attitudes toward the use of various energy sources (nuclear power, coal and oil become viewed ever more negatively and attitudes toward solar, wind and clean coal are much more positive).

» Steady, systematic shift to cleaner, more diverse sources and forms of energy, with more efforts aimed at achieving greater energy efficiency.

» Moves to operationalize innovations in energy (a more holistic approach to environmental and energy stewardship and development both within and across nations).

ENVIRONMENT SIGNPOSTS

» Growth in scientific evidence indicating a link between extreme global weather events and human activity, both in terms of increases in the number of such incidents and the seriousness of their consequences (studies providing empirical evidence of severe impact of climate change).

» Gradual but steady increase in public and elite support for the view that environmental issues are fundamental to security and generating increased concern about energy (as indicated by opinion polls, media coverage, policy debates, etc.).

» Growing environmental consciousness in major states (increase in environmental movements and organizations), as indicated by public attitudes expressed in opinion polls, the number of significant public and official events, meetings directed at saving the environment and/or promoting energy sustainability, donations to environmental causes, gradual shifts in government policy stances and policy (greater participation in organizations focusing on the environment both nationally and internationally—both official and public).

» Gradual but marked improvements in environmental quality across international system (although uneven).

» More systematic planning of cities, recreational areas, more attention of development of smart infrastructure).

» Gradual but steady decline in high-impact global weather events.

MILITARY SIGNPOSTS

» Increasing focus on intra-state conflict.

» Large emphasis on humanitarian assistance, disaster relief and societal reconstruction.

» Key role in environmental enforcement and monitoring.

GLOBAL QUAGMIRE WORLD

Indicators of movement toward the Global Quagmire world stand in stark contrast to those associated with the High-Octane Green world. The road to Global Quagmire would see an increase in nationalist attitudes and rhetoric; a decline in support for international cooperation; global economic decline; and growing societal protest and unrest. Also evident would be declines in scientific and technological innovation; reduced interest and investment in environmental sustainability; increased international and domestic conflict (particularly over energy resources); and a rise in extreme weather events.

SOCIAL SIGNPOSTS

» Social relations become more zero-sum and conflictual due to increasing scarcity of resource and energy (tensions between ethnic groups; growing anti-immigrant attitudes and rhetoric within societies).

» Public and elites increasingly view life as struggle for survival (as indicated by public opinion and statements in media—e.g., "me first" or "my nation first").

» Growing skepticism about, and decline in, societal and international cooperation—gradual decline in quality of infrastructure and social services (e.g., increasing evidence of urban decay).

» Gradual decline in living standards.

» Growing popular unrest given economic and environmental decline (protests and demonstrations, at times violent).

SCIENCE AND TECHNOLOGY SIGNPOSTS

» Decline in R&D budgets due to weakening economies (as indicated by empirical data on trends in government and corporate spending and investment).

» Decline in science and technology innovation (cost becomes restrictive).

» Innovation that has occurred in areas of sustainable energy and environment is increasingly underperforming and increasingly underfunded—decline in R&D efforts to develop alternative energy and diminished promotion of a sustainable environment.

ENERGY SIGNPOSTS

» Gradual decline in existing energy supplies (reserves increasingly determined to be finite and decreasing, as indicated by data on estimated energy stocks and estimated consumption).

» Rise in exploration for additional sources of energy worldwide with emphasis on cheap, "dirty" energy and existing traditional means of extraction (traditional sources such as oil, gas, coal and timber).

» Growth in calls and efforts by states and individuals to protect and hoard existing sources of energy—energy becomes a precious commodity to be guarded at individual, group and state levels (energy price gouging behaviour).

» Growing calls and efforts to exploit remaining, largely unsustainable, energy sources (traditional "dirty" sources: oil, coal, gas, nuclear and timber), backed by strong public support and demand as reflected in opinion polls, media coverage, government rhetoric, events and rallies.

ENVIRONMENT SIGNPOSTS

» Steady increase in extreme global weather incidents and events with high-impact consequences in both the developed and developing world, as indicated by empirical evidence and events illustrating negative trends.

» Steadily worsening degradation of the environment (fresh water, air, cropland and forests) worldwide, as indicated by empirical evidence on environmental conditions such as air and water pollution levels and soil erosion in key regions of the world.

» Move to increasingly reactive environmental cleanup and a decline in cleanup efforts generally.

» Decline in proactive legislation and practices aimed at ensuring greater sustainability and efforts to prevent environmental damage before it starts.

» Increasing efforts to ignore or to actively discredit scientists, scientific evidence and commentators linking climate change and extreme weather events to human activity as indicated by rhetoric from pundits, media reports and criticism of scientific studies.

» Ever-increasing effort to downplay impacts of environmental degradation (e.g., "the earth will heal itself" talk from leaders).

» Sharp rise in humanitarian disasters due to extreme weather events and armed conflict.

MILITARY SIGNPOSTS

» Rise in violent conflicts worldwide, many having a significant resource dimension (e.g., land grabs, resource capture, resource wars)—rise in both inter-state and intra-state armed conflict.

» Increased focus on deterrence and on pre-emptive and preventative military doctrines in many states.

» Rise in state espionage aimed at gaining advantages over other states in the economic, corporate, science and technology, and military spheres.

» Decline in military innovation.

RECYCLABLE SOCIETY WORLD

In the Recyclable Society world, global cooperation is viewed by societies as ever more crucial for coping with limitations imposed by the global situation, particularly in the areas of energy and the environment. Signposts indicating movement toward the Recyclable Society world are numerous and include an increase in attitudes calling for conservation of limited energy supplies and for proactive approaches to the environment, weakening economies and declines in scientific and technological innovation, environmental initiatives that are less dependent on high technology than on shifts in human attitudes, behaviour and social organization, a localization of armed conflict (i.e., intra-state as opposed to inter-state), declining state budgets, and a focus on conflict prevention, stability and constabulary-type operations.

SOCIAL SIGNPOSTS

» Attitudes begin to shift from consumerism and toward a more positive approach to solving problems within regional frameworks—eventually efforts are made to embrace and solve problems on a global level (growing disparity of wealth is one example of a potential problem shift).

» Environmental issues in developing nations will be tackled not only by social organizations but also by national government agencies of more developed nations.

» Illegal migration will become less common as the resources required to migrate will become less available—may be accompanied by increased and targeted foreign aid (aid itself from developed nations will become less available due to declining economic indicators in both the developed and developing world), which in turn begins to address the motives behind mass migrations.

» There will be corresponding drops in right-wing vitriolic speech and the presence of right-wing groups, accompanied by societal rejection of xenophobic and anti-migrant messaging.

» A gradual decline in economic growth in the developed world will be accompanied by efforts to maintain social and economic nation-building efforts in the developing world—ties with international agencies such as the UN will remain strong.

» Recycling programs in urban centres will be expanded exponentially and become the new norm.

SCIENCE AND TECHNOLOGY SIGNPOSTS

» Research and development monies will decline gradually, and science and technology innovation will become localized and geared toward solving environmental and energy issues rather than toward consumerism. For example, recycling will remain one of the few innovative areas for research and development funding.

» Science and technology developments are expected to become more and more reactive, rather than proactive, due to expected economic decline. Developments are more likely to be shared either freely or under very favourable terms than in the other alternative futures, the goal being to support regional or global efforts in the fields of environment and energy.

» The research and development agencies which continue to thrive will see more regional and international partnerships develop, most likely because of the need to pool limited resources.

ENERGY SIGNPOSTS

» Clean energy technologies will be increasingly embraced, but "dirty" sources will not be eliminated completely (although, as an outlier, that may happen sooner rather than later).

» Innovation in the energy sector, but more in extraction than in alternative energy development.

» More effort will be devoted to correction of environmental issues and damage, particularly in the developing world.

» Energy extraction costs will begin to rise significantly and will impair development of new sources.

ENVIRONMENT SIGNPOSTS

» Efforts will increase at the regional and global level to tackle issues of global waste, pollution and general environmental degradation. This will include efforts to undo past environmental damage in the developing world.

» Steady increase in extreme global weather incidents and events with high-impact consequences (developed and developing world, as indicated by empirical evidence and upward trends in events).

» Rise in humanitarian disasters due to extreme weather events, armed conflict and their consequences.

» Steady increase in degradation of the environment (fresh water, air, cropland and forests) worldwide, as indicated by empirical evidence on environmental conditions in key regions of the world.

» Move to increasingly reactive environmental cleanup with some work to enact proactive legislation and practices aimed at ensuring greater sustainability (i.e., efforts to prevent environmental damage before it starts)—but these proactive measures will become less frequent as the economy continues to decline.

MILITARY SIGNPOSTS

» Overall decrease in regional conflict as focus shifts to requests for international assistance from conflict resolution to conflict prevention—proactive involvement of international agencies (e.g., UN) to provide advice and assistance rather than reliance on diplomacy alone.

» Non-state actors become more active regionally versus internationally.

» Police and military interaction on the international stage becomes more cohesive in the prevention of international criminal activity, including terrorism.

» Local and regional authorities increasingly target criminal gangs and seek international military and police assistance.

» Increased focus on providing support to environmental enforcement and monitoring.

» Overall stagnation in military innovation save through necessity—increased emphasis on stability operations and constabulary-type duties.

CHAPTER 4

IMPLICATIONS FOR THE FUTURE ARMY: CAPABILITY DEVELOPMENT

Based on analysis, a number of observations can be made about each world that can help guide the general direction of future capability development. Broadly speaking, the four alternative futures can be mapped onto a continuum of conflict to indicate which campaign themes are most likely to manifest in each world.

The graphic (Figure 13) illustrates that the character and potential intensity of conflict covers a broad spectrum ranging from peaceful interaction to general war. Given that the future cannot be predicted, it is possible that virtually all future worlds may experience incidents of conflict that fall almost anywhere along the spectrum. That said, given the nature and characteristics associated with each world, it is likely that certain campaign themes and types of activities will be more predominant in some worlds than in others.

Indeed, while the High-Octane Green and Recyclable Society worlds may well experience occasional incidents of intense conflict, the trends associated with each suggest that the lion's share of activity is likely to involve cooperative efforts aimed at both preventing and addressing humanitarian disasters and the instabilities they produce. In each alternative future, both peacetime military engagement and peace support operations are more likely to occur than are counterinsurgency or major combat operations. In contrast, while the alternative worlds of Materialism Gone Mad and Global Quagmire may well feature some incidents of peacetime engagement, a more competitive international arena and a higher degree of both inter-state and intra-state conflict in each will likely ensure that incidents of peace enforcement, counter-insurgency and major combat are more likely.

"THE MISSIONS AND TASKS THE ARMY WOULD BE EXPECTED TO PERFORM WILL UNDOUBTEDLY VARY IN FREQUENCY AND SIGNIFICANCE IN EACH ALTERNATIVE WORLD."

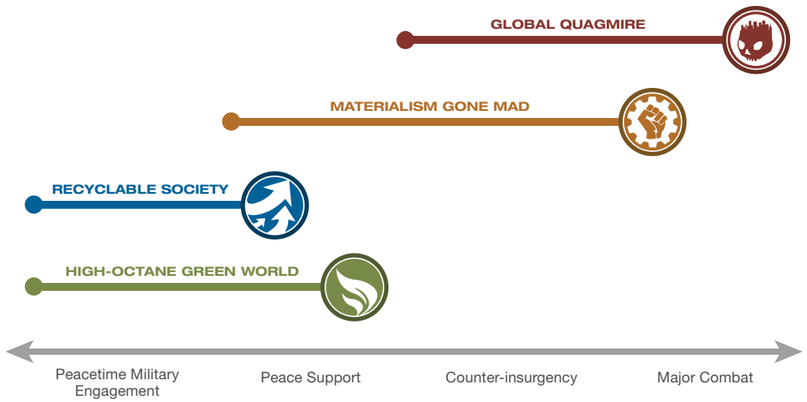


FIGURE 13: MAPPING THE FOUR WORLDS ON THE CONTINUUM OF CAMPAIGN THEMES

ARMY MISSIONS, TASKS AND CAPABILITIES

The missions and tasks the Army would be expected to perform will undoubtedly vary in frequency and significance in each alternative world. So too will the capabilities the Army will require to ensure that the missions and tasks which arise are performed effectively. The identification and ranking of key Army missions, tasks and capabilities for each world is detailed below. The observations are based on data gleaned from participants in the Future Army seminar wargame series and analysis of that data.

