

The Future Security Environment 2013-2040



National Défense
Defence nationale

Canada

The Future Security Environment 2013-2040



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TABLE OF CONTENTS

FOREWORDvii

ACKNOWLEDGMENTSix

EXECUTIVE SUMMARYxi

INTRODUCTIONxv

The Purpose of the *Future Security Environment* (FSE)xv

CHAPTER 1 – GEOPOLITICAL TRENDS 1

Introduction 1

Relative Distribution of Power 2

Major Global Powers 4

 The United States 4

 European Union (EU). 6

 China 8

 Russia 11

Significant Global and Regional Influencers. 13

 KEY TOPIC: North Korea 13

 India 15

 Brazil. 16

Middle East and North Africa (MENA) 17

 KEY TOPIC: The Arab Spring and Governance in the MENA Region . . 17

 Iran 18

 Turkey 20

KEY TOPIC: The Arctic Powers. 20

Role of Alliances and Multi-Lateral Organizations. 22

 North Atlantic Treaty Organization (NATO) 23

 United Nations (UN) 24

 Organization of American States (OAS). 25

 Shanghai Cooperation Organization (SCO). 25

 Association of Southeast Asian Nations (ASEAN) 26



Potential for Instability 26

 Fragile and Failed States 27

 Ungoverned Spaces 28

 Transnational Non-State Actors. 29

Conclusion 29

CHAPTER 2 – ECONOMIC, ENVIRONMENTAL AND SOCIAL TRENDS 39

Introduction 39

Globalization 39

Economic Trends 40

Environment 43

 KEY TOPIC: Climate Change 43

 Food and Water Resources 45

 Energy Resources. 46

 Nuclear Energy 47

 Mineral Resources 48

Social Trends Influencing State Stability 49

 Migration and Population Displacement 49

 Urbanization and Mega-Cities 49

 Disease and Pandemics. 50

 Poverty. 51

Demographics 52

 Canadian Demographic Trends. 54

Conclusion 55

CHAPTER 3 – SCIENCE AND TECHNOLOGY TRENDS 63

Introduction 63

Globalization of Science and Technology 64

Affordability of Technology 67

Additive Manufacturing 68

Socio-technical Networks. 70

Cloud Computing 71

Evolving Sensing & Analysis Technologies. 73

Extension of the Human Frontier	74
Technological Surprise	77
Conclusion	79
 CHAPTER 4 – MILITARY TRENDS	 85
Introduction	85
The CAF Approach to Operations.	85
Historically Consistent Trends	86
The Canadian Armed Forces	86
Coalition Operations	86
The Defence of Canadian National Interests	87
The Character of Future Armed Conflict	88
War & the International System	88
Future Conflict	92
Weapons Proliferation	96
KEY TOPIC: Weapons Proliferation	97
Technological Adaptation	100
Non-State Actors	101
Armed Non-State Actors – Adversarial	101
KEY TOPIC: Radicalization, Extremism and Terrorism	102
Armed Non-State Actors – Non-Adversarial	103
Non-Governmental Organizations (NGO).	104
Flexibility	104
Rationalization of Capabilities to Available Resources.	105
Future Conflict and the Law	108
The Future Operating Environment (FOE)	109
Natural Geography.	111
Geographic Chokepoints.	111
Urban Terrain and Human Geography	112
Maritime and Littoral Regions	112
Global Commons	115
Conclusion	118



CONCLUSION 127

SUMMARY OF MILITARY IMPLICATIONS 129

METHODOLOGY 139

GLOSSARY 141

LIST OF ACRONYMS 147

BIBLIOGRAPHY 151



FOREWORD

I am pleased to present *The Future Security Environment 2013 – 2040* for use by the Department of National Defence (DND) and Canadian Armed Forces (CAF) Force Development Community. It is with the recommendation of the Defence Policy Committee that I endorse this document.

The Future Security Environment (FSE) examines current and past trends with the intent of providing context to DND/CAF strategic level long-term Force Development activities.

Initiated by a Vice Chief of the Defence Staff Directive issued in October 2012, the FSE is an internal publication that will serve force development purposes by maintaining a baseline view of current and emerging geopolitical, economic, environmental, social, science and technology, and military trends. As an internal document, it is not endorsed by the Government of Canada and is meant solely to stimulate Force Development discussions. It is designed to serve as a starting point for the Force Development Capability Based Planning (CBP) cycle.

The FSE does not predict the future, nor does it prescribe capability requirements. This document is not a DND/CAF policy document. It neither replaces near-term intelligence or regional analysis nor does it provide threat or risk analysis. The FSE does not speculate on who future adversaries may be or their potential objectives.