Participant discussion and identification of missions, tasks and capabilities for each alternative world was conducted in syndicates. Data was collated by the core Army Futures team and presented in a plenary session at the conclusion of each seminar wargame. The relative importance of missions, tasks and capabilities were ranked in the seminar wargame plenary. Missions and tasks are ranked based on an assessment of the likelihood of missions and tasks arising (i.e., being required) and the impact on national defence and security of the Army's inability to effectively conduct the mission or task under consideration. Capabilities are ranked on a sevenpoint scale, with seminar wargame participants instructed to rank items according to their judgment of the importance of each to the Army in the particular alternative world under examination.

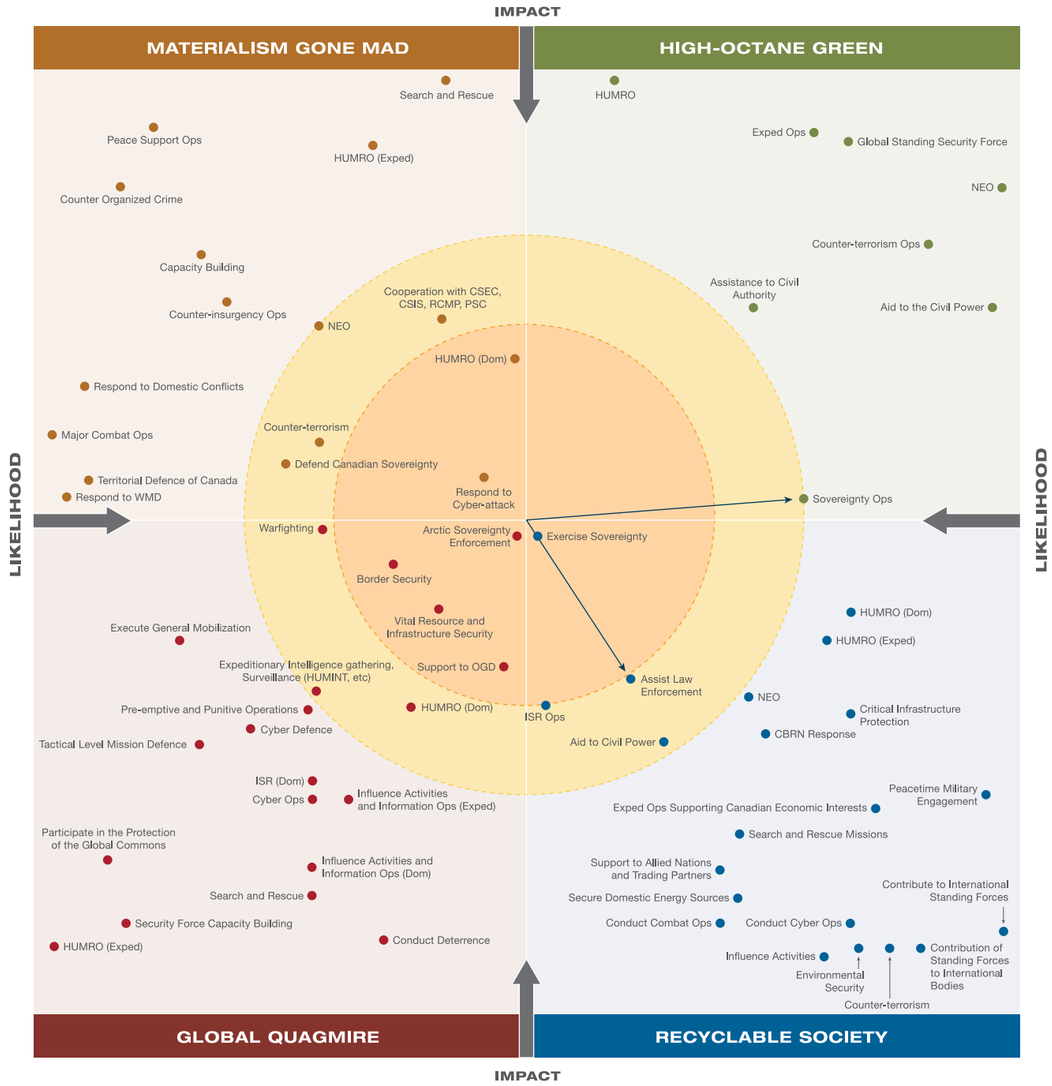


FIGURE 14: FINDINGS FROM THE FOUR FUTURE ARMY SEMINAR WARGAMES

MISSIONS AND TASKS

Judgments regarding the Army missions and tasks most required in each world can be graphically illustrated as follows:

MATERIALISM GONE MAD WORLD – OVERVIEW

EXPEDITIONARY	DOMESTIC
Medium to Heavy Force	
Rapidly Deployable	
Counter or respond to terrorism	Domestic HADR
NEO	Homeland security tasks including: » border security » resource & infrastructure security » Arctic sovereignty enforcement » ALEA/ACP
Warfighting	
SFCB	

FIGURE 15: MATERIALISM GONE MAD WORLD EXPECTED MISSION AND TASKS BROKEN DOWN BY EXPEDITIONARY VERSUS DOMESTIC

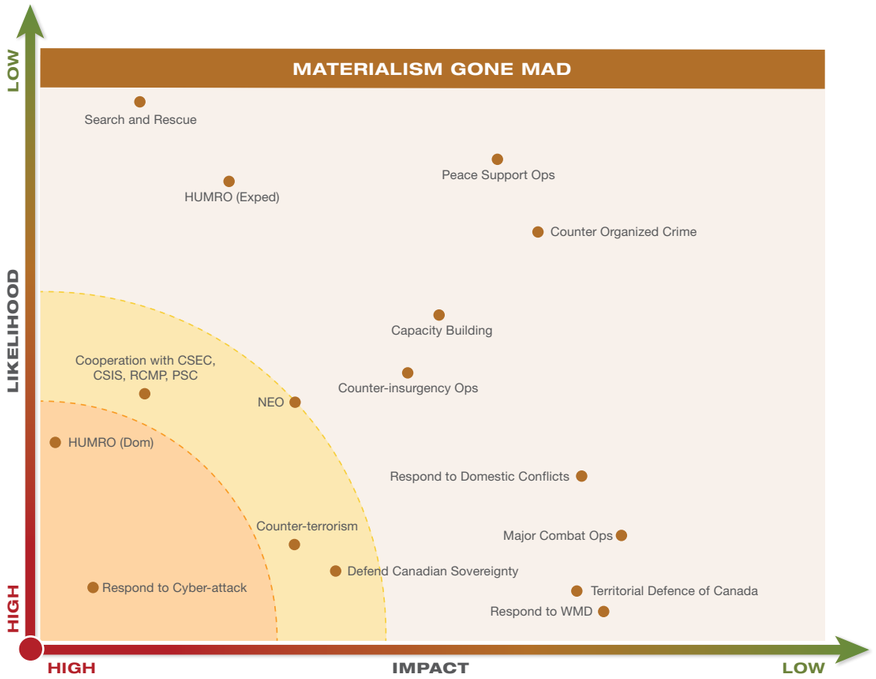


FIGURE 16: RANKING MISSIONS AND TASKS IN THE MATERALISM GONE MAD WORLD BASED ON LIKELIHOOD VERSUS IMPACT

MATERALISM GONE MAD WORLD MISSION AND TASKS

As the above figures indicate, missions and tasks in the Materialism Gone Mad world are a somewhat more intense version of those arising from the threats and challenges confronted in the world of today. Threats of terrorism, challenges to Canadian sovereignty, and prospects of cyber-attack all rank highly in terms of their onset, their potential impact on national security and defence, and the need for an effective Army response. Accordingly, in the highly competitive Materialism Gone Mad world, the defence of Canada's sovereignty, the conduct of counterterrorism operations, and the capacity to effectively defend against cyber-attack rank most highly in terms of key missions and tasks.

The dangers posed by the prospects of terrorism and cyber-attack, as well as the growing possibilities in this world for a steady rise in extreme and impactful weather events, underline the fact that providing effective humanitarian assistance and disaster response domestically and conducting Army operations in close cooperation with other government departments (OGD) than National Defence will also be important priorities. So will the capacity to conduct counterinsurgency operations, non-combatant evacuation operations and security force capacity-building efforts.

In contrast, missions and tasks such as responding to the use of weapons of mass destruction, defending Canada's territorial integrity, engaging in major combat operations and responding to cases of internal domestic conflict, while still essential, are less pressing in terms of key priorities. Although they are highly important in terms of the potential impact that a failure to effectively conduct such missions and tasks would produce, there is a far lower likelihood that the threats they address will occur. Therefore, an excessive focus on them would be misplaced.

Meanwhile, the conduct of expeditionary humanitarian assistance and disaster relief, peace support operations, and responding to organized crime rank lowest, particularly in terms of their impact on defence and security. Although they are strongly in line with Canada's values and traditions, their significance in terms of impacting national security interests in Materialism Gone Mad suggest that the capacity to engage in such operations would be a secondary priority.

Overall, the threats and challenges posed in the Materialism Gone Mad world reinforce the need for a medium- to heavy-weight land force that is adaptive, rapidly deployable, multipurpose and capable of full-spectrum operations. The majority of threats and challenges likely to be confronted imply missions and tasks squarely in the middle range of the conflict spectrum.

HIGH OCTANE GREEN WORLD – OVERVIEW

EXPEDITIONARY	DOMESTIC
Light to Medium Force	
Environmentally Conscious Force	
Rapidly deployable	ALEA & ACP
Global projection	
Nation building (humanitarian & reconstruction tasks)	Sovereignty protection (environment focus)

FIGURE 17: HIGH OCTANE GREEN WORLD EXPECTED MISSION AND TASKS BROKEN DOWN BY EXPEDITIONARY VERSUS DOMESTIC

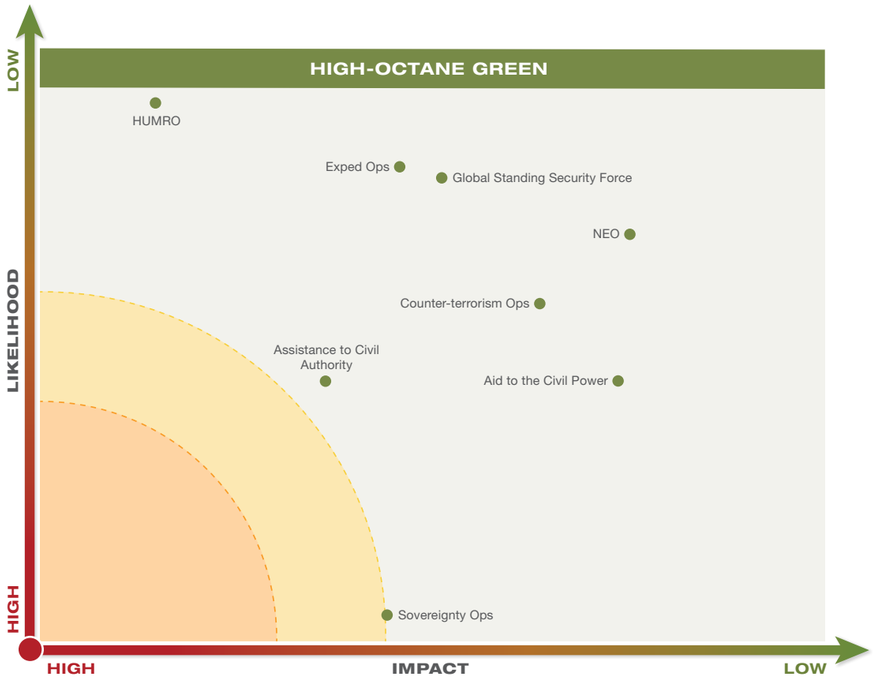


FIGURE 18: RANKING MISSIONS AND TASKS IN THE HIGH OCTANE GREEN WORLD BASED ON LIKELIHOOD VERSUS IMPACT

HIGH OCTANE GREEN WORLD MISSIONS AND TASKS

Key Army missions and tasks in the High-Octane Green world reflect the need for a land force less focused on traditional combat roles. Whereas a capacity to conduct combat-oriented missions and tasks will be required, the nature of the world itself and the threats and challenges characterizing it work to ensure that such missions and tasks are eclipsed by those aimed at maintaining domestic security and national sovereignty and supporting growing global stability and a sustainable planet.

As the data presented in the tables above indicate, there will be a continuing need for an Army capable of providing support for counter-terrorism operations, expeditionary missions and non-combatant evacuation. Due to steadily improving economic and social conditions worldwide, each of these missions and tasks ranks relatively low in terms of frequency and impact. In the High-Octane Green world, humanitarian assistance and disaster relief may be the most likely mission the Army will be called upon to perform.

Far more important will be an ability to maintain security and stability on the domestic front. The capacity to conduct sovereignty operations and provide assistance to civil authorities in cases of domestic crisis and emergency are key requirements, particularly in view of the potential impact of failure to effectively perform such missions and tasks on national security and confidence in government.

Overall, movement toward the High-Octane Green world offers the prospect of a more benign security environment, one in which the majority of threats and challenges confronted imply Army missions and tasks aimed at the lower range of the conflict spectrum. Combined with steadily improving economic and social conditions and a growing support for sustainability, both on the energy and environmental fronts, a shift to the High-Octane Green world suggests the need for a force that is highly skilled, light- to-medium-weight, rapidly deployable and environmentally conscious. Beyond that, and given growing interest in both domestic and international cooperation, it provides a strong argument for a force dedicated to ensuring interoperability with other military, governmental and non-governmental partners.

GLOBAL QUAGMIRE WORLD – OVERVIEW

EXPEDITIONARY	DOMESTIC
Medium to Heavy Force	
Warfighting	Deterrence
SFCB	Homeland security tasks including:
Tactical missile defence	» border security
	» resource & infrastructure security
Pre-emptive & punitive operations	» Arctic sovereignty enforcement
	Humanitarian assistance including ground search & rescue

FIGURE 19: GLOBAL QUAGMIRE WORLD EXPECTED MISSION AND TASKS BROKEN DOWN BY EXPEDITIONARY VERSUS DOMESTIC

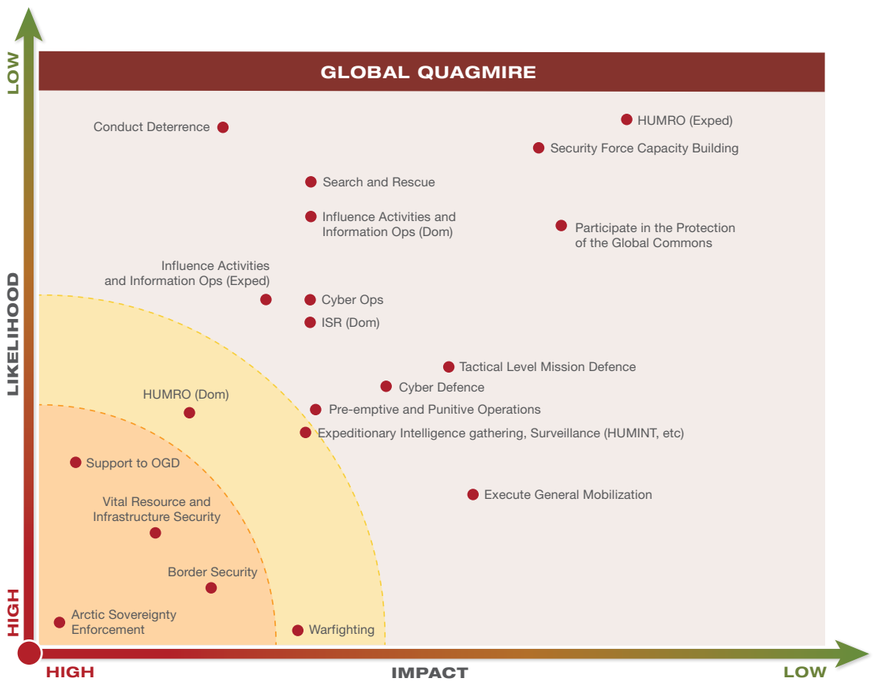


FIGURE 20: RANKING MISSIONS AND TASKS IN THE GLOBAL QUAGMIRE WORLD BASED ON LIKELIHOOD VERSUS IMPACT

GLOBAL QUAGMIRE WORLD MISSIONS AND TASKS

Missions and tasks required to address the threats and challenges likely to arise in the Global Quagmire world contrast sharply with those most typical of the High-Octane Green world. In Global Quagmire, the spectrum of potential threats is wider but the threats themselves are likely to be far more severe. In a world of declining resources and rampant competition for survival, prospects for territorial conquest will rise, as will the chances of both inter-state and intra-state war.

Not surprisingly, Army missions and tasks such as warfighting, the protection of sovereignty (particularly in Canada's Arctic), border security and a capacity to provide for the protection of national resources and infrastructure rank highly in terms of both likelihood and impact. The capacity to provide domestic humanitarian assistance and disaster relief and protection against cyber-attack ranks only moderately lower. Possessing an ability to protect the global commons, security force capacity building and expeditionary humanitarian assistance and disaster relief rank lowest in terms of both likelihood and impact. While search and rescue and domestic influence and information activities are viewed as highly likely missions and tasks, the Army's failure to conduct them effectively is seen as having only marginal impact on security. In an environment in which everyday life is increasingly viewed as a competitive struggle for survival, a capacity to generate kinetic effects is the main priority.

Growing concerns over the prospect of armed attack against national territory will ensure that the conduct of general mobilization and an ability to conduct tactical missile defence stand as relatively significant missions and tasks. Beyond this, a capacity to provide effective deterrence will be a constant requirement.

Overall, the threats and challenges likely to characterize Global Quagmire strongly indicate the need for a medium-to-heavy-weight force that emphasizes missions and tasks at the more intense end of the conflict spectrum. Warfighting, pre-emptive and punitive operations, homeland security, security of domestic resources and the enforcement of sovereignty would all be key missions. Missions and tasks requiring cooperation with other nations are, by and large, of secondary importance.

RECYCLABLE SOCIETY WORLD – OVERVIEW

EXPEDITIONARY	DOMESTIC
Light to Medium Force	
Environmentally Conscious Force	
HADR & environmental disasters	ALEA & ACP in maintenance of order
	Sovereignty protection (environment focus)
Alliance &/or coalition based peace support operations	
	Environmental & humanitarian assistance
SFCB	

FIGURE 21: RECYCLABLE SOCIETY WORLD EXPECTED MISSION AND TASKS BROKEN DOWN BY EXPEDITIONARY VERSUS DOMESTIC

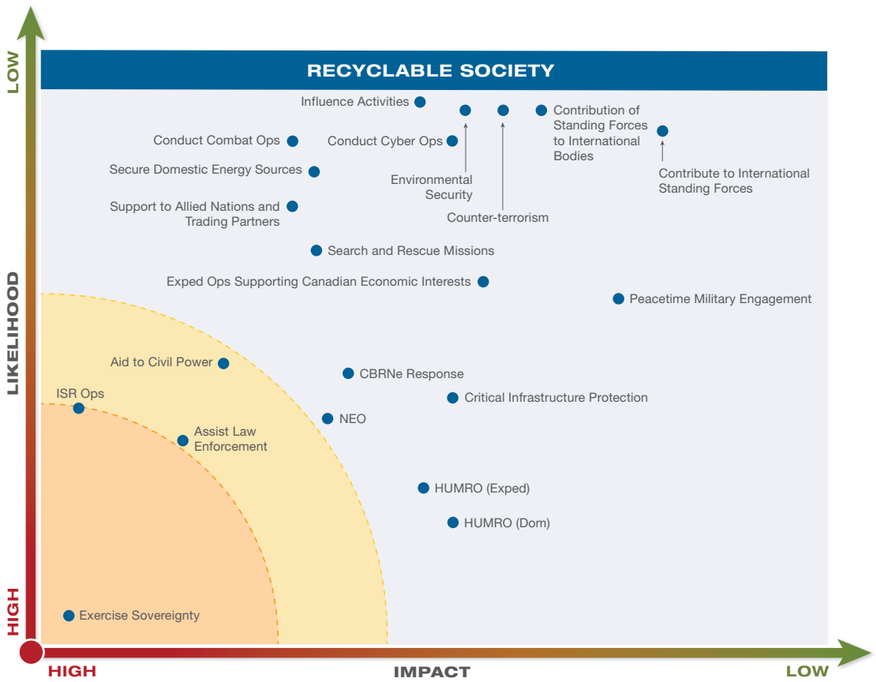


FIGURE 22: RANKING MISSIONS AND TASKS IN THE RECYCLABLE SOCIETY WORLD BASED ON LIKELIHOOD VERSUS IMPACT

RECYCLABLE SOCIETY WORLD MISSIONS AND TASKS

Due to the realities associated with the Recyclable Society world, key Army missions and tasks tend to fall primarily at the low end of the conflict spectrum. In a world of scarce energy, growing concern with the future of the environment, and an increasing realization that cooperation is essential for survival, ensuring domestic and international stability, energy security and environmental conservation overshadow armed conflict as the key drivers of Army missions and tasks. Energy scarcity and economic decline mean that responses are limited.

Key missions and tasks focus primarily on the home front. International humanitarian support will likely be a key external mission, but most missions are geared toward the domestic realm. Defence of Canada and Canadian sovereignty, responses to domestic environmental emergencies, assistance to law enforcement agencies, critical infrastructure protection, and aid to the civil power all rank high in terms of both likelihood and impact.

The likelihood of certain external missions and tasks arising, such as support to allies, major combat operations and influence activities, is evident. The impact of the Army's inability to address them in terms of security is less evident. Other foreign missions and tasks such as security force capacity building and contributions of standing forces to international bodies rank low on both likelihood and impact.

The threats and challenges of the world of Recyclable Society and the constraints which that world imposes indicate the need for a light-to-medium-weight force that is more domestic than externally oriented and is environmentally conscious. Beyond this, and notwithstanding the fact that armed conflict will continue to mark the operational environment, key Army missions and tasks will be more heavily focused on ensuring resource security and maintaining order and stability, both at home and abroad.

CAPABILITIES

For each of the four alternative worlds, most of the current Army capabilities will remain largely unchanged or change only subtly in terms of development and employment. However, some capabilities that emerge from the analysis of the conduct of the seminar wargames are more specific to one or more worlds. This section provides a breakdown of those capabilities by world, beginning with an overview of what each world will require. Capabilities are broken down into four blocks differentiated on the basis of impact and likelihood.

HIGH IMPACT, LOW LIKELIHOOD	HIGH IMPACT, HIGH LIKELIHOOD
- Grey or black swans - Capabilities which provide security from surprise, but may be most difficult to support vis-à-vis efficiency	- Must-have capabilities - Don't leave home without them!
LOW IMPACT, LOW LIKELIHOOD	**LOW IMPACT, HIGH LIKELIHOOD**
- Capabilities that are nice to have but not essential - First for chopping board - Can be obtained from other partners, but won't be missed	- Capabilities can be provided by partners - Not necessarily core to the Army but, given the likelihood of their being required, will likely attract the most attention by their absence

The most dangerous or destructive capabilities are those that are considered high-impact but have a low likelihood of manifesting. They are captured under the term "wild card."[18] Wild cards are unexpected, unlikely and therefore highly unpredictable occurrences or events that would have enormous consequences or impacts were they to occur.

18. Wild cards are defined in more detail in the glossary. They are understood to include events known as outliers or grey or black swan events. See Annex C for a list of possible wild card events.

RISK MANAGEMENT GUIDANCE

MATERIALISM GONE MAD WORLD AND CAPABILITIES

HIGH IMPACT, LOW LIKELIHOOD	HIGH IMPACT, HIGH LIKELIHOOD
- Independently initiate operations including permissive and non-permissive entry operations	- Ability to convey Commander's intent - Ability to communicate with Canadians (Strat Comms/PA) - Ability to conduct rapid analytics and decision support, using massive amounts of data from diverse data feeds. - CBRNe (+ NANO) defence - Conduct HADR operations - GBAMD/CRAM capability - Sustain land ops from the sea
LOW IMPACT, LOW LIKELIHOOD	**LOW IMPACT, HIGH LIKELIHOOD**
- None	- Ability to conduct forward deployment (cultural awareness transfer) - Ability to defend against adversarial Influence activities - Cyber-sense capability - Conduct Red Teaming - Defend against adversarial influence activities - Pre-trauma, prevention and mitigation - Capability for prototyping while operationally deployed on operations (additive manufacturing)

HIGH OCTANE GREEN WORLD AND CAPABILITIES

HIGH IMPACT, LOW LIKELIHOOD	HIGH IMPACT, HIGH LIKELIHOOD
- None	- Pervasive network internally and among all potential partners - Capability to inform and influence behaviour and opinion across domestic, international and adversarial audiences - Interoperability with traditional and non-traditional allies (international force) - Capability for rapid procurement of materiel requirements both during operations and in capability development - Capability to create tactical-level cyber effects - Capacity to create understanding using analytics, diagnostics and fusion
LOW IMPACT, LOW LIKELIHOOD	**LOW IMPACT, HIGH LIKELIHOOD**
- Capability to maintain persistent ISR linked to effects delivery (loitering) - Automated systems that reduce physical and cognitive loads on humans - Capability to force project globally (urban/littoral) (amphibious/airborne) - Capability to conduct focused close combat	- Capability to create precision, scalable, "green" effects - Consistent, comprehensive interoperability (particularly OGD) - Capability to conduct complex environmental tasks (containment, remediation, etc.) - Capability to conduct constabulary tasks - Capability to conduct effective operations in urban conditions

GLOBAL QUAGMIRE WORLD AND CAPABILITIES

HIGH IMPACT, LOW LIKELIHOOD	HIGH IMPACT, HIGH LIKELIHOOD
- None	- Information management - Responsive procurement system - Log system (moving toward self-sustainment, tapping into domestic infrastructure, water recovery/purification, alternative energy sources (to reduce vulnerability, resource consumption and size of tail) - Direct fire - Indirect fire - Mobility - Capability development process - Counter-mobility - Surveillance - Accessible SMEs - Tactical lift - Influence activities (CIMIC, PSYOPS, etc) - Intelligence - Computer network operations - Pre-/post-operations medical care - Electromagnetic spectrum operations
LOW IMPACT, LOW LIKELIHOOD	**LOW IMPACT, HIGH LIKELIHOOD**
- Search and rescue - Tactical offensive CBRNe capability - Ground-based air and munitions defence - In-field prototyping	- CBRNe defence (including nano/genome/toxic industrial materials, collective protection/ consequence management) - Special operations - Strategic lift - Engineering for domestic construction/re-construction - Non-lethal effects (eg, for ALEA) - Detainee/refugee/IDP/handling etc - Distributed, simulation training

RECYCLABLE SOCIETY WORLD AND CAPABILITIES

HIGH IMPACT, LOW LIKELIHOOD	HIGH IMPACT, HIGH LIKELIHOOD
- None	- All-source info fusion to support decision-making (data processing enhancements for individual and organizationally) - Ability to operate in the JIMP environment to include interconnectivity and collaborative training with key OGDs at regional/provincial/federal levels - Network capable of supporting static and deployed ops to include secure communications - Influence activities - Flexible, decentralized and targeted training system - Ability to operate in a network-degraded environment - An adaptive and flexible procurement (COTS) strategy
LOW IMPACT, LOW LIKELIHOOD	**LOW IMPACT, HIGH LIKELIHOOD**
- Amphibious ops - Riverine/brown water ops - Operate with a minimal environmental impact and reliance on local resources and shared services - Conduct crowd confrontation - Smart munitions (multiple effects, scalable, precision insensitive, green, lethal/less than lethal) - Land-based strategic lift (integral/contracted) - Ability to conduct close combat	- Robust physical and mental health tools / systems - Counter emerging technological threats - Vertical and horizontal construction and the provision of essential services - CBRNe Defence - Non-lethal counter-mobility - Protected light-medium mobile direct fire capability - Ground-based air and missile defence capability - Ability to provide basic social services to personnel and their families

CHAPTER 5

TOWARD A DRAFT WARNING SYSTEM

Analysis and identification of key trends, signposts and signals provide the most value for capability development when they are part of an early warning system: that is, a framework which allows for warning signs or waypoints to be easily identified and tracked on a regular basis. An effective framework will allow for sufficient warning to be provided in advance so that action (in this case, capability development) can occur before the opportunity to address the threat has passed.

POTENTIAL PROCESS FRAMEWORK FOR AN EARLY WARNING SYSTEM

- Identify a set of competing hypotheses or scenarios.
- Create separate lists of potential activities, statements or events expected for each hypothesis or scenario.
- Regularly review and update the indicator lists to see which are changing (each indicator for the competing scenarios is provided with a baseline value against which changes indicated via the various scenarios are measured).
- Identify the most likely or most correct hypotheses or scenarios, based on the number of changed indicators that are observed.

Development of an effective framework depends, first, on reliable sources of information that allow for the identification of key trends, signposts and signals and, second, on metrics or indicators which provide evidence of change or deviation. Annex D lists a number of international agencies, national government and non-governmental agencies involved in foresight activities and their key products. Some of the agencies identified are quite comprehensive in their coverage; for example, the UN provides background data in a host of societal sectors, tracking everything from individual country demographic trends to long-term and global trends in conflict. Others are specific in their focus and expertise; for example, the U.S. Office of the Deputy Assistant Secretary of the Army (Research and Development) provides information on science and technology trends of interest to the U.S. defence and security sectors.

“DEVELOPMENT OF AN EFFECTIVE FRAMEWORK DEPENDS, FIRST, ON RELIABLE SOURCES OF INFORMATION THAT ALLOW FOR THE IDENTIFICATION OF KEY TRENDS, SIGNPOSTS AND SIGNALS AND, SECOND, ON METRICS OR INDICATORS WHICH PROVIDE EVIDENCE OF CHANGE OR DEVIATION.”

CONCLUSION

How the Canadian Army, and by extension the CAF, evolves in future decades will be a key factor shaping future Canadian defence and security policy. The potential paths that the international community could take into the future are numerous. Given the analysis of a number of key trends and two main drivers—energy and environment—four alternative futures appear to be distinct possibilities.

This volume identifies the signals, signposts and trends which will help decision makers recognize when particular alternative worlds may be emerging. It completes this cycle in the Future Army process. The analytical work from this cycle provides Army planners with a wide spectrum of possibilities and a framework that allows the Army to monitor the international and domestic security environment to ensure that it is well prepared to address the requirements of future developments.

Completion of this strategic foresight process yields a number of cautionary observations. First, the time taken for full iteration of the process can be lengthy (the Future Army project took approximately eight years), thus posing risks such as institutional fatigue or loss of focus. Consequently, it is essential to carefully examine the process itself to formulate a more accelerated completion without impacting on the quality of the results produced. It is also important to be wary of potential institutional blinkers concerning baseline worlds (in this case, Materialism Gone Mad). It is sometimes difficult to see beyond a baseline once it is established. Baselines tend to entrench expected futures and are often difficult to challenge. Conversely, less likely, yet plausible, futures tend to be disregarded if they challenge traditional roles. The High-Octane Green world, for example, moves the Army away from traditional Army tasks and activities and into the potential for developing a paramilitary or constabulary role in the future. Making the leap to such a new role has been very challenging in the past for other army and political leaders, and there is little reason to believe that Canada's experience would be different.

"AN EARLY WARNING FRAMEWORK MAY WELL INCREASE CHANCES THAT THE ARMY WILL SEE THOSE SHIFTS INTO ALTERNATIVE WORLDS AS A GRADUAL AND PROACTIVE PROCESS. IN THE ABSENCE OF AN EARLY WARNING SYSTEM, THE SHIFTS BECOME MORE DRAMATIC AND HENCE MORE COSTLY."

Lastly, it should be understood that the early warning framework proposed constitutes part of a larger risk management portfolio and is one potential tool for the Army in dealing with an uncertain future. An early warning framework may well increase chances that the Army will see those shifts into alternative worlds as a gradual and proactive process. In the absence of an early warning system, the shifts become more dramatic and hence more costly. In a world in which the speed of change is increasing, institutional agility becomes more critical and more dependent on early warning of impending shifts in the security environment. The framework proposed in this volume is one means by which the Army can continue to ensure the institutional agility that allows quick recovery from shocks to the system and the capacity to adjust to new realities without compromising its expertise and its reputation.

ANNEX A

MATERIALISM GONE MAD (BASELINE WORLD): KEY TRENDS

TREND AREA: SOCIAL

TREND DESCRIPTION

» Short-term thinking and self-interest dominate in the West.

» Focus is on maximizing economic growth and material gain and satisfying domestic consumerism (materialism).

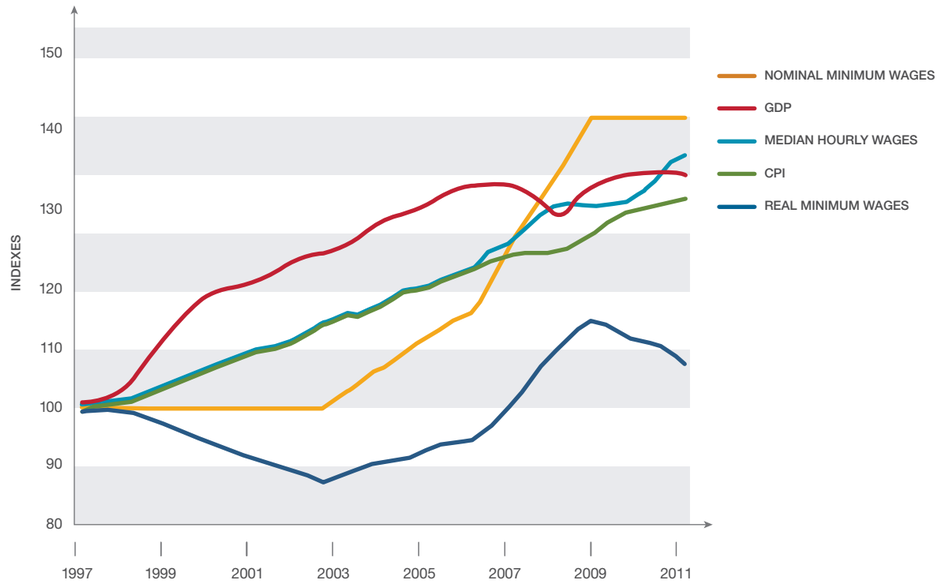


FIGURE 23: TRENDS IN MINIMUM WAGE AND ECONOMIC INDICATORS: ONTARIO (INDEXED TO 1997=100)[19].

19. Source: Ontario ministry of Labour, 2014 Minimum Wage Advisory Panel Report and Recommendation to the Minister of Labour, 27 January 2014. Online at https://www.labour.gov.on.ca/english/es/pubs/mwap/index.php.

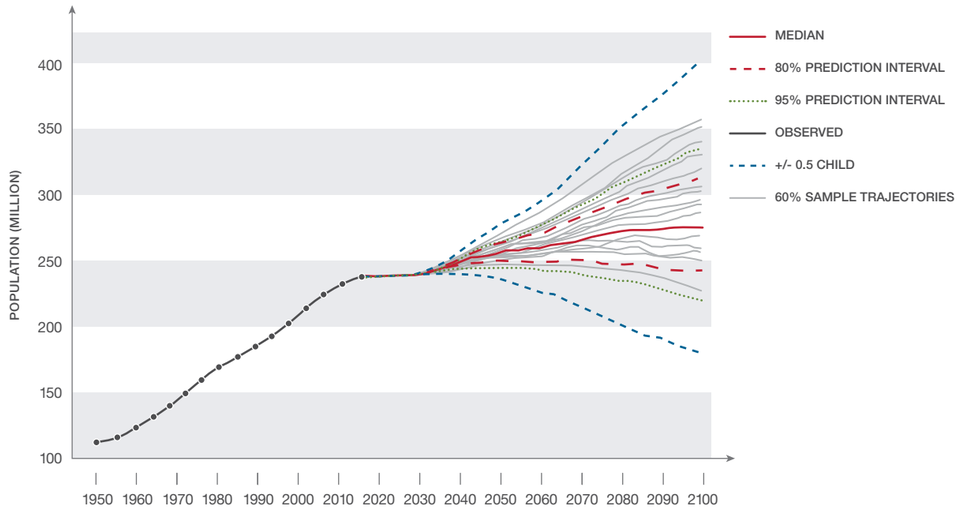


FIGURE 24: NORTHERN AMERICA: POPULATION (AGE 15–64)[20]

» Migration from economically depressed developing areas rises.

» Illegal migration rises, sparking backlash against immigrants in the developed world. Rise in nationalism and increase in extreme right parties—xenophobic messages increase in domestic polities (particularly in the West).

» Societal interest in social responsibility and long-term welfare decline.

» Global poverty rates in developing world continue to rise.
  – Rising numbers of working poor in Western nations.
  – Increased child poverty in West.

» Populations in environmentally stressed areas experience declines in health.

» Populations in developing nations are aging, leading to more immigration and changes in workplace culture.

20. Source: United Nations, Department of Economic and Social Affairs, Population Division (2015). *World Population Prospects: The 2015 Revision.* http://esa.un.org/unpd/wpp/.

» Rise in criminal gangs, particularly those linked to illegal migration from the developing world.

» Flight of capital from developing nations continues to rise.[21]

» Developed nations increasingly move toward more lucrative employment areas (service or information jobs versus traditional blue-collar).

» Employment becomes international in nature—employees on other side of world connected by WWW—while routine work can be contracted out, as can specialized skills (contracted from anyone, anytime, anywhere and for only as long as required).

» Increased use of crowdsourcing for funding of projects and programs that traditionally have been seen as a government responsibility.

Social Example

Sub-Saharan Africa remains an area of significant concern—political instability, economic disruptions, civil wars, migratory issues. "The number of countries with youthful age structures in the current 'arc of instability' is projected to decline by as much as 40 percent. Three of every four youth-bulge countries that remain will be located in Sub-Saharan Africa; nearly all of the remainder will be located in the core of the Middle East, scattered through southern and central Asia, and in the Pacific Islands."[22]

21. Capital flight refers to monies that flow, often illegally, from a developing country to any entity outside that nation, typically into multinational corporations or the Western world. Flight of capital can be legal or illegal (alternative terms more generally acceptable to economists are "recorded" and "unrecorded"), but the available data is insufficient to differentiate between the two. It includes trade mispricing, smuggling, bulk cash movement (eg, withdrawal of profits), etc. Even at the lower end of the range of estimates, the volume of illicit financial flows out of developing countries increased at a compound rate of 18.2 percent over the five-year period analyzed for the study. Illicit financial outflows occur through two channels: clandestine use of the international banking system to send money out of a country, captured by the Hot Money (Narrow) and World Bank Residual models, and trade mis-invoicing, which generates illicit funds that are shifted abroad.

22. Source: US National Intelligence Council, Global Trends 2025: A Transformed World (November 2008, viii.) Online at *www.dni.gov/nic/NIC_2025_project.html.*

TREND AREA: SCIENCE & TECHNOLOGY

TREND DESCRIPTION

- Overconfidence in science and technology as a source of solutions to global problem sets (e.g., repairing environmental damage).
- Investment in science and technology is inconsistent and is often sacrificed for short-term gains in development and productivity.
- Science and technology solutions remain limited.
- Investments in science and technology solutions to environment- and energy-related issues continue to rise but remain largely reactive.
- Emerging and disruptive science and technology trends have been identified elsewhere (e.g., autonomous and robotics systems, additive printing, human augmentation, dispersed (cloud) and quantum computing, genomics, energy storage, and renewable energy).

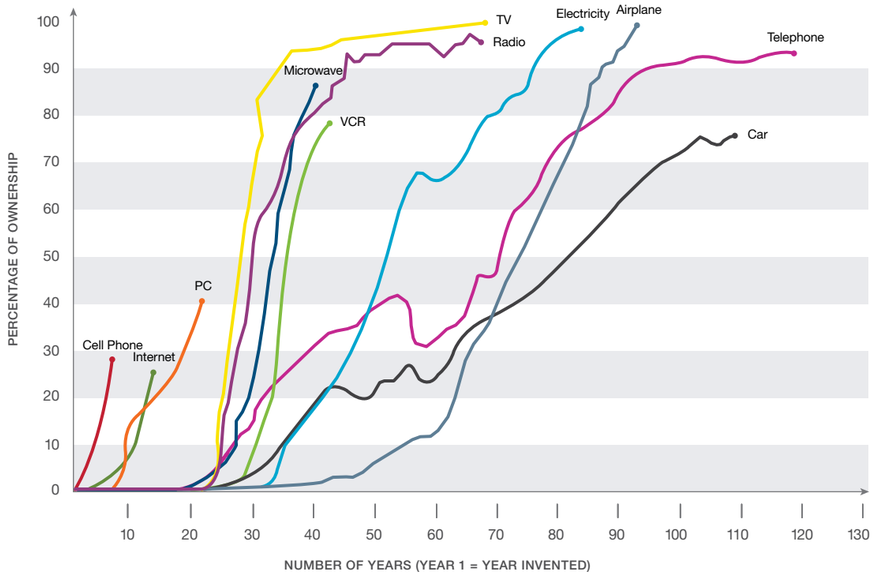


FIGURE 25: TECHNOLOGY ADOPTION[23]

23. Source: Forbes Magazine

FIGURE 26: CANADIAN MINING INDUSTRY CLUSTERS (MODIFIED FROM STOTHART, 2011)[24]

24. Source: F.J. Warren and D.S. Lemmen (editors), *Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation* (Ottawa: Natural Resources Canada, 2014), 77.

When will the future arrive?

800 technology executives and experts from the information and communications technology sector were surveyed as part of our Technology Tipping Points and Societal Impact report.

TECHNOLOGY TIPPING POINTS EXPECTED TO OCCUR BY 2025	PERCENTAGE OF RESPONDENTS
10% of people wearing clothes connected to the internet	91.2
The first robotic pharmacist in the U.S.	86.5
The first 3D-printed car in production	84.1
5% of consumer products printed in 3D	81.1
90% of the population with regular access to the internet	78.8
Driverless cars equaling 10% of all cars on US roads	78.2
The first transplant of a 3D-printed liver	76.4
Over 50% of internet traffic to homes for appliances and devices	69.9
The first city with more than 50,000 people and no traffic lights	63.7
The first AI machine on a corporate board of directors	45.2

FIGURE 27: TECHNOLOGY TIPPING POINTS AND SOCIETAL IMPACT[25]

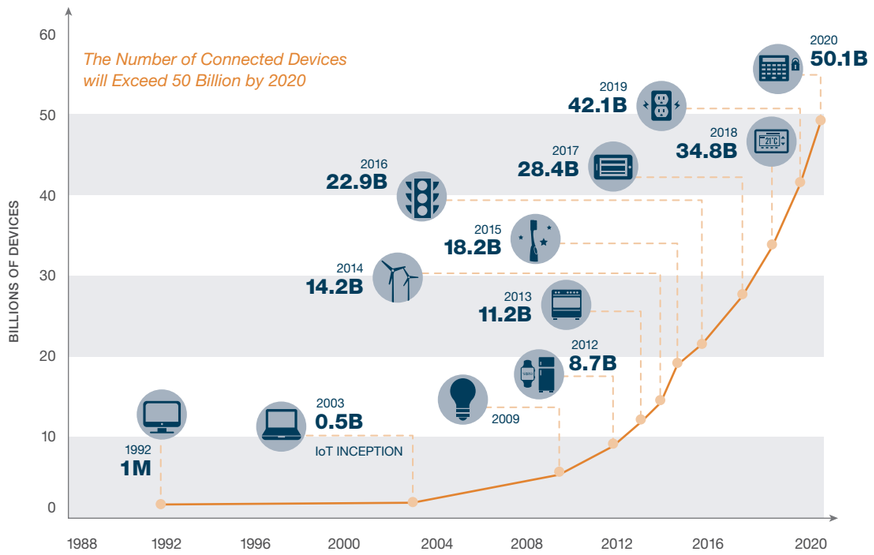


FIGURE 28: GROWTH IN THE INTERNET OF THINGS[26]

25. Source: World Economic Forum, *Technology Tipping Points and Societal Impact report*, 2015.

26. Source: CISCO.

TREND AREA: ENERGY

TREND DESCRIPTION

- Global demand for energy will continue to rise.
- Energy security emerging as a new strategic driver or imperative.
- Looming energy crisis leads to aggressive exploitation and extraction practices at expense of environment.
- "Dirty" energy continues to represent majority of global supply—corresponding increase in environmental damage worldwide (particularly in developing world).
- Oil and gas production from traditional energy producers is expected to continue to decline—oil and gas production expected to increase in unstable areas.
- Discovery of new methods for extracting fossil fuels (e.g., fracking) means that carbon-based fuels continue to represent large part of global energy equation.
- Growth in renewable energy sources slows or levels off.

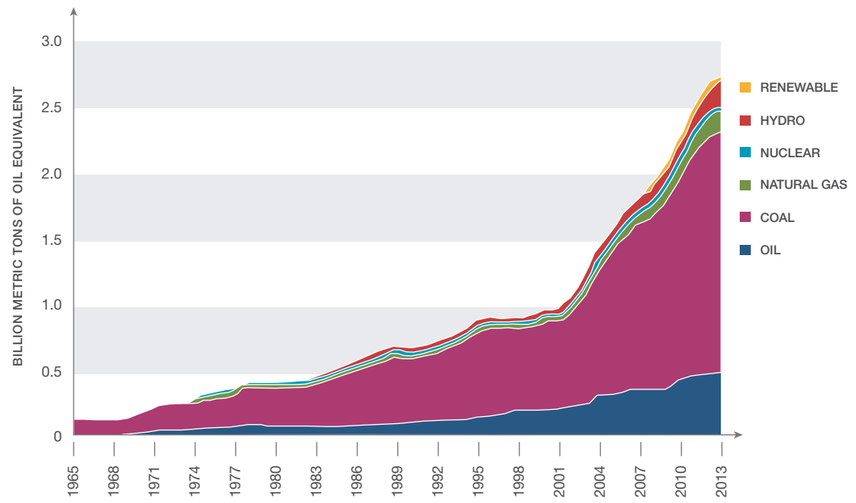


FIGURE 29: CHINA ENERGY CONSUMPTION BY SOURCE[27]

27. Source: Gail Tverberg, OurFiniteWorld.com.

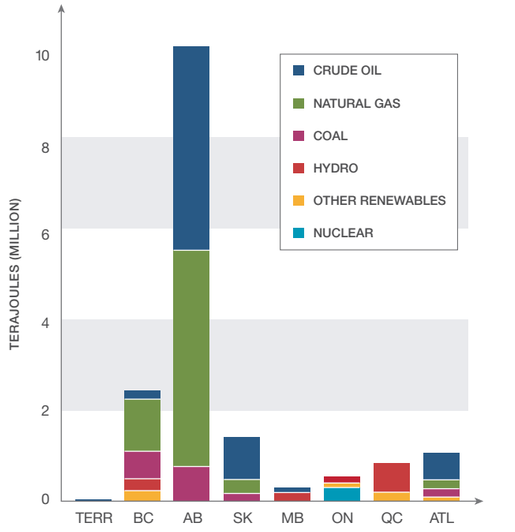


FIGURE 30: PRIMARY ENERGY PRODUCTION BY PROVINCE[28]

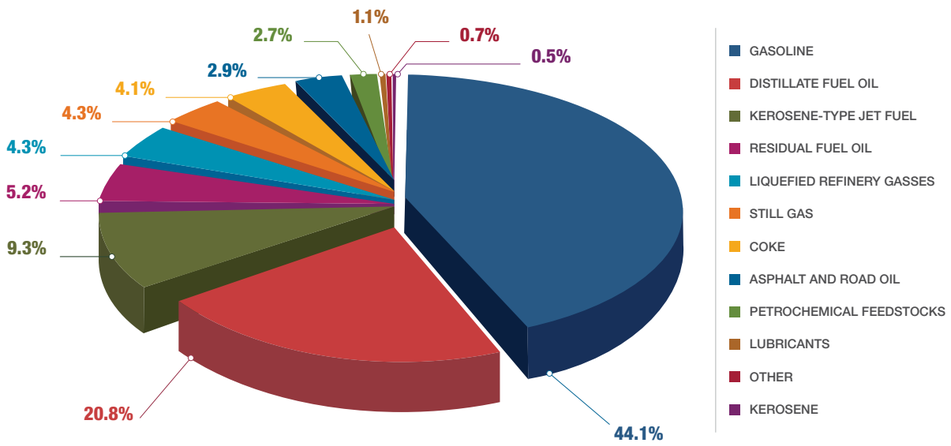


FIGURE 31: WHAT CRUDE OIL MAKES[29]

28. Source: Primary Energy Production by Province (Warren and Lemmen, 2014).

29. Source: Curious.org

TREND AREA: ENVIRONMENT

TREND DESCRIPTION

» Increasing global waste, pollution and general environmental degradation, leading to societal instabilities and increased insecurity (primarily in developing world).

» Efforts at remediation and cleanup are reactive, and increasingly lag behind environmental realities.

» International agencies are limited in influence regarding environmental issues such as cleanup, regulation and enforcement.

» Protection of the environment is largely within individual state purview and based on local interests.

» Developing nations increasingly being used as either branch plants or dumping grounds.

» Environmental degradation leading to greater damage from severe climate and weather events such as floods, tornadoes, etc.—more frequent and severe weather patterns are expected.

» Food demand rises given growing world population, rising affluence and growing middle classes—food shortages in environmentally stressed developing regions (e.g., Africa and the Middle East).

» Rising BRIC nations decline to become heavily involved in dealing with climate change. Increased reliance on others to carry the primary burden (instead, their focus is on geopolitical and economic issues related to growth: BRIC official rhetoric stresses national priorities, primarily economic development).

» Failure of existing multilateral institutions to adapt to changes in international environment—failure to maintain institutional agility leads to decline in environmental interest, protection and enforcement.

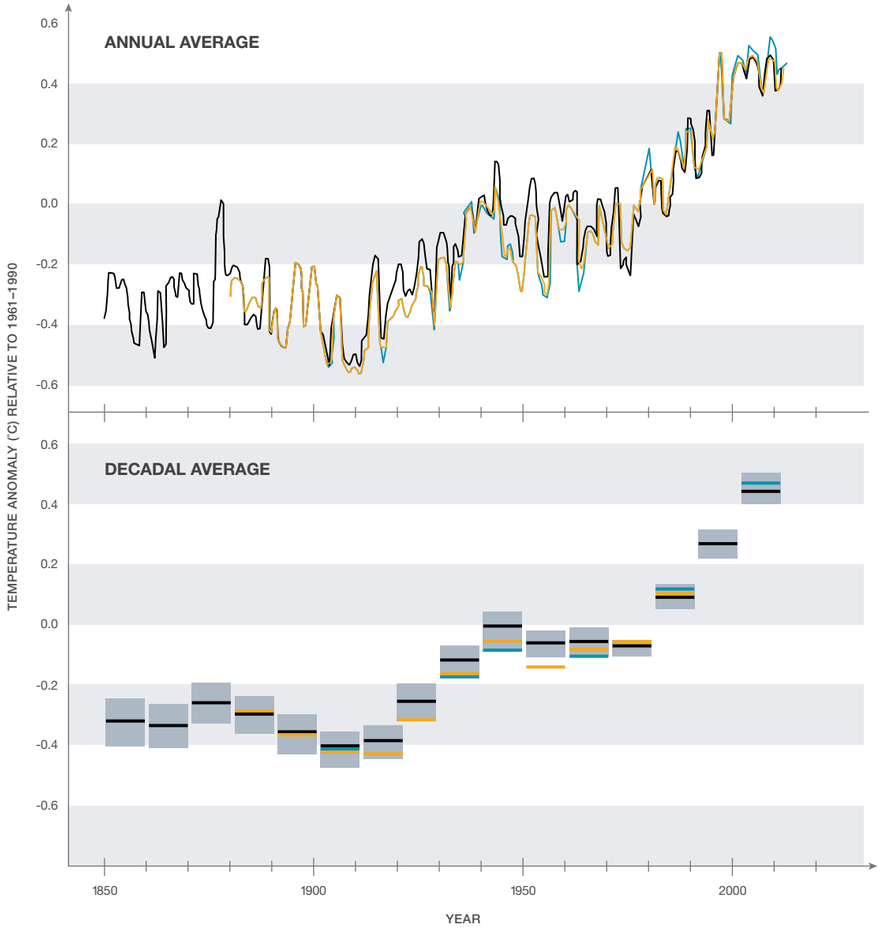


FIGURE 32: OBSERVED GLOBALLY AVERAGED COMBINED LAND AND OCEAN SURFACE TEMPERATURE ANOMALY 1950–2012[30]

30. Source: https://www.climatechangeinaustralia.gov.au/en/climate-campus/global-climate-change/trends/.

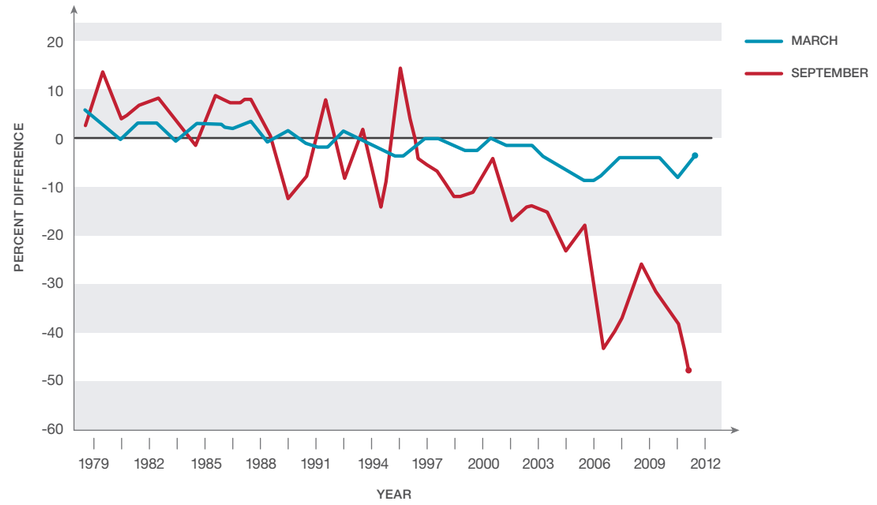


FIGURE 33: TIME SERIES OF THE PERCENT DIFFERENCE IN ICE EXTENT IN MARCH (THE MONTH OF ICE EXTENT MAXIMUM) AND SEPTEMBER (THE MONTH OF ICE EXTENT MINIMUM) RELATIVE TO THE MEAN VALUES FOR THE PERIOD 1979–2000[31]

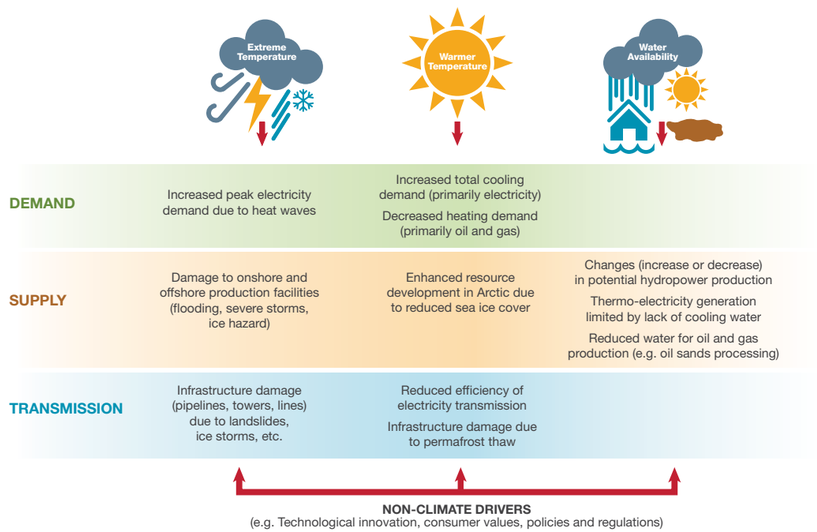


FIGURE 34: CLIMATE VARIABILITY AND CHANGE[32]

31. Source: US Department of Commerce National Oceanic and Atmospheric Administration (NOAA) Arctic Report Card for 2011.

32. Key climate change impacts in the energy sector, recognizing the importance of non-climate drivers in determining adaptation actions. F.J. Warren and D.S. Lemmen (editors), *Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation* (Ottawa: Natural Resources Canada, 2014), 83.

TREND AREA: DEFENCE AND SECURITY

TREND DESCRIPTION

» Wide range of security threats and challenges globally—in the developing world, environmental decay is a major factor in conflict with developing nations.

» U.S. maintains the same level of involvement in the international community—committing ground troops will remain in extremis and to be avoided.

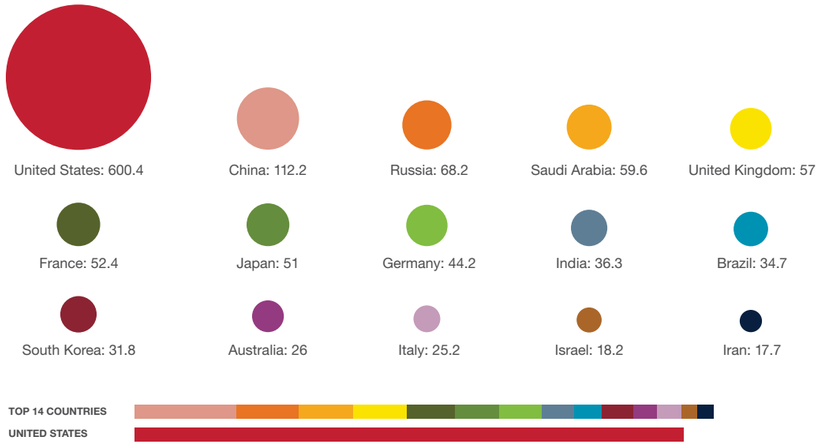


FIGURE 35: TOP 15 DEFENCE BUDGETS 2013 (US$bn)[33]

» Most conflict is South–South or North–South and is typically based on either energy extraction or environmental damage. Religious, economic and cultural issues also continue to play a role.

» Developed nations have military recruitment issues—declining interest, more emphasis on immigrants and diversity.

» Increasing emphasis on secure borders in developed world.

» Increased involvement of key regional powers in regional conflict resolution (e.g., China, India and Russia).

» Rise in the use of private military companies throughout the developed and developing world.

» Rise in regional conflict due to cross-border pollution, industrial espionage, illegal migration, and conquest of neighbouring territories—often to provide additional living space for citizens in environmentally stressed regions—and ethno-religious issues.

» Likelihood of intra-state conflict in the developing world is very high.

» Rise in local insurgent and terror groups, especially in those developing nations hosting Western energy companies. Kidnapping, murder and sabotage are significant threats.

» Increase in organized crime and gang activity in fragile states.

» Efforts to gain nuclear weapons continue.

» Efforts to weaponize space will continue.

» Diffusion of technology allowing for mass-casualty terror attacks will continue and grow.

» Growth in autonomous systems becoming a new priority for cyber defence (e.g., an attractive adversarial target).

33. Source: IISS

ANNEX B

MATERIALISM GONE MAD TRENDS COMPARED TO THE OTHER ALTERNATIVE WORLDS

SOCIAL SECTOR

BASELINE MATERIALISM GONE MAD	GLOBAL QUAGMIRE	RECYCLABLE SOCIETY	HIGH OCTANE GREEN WORLD
- Short-term thinking and self-interest dominate in the West. - Domestic focus is on maximizing economic growth and material gain and satisfying domestic consumerism (materialism). - Illegal migration rises, sparking backlash against immigrants in developed world: increase in nationalism, extreme-right parties and xenophobic messages in domestic politics in the West in particular. - Migration from economically depressed developing areas rises. - Global poverty rates in the developing world continue to rise: higher numbers of working poor and increased child poverty in the West. - Populations in environmentally stressed areas experience declines in health. - Aging populations in developed nations, leading to more immigration and changes in workplace culture. - Continued decline in economic growth globally. - Social responsibility and long-term welfare interest declines. - Global population continues to rise with developing nations continuing to push cheap labour both at home and abroad as main product. - Increase in criminal gangs, particularly those linked to illegal migration from developing world.	- Greater support in Western societies for xenophobic messaging from right-wing parties advocating less immigration and crackdowns on illegal immigration. Immigration quotas and selective immigration become the norm. - Right-wing parties become more common and more extreme in messaging. - Dramatic decline in economic growth with the developed world also hit hard, leading to reluctance to commit resources globally to resolve energy or environmental problems.	- Growing movement away from consumerism and shift toward valuing environmentalism. - Immigration issues lose traction and become less common as electoral and media themes, largely because resources to migrate become less available in fragile states. - Less strident right-wing movements. - Significant decline in economic growth with the developed world also hit hard, leading to reluctance to commit resources globally to resolve energy or environmental problems.	- Growing movement away from consumerism and shift toward valuing environmentalism. - Immigration mitigated by increased allocation of aid monies to fragile nations. - Although immigration quotas may increase in developed nations, the number of migrants is expected to decrease significantly. - Upswing in economic growth expected.

BASELINE MATERIALISM GONE MAD	GLOBAL QUAGMIRE	RECYCLABLE SOCIETY	HIGH OCTANE GREEN WORLD
- Flight of capital from developing nations continues to rise. - Developed nations increasingly moving toward more lucrative employment areas (service or information jobs versus traditional blue-collar). - Employment becomes international in nature: employees on other side of world connected by WWW, routine work can be contracted out, and specialized skills can be contracted from anyone, anytime, anywhere for as long as required. - Increased use of crowdsourcing for funding of projects and programmes that traditionally have been seen as a government responsibility.			

SCIENCE AND TECHNOLOGY SECTOR

BASELINE MATERIALISM GONE MAD	GLOBAL QUAGMIRE	RECYCLABLE SOCIETY	HIGH OCTANE GREEN WORLD
- Overconfidence in science and technology as the solutions to global problems will continue (e.g., resolving environmental damage). - Investment in science and technology is inconsistent and is often sacrificed for short-term gains in development and productivity. - Science and technology solutions remain limited. - Investments in science and technology solutions to environment- and energy-related issues are expected to continue to rise but remain largely reactive in nature. - Emerging and disruptive science and technology trends include autonomous and robotic systems, additive printing, human augmentation, dispersed (cloud) and quantum computing, genomics, energy storage, and renewable energy.	- Dramatic decline in monies devoted to science and technology. - Innovations in the energy and environmental realm of science and technology are developed out of necessity—reactive and rare (cognitive and physical).	- Decline in investment in science and technology. - Investment in environmental research and development will become of secondary importance to investment in the energy sector. - Innovation is reactive rather than proactive.	- Dramatic increase in science and technology monies allocated to energy and environmental solutions. - Science and technology work and investment will seek to foster more proactive innovation.

ENERGY SECTOR

BASELINE MATERIALISM GONE MAD	GLOBAL QUAGMIRE	RECYCLABLE SOCIETY	HIGH OCTANE GREEN WORLD
- Global demand for energy will continue to rise. - Energy security emerging as new strategic driver or imperative. - Looming energy crisis leads to aggressive exploitation and extraction practices at the expense of the environment. - "Dirty" energy continues to be the majority of global supply, with a corresponding increase in environmental damage worldwide, particularly in the developing world. - Oil and gas production from traditional energy producers is expected to continue to decline, and oil and gas production is expected to increase in unstable areas. - Discovery of new methods for extracting fossil fuels (e.g., fracking) means that carbon-based fuels continue to represent a large part of the global energy equation. - Growth in renewable energy sources slows or levels off. *The energy sector is the one area where planning should begin to deal with a black swan or wild card event: a major breakthrough in an alternative energy source that spawns a new energy age. The most likely candidates are low-cost hydrogen fracking and fuel cells, and a breakthrough in nuclear fusion.*	- Energy security will become the dominant factor in any strategic policy decisions. Environmentalism will become a smaller consideration. - Aggressive exploitation of any cheap and plentiful energy sources, including a possible return to coal.	- As much emphasis on clean and alternative energy exploitation as possible. - While energy demand will continue to rise, research and development monies spent in the energy field will allow that growth to be offset by alternative energy development. - More effort at innovation but within the realm of traditional extraction. Expect to see science and technology breakthroughs in such areas as new fracking techniques, rather than moves into alternative energy sources.	- Heavy emphasis will be on clean and alternative energy exploitation as much as possible with significant monies devoted to research and development. - While energy demand will continue to rise, research and development monies spent in the energy field will allow that growth to be offset by alternative energy development. - Oil and gas production will continue to increase, but the sources will become more innovative and reduce reliance on production from unstable regions.

ENVIRONMENT SECTOR

BASELINE MATERIALISM GONE MAD	GLOBAL QUAGMIRE	RECYCLABLE SOCIETY	HIGH OCTANE GREEN WORLD
- Global waste, pollution and general environmental degradation are increasing, leading to greater global insecurity. - Efforts at remediation and cleanup are reactive and increasingly lag behind environmental realities. - International agencies are limited in influence on environmental issues like cleanup, regulation and enforcement; energy security is the driving force. - Protection of the environment is largely within individual state purview and based on local interests. - Developing nations are increasingly being used as either branch plants or dumping grounds. - Environmental degradation leads to greater damage from severe weather events such as floods and tornadoes. More frequent events and more severe weather patterns are expected. - Food demand rises, driven by growing world population, rising affluence, and growing middle classes in developing world shifting to Western dietary preferences. Food shortages in environmentally stressed developing regions (e.g., Africa and the Middle East). - Rising BRIC nations decline to become heavily involved in dealing with climate change—increased reliance on others to carry primary burden, with their focus instead on geopolitical and economic issues related to growth. Official rhetoric downplays global issues and instead focuses on national priorities such as economic development. - Existing multilateral institutions fail to adapt to changes in international community quickly enough. Failure to maintain institutional agility leads to decline in environmental interest, protection and enforcement.	- The traditional employment of developing nations as environmental dumping grounds will accelerate. - The environment is viewed by governments as just another area for competition and exploitation. - In this world, the environment is a concern only when it impacts on local interests.	- Focus is on local solutions to environmental problems—any global institutional emphasis has, out of necessity and reality, been marginalized. - Environment is a major concern, but solution sets are more reactive than proactive. - There is a more global view of the environment, although local and regional concerns are largely prioritized over global initiatives.	- Less need to rely on the global institutions like the UN for influence, as environmentalism remains an important priority for maintaining a competitive edge within a cooperative framework. - Activity in international environmental agencies generates not only prestige but also well-paying employment. - More proactive and longer-term approaches to environmental problems are sought. - The emphasis is on global solutions, although local and regional concerns are not ignored.

DEFENCE AND SECURITY SECTOR

BASELINE MATERIALISM GONE MAD	GLOBAL QUAGMIRE	RECYCLABLE SOCIETY	HIGH OCTANE GREEN WORLD
- Widespread security threats and challenges dominate the global picture. In the developing world, environmental decay is a major factor in conflict with developing nations. - U.S. expected to maintain the same level of involvement in the international community. Committing boots on the ground will remain *in extremis* and to be avoided. - Most conflict is South–South or North–South and typically based on either energy extraction or environmental damage—religious, economic and cultural issues continue to play a role. - Developed nations have military recruitment issues—declining interest, smaller working-age population, and more emphasis on immigrants and diversity. - Increasing emphasis on secure borders in developed world. - Increased involvement of key regional powers in regional conflict resolution (e.g., China, India, Russia). - Rise in the use of private military companies throughout the developed and developing world. - Rise in regional conflict due to cross-border pollution, industrial espionage, illegal migration, conquest of neighbouring territories (often to provide additional living space for citizens in environmentally stressed regions) and ethno-religious issues. - Likelihood of intra-state conflict in developing world is very high. - Rise in local insurgent and terror groups, especially in developing nations hosting Western energy companies—kidnapping, murder and sabotage are the main threats. - Increase in organized crime and gang activity in fragile states. - Efforts to gain nuclear weapons continue. - Efforts to weaponize space will continue. - Diffusion of technology allowing for mass-casualty terror attacks will continue and grow. - Growth in autonomous systems is new priority for cyber defence (attractive adversarial target).	- Energy security dominates defence and security planning. - Rise in armed conflict globally. Intense regional conflict with potential to flare into wider global conflict. - Recruitment issues largely disappear due to increasing nationalism and greater unemployment in both developing and developed worlds. - Private military companies remain part of security networks for developed nations, but there is less reliance on them except for specific and expensive capabilities (widespread unemployment removes recruitment issues). - Terrorism as a problem continues to increase and manifests itself on the global stage, although resources become less available. Terror tactics at regional levels in developing world become commonplace. - Wild card: acquisition of nuclear weapons by a non-state actor. - While science and technology monies decline and innovation suffers, investment is largely in the defence and security field.	- Regional conflict continues over environmental and energy issues. - Energy security, in particular, is a major theme for security policy and manifests itself in cooperative security agreements at the regional level. - Limited peace support operations become the main theme for developed nations' involvement. - Terrorism is still a problem but largely remains within the developing world. - Science and technology monies in the defence and security field decline, save for those devoted to resolving cross-field issues related to environment and energy.	- Humanitarian assistance and disaster relief activities dominate within a broader peacebuilding framework. - Conflict remains regionally based but limited in scope and duration. - Terrorism remains an issue, but as the developed world becomes more complacent about such events they also become less common: terrorism in the West becomes a wild card event. - There are greater cooperative controls and impediments to the development of nuclear arms and space-based weapon systems. - Science and technology monies in the defence and security field decline, save for those devoted to resolving cross-field issues related to environment and energy.

ANNEX C

EXAMPLES OF WILD CARDS

» Collapse of European Union.

» Collapse of NAFTA.

» Development of true machine intelligence or consciousness (linked to the idea of the technology singularity).

» Adoption or recognition of machine intelligence rights.

» Emergence of an alien race.

» Emergence of an asteroid or other large object on collision course with earth.

» Emergence of a clean and cheap alternative fuel source (cold fusion or algae production).

» Disease vectors that allow animal-to-human transmission.

» Discovery of immortality (or significantly increased longevity).

» Collapse and fragmentation of Chinese society.

» Quantum computing perfected.

» Public-key algorithms are cracked.

» Shift in Canada away from public healthcare toward the adoption of a U.S.-style model.

» Polar magnetic field flip.

» Cloning becomes acceptable for a variety of discretionary applications, including military use.

» Breakthrough in human enhancement drugs (either physical or mental).

» Space colonization and mining.

» Weaponization of space and space war.

- Massive solar activity resulting in disruption of critical systems.
- Achievement of revolutionary space propulsion.
- Achievement of transporter technology.
- UN sanction levelled against the U.S.
- Revolutionary changes to the UN, including rescinding or re-allocation of traditional veto powers.
- *Star Trek*-style medical tricorder becomes reality.
- Invisibility through chemical or technological application becomes reality.
- Global move away from capitalism.
- Autonomous transport systems become reality, as do smart driving systems with advanced safety features.
- Misuse of nuclear material by terrorists.
- Proliferation of neighbourhood nuclear-based power generation.
- Flying cars are adopted for widespread use.
- Intellectual property rights are abolished, either globally or in select regions.
- Rise of theocracies, particularly in the U.S.
- Revolutionary shift in monetary systems, perhaps including a universal currency.
- Attainment of power by neo-fascists in one or more major European nations.
- Water is privatized and access is no longer considered a right.
- Ability to physically kill or injure opponents through online computer gaming.
- Weather control made possible.
- Inter-species communication perfected (ie, ability to speak to and understand animals).
- In Canada, the removal of automatic right to citizenship through birth.
- In Canada, the full integration of the Canadian Armed Forces with U.S. forces.
- Death of the worldwide bee population (responsible for pollination of around 70 of the 100 crop species that feed 90% of world's population).
- Re-animation of deadly disease via polar exploration.
- Real or synthetic telepathy.
- Cancer cure (either specific type or cancer generally).
- Theory of relativity is rewritten in the context of black holes.
- Bioweapons based on genetic targeting.
- Breakthrough in ways to reach outer space: space elevator, or commercially inexpensive space travel.
- Breakthrough in regenerating human organs or appendages (re-growing arms, legs or new organs).

ANNEX D

INTERNATIONAL AGENCIES INVOLVED IN FORESIGHT AND RELEVANT PRODUCTS

This list is not all-inclusive. It is intended to provide a cross-section of key governments, organizations and agencies involved in foresight activities that should be exploited to create the basis for the Army's early warning system.

United Nations (UN)

PRODUCTS OF INTREST: Various background products and future trend products.

REMARKS: The UN website provides access to a vast variety of background reports: mainly statistical data, but also a number of reports which provide future trends, predominantly in development. The data related to the UN's Millennium Development Goals is very useful for forecasting activities www.un.org/millenniumgoals.

CONTACT: www.un.org

U.S. National Intelligence Council

PRODUCTS OF INTREST: Global Trends.

REMARKS: Part of the Office of the Director of National Intelligence, the NIC has been producing "Global Trends" since 1997. It provides, with an American bias, an examination of trends based on globalization, demography and the environment. Other products of interest include "Global Water Security," "Global Health Implications" and "Global Food Security," plus assorted papers discussing the impact of climate change.

CONTACT: www.dni.gov/index.php/about/organization/national-intelligence-council-who-we-are

UK MOD DCDC Strategic Trends Programme

PRODUCTS OF INTREST: Global strategic trends.

REMARKS: The UK MOD Development, Concepts and Doctrine Centre (DCDC) publishes a recurring report which describes a future context for defence and security. The 2014 study reflects trends out to 2045. It also identifies likely threats.

CONTACT: www.gov.uk

RAND Corporation

PRODUCTS OF INTREST: Various products.

REMARKS: The RAND Corporation produces various products in support of the U.S. Army. These have included various foresight products examining the 2020 timeframe and others providing alternative futures and trends related to Army force planning (e.g., Brian Nichiporuk, *Alternate Futures and Army Force Planning* (2005)).

CONTACT: www.rand.org

Oxford Martin School, University of Oxford

PRODUCTS OF INTREST: Various products.

REMARKS: The Oxford Martin School has produced many background papers on a variety of themes related to the environment and energy. Most recently, the School published *Now For the Long Term: The Report of the Oxford Martin Commission for Future Generations* (October 2013), which examined future global trends, outlined some past lessons on successful responses to past challenges, and wrapped up the report with some practical examples that they believe will be useful going forward.

CONTACT: www.oxfordmartin.ox.ac.uk

Singapore's Centre for Strategic Futures (CSF)

PRODUCTS OF INTREST: Various foresight products.

REMARKS: The CSF was established within Singapore's Prime Ministerial office to develop future scenarios in a whole-of-government framework. In addition to a very useful and comprehensive glossary of foresight terms, the Centre also engages in various futures conferences and produces a number of useful publications (e.g., *Foresight 2015*).

CONTACT: www.csf.gov.sg

US Defense Advanced Research Projects Agency (DARPA)

PRODUCTS OF INTREST: Various publicly released research and development products.

REMARKS: The DARPA Open Catalog is a public web portal that organizes and shares the publicly releasable results of DARPA research in the form of software, peer-reviewed publications, data and experimental details. There are useful background papers on various technological trends.

CONTACT: www.darpa.mil

Office of the Deputy Assistant Secretary of the Army (R&D)

PRODUCTS OF INTREST: Science and technology trends.

REMARKS: Most recent product of interest was *Emerging Science and Technology Trends: 2015–2040*, published 20 April 2015.

It is a very informative and excellent resource for understanding which key science and technology trends the U.S. Army believes will influence the future security environment and their impact on warfighting capabilities over the next 30 years.

CONTACT: Through Canadian Defence Liaison Officers

University of Cambridge

PRODUCTS OF INTREST: Research and development trends in science and technology.

REMARKS: U.K. MOD commissioned two studies by the University of Cambridge's Institute for Manufacturing that examined the technology landscape out to 2035 and was intended to help inform MOD research and development strategy in technology. Key products include *The Defence and Security Technology Competency Report: Collaboration and leverage towards the UK 2035 landscape* (2012).

CONTACT: www.ifm.eng.cam.ac.uk

Council on Foreign Relations (CFR)

PRODUCTS OF INTREST: Database links to various agencies engaged in foresight.

REMARKS: BP produces an energy outlook which examines the state of the industry into the distant future. BP examines global trends and insights by region and provides the data tables they use for their analysis.

CONTACT: www.cfr.org/global-future-trends/global-future-trends/p33893

British Petroleum (BP)

PRODUCTS OF INTREST: Energy futures reports.

REMARKS: The CFR, in addition to publishing a number of foresight-related reports, also provides the most comprehensive database of international agencies engaged in foresight activities.

CONTACT: www.bp.com

Shell Global

PRODUCTS OF INTREST: Energy futures reports.

REMARKS: Shell has developed a number of alternative futures based on long-term energy, economic, social and geopolitical trends. Their scenarios are updated and allow for past scenario development to be examined to track their prescience (or lack thereof).

CONTACT: www.shell.com

Government of Finland, Committee for the Future

PRODUCTS OF INTREST: Strategic and regional futures analysis.

REMARKS: The Finnish Parliament established a Committee for the Future which has published a number of regional strategic analyses in English.

CONTACT: www.eduskunta.fi/EN/lakiensaataminen/valiokunnat/tulevaisuusvaliokunta/Pages/default.aspx

International Monetary Fund (IMF)

PRODUCTS OF INTREST: Strategic and regional economic analysis.

REMARKS: The IMF provides regional and strategic analysis largely grounded in the present but with implications for the near future. This is a very useful site for regional economic figures.

CONTACT: www.imf.org

The World Bank

PRODUCTS OF INTREST: Strategic and regional analysis (largely economic).

REMARKS: The World Bank provides various analysis papers on regional trends and future prospects, largely focused on economic factors. Their various analytical reports can be accessed through their Open Knowledge Repository via the World Bank site.

CONTACT: www.worldbank.org

International Institute for Strategic Studies (IISS)

PRODUCTS OF INTREST: Strategic analysis of global security issues.

REMARKS: The key product is *The Military Balance*, an annual product that examines the military capabilities and defence economies of over 170 nations worldwide.

CONTACT: www.iiss.org

World Economic Forum

PRODUCTS OF INTREST: Various strategic and local economic reports.

REMARKS: This organization provides various futures-based reports on a variety of economics-related topics such as healthcare, job creation and the Internet.

CONTACT: www.weforum.org

Resources for the Future (RFF)

PRODUCTS OF INTREST: Various reports on environment, energy and resource issues.

REMARKS: This U.S. non-profit research agency provides a number of reports on environmental, energy and natural resources issues, with a predominantly American focus. Much of their analysis has centred on the expected effects of various forms of energy development and of various policy initiatives.

CONTACT: www.rff.org

International Water Management Institute (IWMI)

PRODUCTS OF INTREST: Various reports and publications on water and land resources in developing nations.

REMARKS: Their key product is the Annual Report, which outlines development issues around water resources, including population growth, urbanization and climate change. Its main focus areas are Africa and Asia. The site also includes links to a number of peer-reviewed published academic papers that are within the Institute's mandate for review.

CONTACT: www.iwmi.cgiar.org

CANADIAN AGENCIES OUTSIDE THE CANADIAN ARMED FORCES ENGAGED IN FORESIGHT ACTIVITIES

The agencies identified here are those accessible through the World Wide Web. There are a number of internal government agencies that have forecasting capabilities but whose information is available only in the classified government realm.

Statistics Canada

PRODUCTS OF INTREST: Statistics in various fields.

CONTACT: www.statcan.gc.ca

National Research Council (NRC)

PRODUCTS OF INTREST: Foresight products targeted to Canadian industry.

REMARKS: NRC maintains a Foresight Office that examines emerging trends and insight with an aim to anticipating future requirements in Canadian industry.

CONTACT: www.nrc-cnrc.gc.ca

Privy Council Office (PCO)

PRODUCTS OF INTREST: Foresight products.

REMARKS: Policy Horizons Canada (PHC) has been operating within the PCO since 1996 under various names. It provides foresight products and trend analysis in various areas of interest to Canada. Its main products are various Metascans (e.g., *Metascan 3: Emerging Technologies,* September 2013).

CONTACT: www.horizons.gc.ca

The Conference Board of Canada

PRODUCTS OF INTREST: Foresight products.

REMARKS: PRODUCTS OF INTREST: The Conference Board of Canada provides foresight products and runs conferences and training sessions on foresight and foresight methodology.

CONTACT: www.conferenceboard.ca

Innovation, Science and Economic Development Canada (ISEDC)

PRODUCTS OF INTREST: Consumer and industry trends.

REMARKS: PRODUCTS OF INTREST: ISEDC provides trend analysis reports on the consumer and industry realms.

CONTACT: www.ic.gc.ca

Environment and Climate Change Canada (ECCC)

PRODUCTS OF INTREST: Climate trends.

REMARKS: PRODUCTS OF INTREST: ECCC provides current and foresight trend analysis dealing with climate and the environment.

CONTACT: www.ec.gc.ca

GLOSSARY OF TERMS

BLACK SWAN

A metaphor describing an extremely low-probability or unforeseen high-impact event that takes everyone by surprise. *Alternate*—a rare, high-impact, hard-to-predict and discontinuous event beyond the realm of normal expectations.

BLIND SPOTS

Issues which have not yet appeared. There are typically three different blind spots. ***Unknown unknowns*** are issues whose existence is unknown to the organization, or whose relevance, impact or significance has been underestimated because of lack of knowledge. ***Unknown knowns*** are unknown because wilful blindness (organizational and/or cognitive blindness has obscured their existence and/or their significance to the organization). ***Known unknowns*** are blind spots the organization realizes it has and which it attempts to research and study further in order to understand potential impacts).

DRIVER

A factor, force or event which changes, affects or shapes the future. Can be direct or indirect. *Alternate*—significant trends, observable in the present, which are expected to continue to affect the future. May be predetermined drivers which are stable and predictable or critical uncertainty drivers which open a variety of plausible future trajectories.

INDICATOR

A statistic or measurement used to gauge the condition of something.

LEADING INDICATOR

A variable whose change generally precedes some other event or situation, or an event with a similar characteristic.

NOISE

Data which appear to indicate a trend but are in fact irrelevant. May become confused with weak signals. *Alternate*—mass of background signs and facts which point in inconsistent directions.

OUTLIER

Also known as a wild card. An unexpected, unlikely or unpredictable event that would have enormous consequences if it occurred. Sometimes known as a black swan, but it should be differentiated from a black swan: wild cards can be imagined but are often discounted because of extremely low probability, whereas a black swan is an unforeseen or unimagined occurrence.

SIGNAL

A small or local innovation or disruption that has the potential to grow in scale and geographic dispersion. May be a new product, policy or technology. May also be an event, a local trend or an organization. Signal detection depends on the type of organizational filters in place: ***surveillance filters*** (signals missed because of organizational gaps), ***mental filters*** (blocks signals which do not conform to expectations or frame of reference), or ***power filters*** (which tend to block signals that are not in the best interest of the organization).

SIGNPOST

An indicator that marks waypoints between the present and a plausible future. Signposts can either be discrete events or thresholds or take the form of trends or patterns. Particularly useful in providing an understanding of the extent to which a particular plausible future scenario is developing. Usually understood in terms of their importance to early warning systems. A **waypoint** can also be considered a signpost.

STRATEGIC SURPRISE

An event of great strategic relevance which suddenly and unexpectedly arrives and creates new issues for which the organization has no immediate response strategy. *Alternate*—an issue or event arises which requires immediate action but cannot be handled by normal systems and processes. May result from wild cards, black swans, or other critical events such as those categorized as "unknown known" blind spots.

STRONG SIGNAL

Also known as emerging trends, strong signals are generally recognized trends or assumptions. They are visible and relatively concrete. Most planning approaches or techniques focus on strong signals.

TREND

A general tendency or direction of movement or change over time. May be strong or weak and increasing, decreasing or stable. Also known as a pattern.

WEAK SIGNAL

Things that are happening now, perhaps sporadically or quietly, and are indicative of a force or trend that will become significant in the future. Vital to futuring work. *Alternate*: An early indication or warning, potentially incomplete and erratic, of a potentially important new event emerging phenomenon that could become an emerging pattern, a major driver or the source of a new trend. May be social demographic, technological, economic or psychological. *Alternate*—advanced and imprecise symptoms of impending future problems. Based on premature and imperfect information. *Alternate*—can be thought of as anomalies or threats to the status quo which are often discarded and ignored. They may pile up and lead to the development of a strong signal and ultimately a paradigm shift. *Alternate*—can be thought of as "gross data, i.e. premature, incomplete, unstructured, and fragmented informational raw material, that can be scrutinised, compiled, analysed and converted into an indicator of potential change of a trend or system toward an unknown direction and an unpredictable rhythm."[34]

34. Sandro Mendonça, Gustavo Cardoso and João Caraça, "Some Notes on the Strategic Strength of Weak Signal Analysis," *Lisbon Internet and Networks*, LIN Working Papers No. 2 (2013), 21. Online at http://www.lini-research.org/np4/?newsId=9&fileName=SMENDONCA_ETAL_LINI_WP2.pdf.

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Mr. Gizewski's recent publications for the DRDC-CORA and the CALWC include an assessment of NATO deterrent capabilities in the wake of Russian actions in the Ukraine and Crimea, a study of the pros and cons of military intervention, and various works examining the future security environment and its implications for Canada's Army.

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ACRONYMS

3D – Three dimensional

AI – Artificial intelligence

ALEA – Assistance to law enforcement agencies

ACP – Aid to the Civil Power

CALWC – Canadian Army Land Warfare Centre

CBRNe – Chemical, biological, radiological, nuclear and explosive

CIMIC – Civil-military cooperation

COTS – Commercial off the shelf

CPI – Consumer price index

CRAM – Counter rocket, artillery and mortar

CSEC – Communications Security Establishment of Canada

CSIS – Canadian Security and Intelligence Service

Dom – Domestic

Exped - Expeditionary

FSE – Future security environment

GBAMD – Ground-based air and missile defence

GDP – Gross domestic product

HADR – Humanitarian assistance and disaster relief

HUMINT – Human intelligence

HUMRO – Humanitarian relief operation

IA – Influence activities

IMF – International Monetary Fund

ISR – Intelligence, surveillance, reconnaissance

NAFTA – North American Free Trade Agreement

NEO – Non-combatant evacuation operations

NGO – Non-governmental organization

OGD – Other government departments

PA – Public affairs

PC – Personal computer

PSC – Private security company

PSYOPS – Psychological operations

RCMP – Royal Canadian Mounted Police

R&D – Research and development

SFCB – Security force capacity building

StratCom – Strategic communications

SME – Subject matter expert

UK – United Kingdom

UK MOD – UK Ministry of Defence

UN – United Nations

USMC – United States Marine Corps

VCR – Videocassette recorder

WMD – Weapon of mass destruction

WWW – World-Wide Web

INDEX

NOTES

The third and final volume in the three-volume Future Army series, *Canada's Future Army, Volume 3: Alternate Worlds and Implications*, presents the results of the four alternative futures developed by the Army Futures project team, identifying signposts that indicate possible shifts toward each of the alternate worlds described, and the concepts, capabilities, missions and tasks likely to be required by Canada's Future Army in each of these worlds. This volume not only provides a more detailed and nuanced appreciation of future capability development requirements for Canada's Army, but also gives guidance to better prepare capability developers for anticipating change and adapting more effectively to the changes that will occur in the security environment in the decades ahead.

CANADIAN ARMY LAND WARFARE CENTRE

The Canadian Army Land Warfare Centre serves as the army's intellectual foundation for the development of overarching concepts and capabilities for tomorrow and into the future. It is responsible for delivering concept-based, capability-driven tenets and specifications for force structure design; drawing up the army's concept development and experimentation plan; serving as a focal point for connection with other warfare centres, government departments, partner nations, external agencies and academia; and delivering high-quality research and publications in support of the Canadian Army's force development objectives.

National Defence Défense nationale

Canada