This revised edition is grounded in thorough research to ensure that identified trends were rigorously substantiated. The non-prescriptive military implications contained herein should encourage discussion and, when necessary, more detailed analysis in follow-on CBP activities. The collaborative approach taken in the formulation of this document sought to generate transparency through constant engagement with stakeholders. I believe this to be a major strength of this FSE.

I encourage all to read this document and consider contemporary trends, their potential implications and to consider how we may better prepare the CAF for the challenges of tomorrow.

D. Michael Day
Major-General, Chief of Force Development



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The successful completion of this document was made possible because of the DND/CAF stakeholders who participated throughout the process. The stakeholders illustrated patience and commitment while examining several iterations of each chapter as the document evolved. Stakeholder expertise is evident in the document because they provided suggestions, advice, reference material and sections of text. The relationships built while the FSE document was prepared were important to this effort and will continue to be leveraged for all similar projects within the Chief of Force Development organization.



EXECUTIVE SUMMARY

Introduction

The purpose of the *Future Security Environment* (FSE) is to provide a pragmatic assessment out to 2040 of trends significant to security and defence in order to inform Canadian Armed Forces (CAF) Force Development (FD). For many decades, three enduring roles have been assigned to the CAF to support the Government's broader national security and foreign policy objectives: Defend Canada by operating across the length and breadth of Canada as necessary; be a strong and reliable partner in the defence of North America; and, contribute to international peace and security by making meaningful contributions to expeditionary operations. These roles imply that the CAF must be able to undertake operations ranging from the provision of humanitarian assistance to the employment of combat capabilities against any adversaries that may seek to threaten Canada's national interests. Thus, the preparations required to fulfill these tasks assigned by the Government of Canada (GoC) are bound to be challenging. This document is meant to help address that challenge by identifying and analyzing trends relevant to defence and security. To achieve this, the document is divided into four chapters: Geopolitical trends, Economic, Environmental and Social trends, Science and Technology trends, and Military trends.

Geopolitical Trends

The process of globalization continues to be the major common factor affecting geopolitical trends. Globalization has contributed to the diffusion of power amongst states. A primary effect of this has been the evolution to a more multi-polar international balance than that of the period from 1945-1991. The United States will likely remain the only state able to project power and influence events on a truly global scale. However, others such as China, Russia, and India will wield sufficient power that their actions will be able to affect much more than regional issues and events. Although trans-national non-state actors will continue to be able to influence the outcomes of some events there is currently no obvious alternative to the system of nation-states that has characterized geopolitics for more than 300 years. The processes and effects of globalization have also led to a much more global level of economic interconnectedness than in the past. Despite this, state versus state conflict will take place, but the likelihood of such conflict occurring between major powers is low and those amongst less influential states is not likely to be lengthy

or of sustained high intensity. Instability will likely occur in regions where national interests and spheres of influence overlap and in areas where governance is fragile or ineffective. In this challenging environment, Canada may be required to employ its armed forces to protect both its sovereignty and to promote its national interests. The GoC will almost certainly continue to promote alliances as necessary to assist in the achievement of strategic aim. The US will remain Canada's closest ally and the key partner in such alliances but Canada's global interests will likely see the further development and establishment of new relations with other partners. Therefore, the CAF must be sufficiently flexible and adaptable to work with both traditional and non-traditional partners.

Economic, Environmental and Social Trends

When considered in conjunction with the geopolitical, scientific, and technological trends discussed in this document, it becomes clear that the effects of globalization and issues such as the availability of certain natural resources, demographics, and urbanization might ultimately have repercussions on how military forces are funded and staffed, where those forces might operate, in what kind of conditions, and to a degree, perhaps why. Economic, environmental, and social trends are unlikely by themselves to be the trigger of conflict but such issues may magnify wider drivers of instability, such as weak governance, that have the potential to make instability and conflict more likely. The diffusion of economic power and the interconnected nature of the global economy suggest a lower likelihood of major or widespread conflict. However, the competition for non-renewable resources may, as in the past, exacerbate political tensions between states. The general trend of urbanization and the migration of people searching for employment or security from conflict may create pressures in areas where governance is fragile or not sufficiently robust to handle the strain such trends may place on state resources. Cyclical demographic trends such as youth bulges that occur in these same regions have the potential to contribute to instability if the availability of employment, education, and general opportunity is limited. In the past, Canada has contributed military forces to international actions meant to help assure political stability and the maintenance of global trade. As Canada's prosperity is tied to the ability to trade in goods and services, it is highly likely that the CAF will be called upon to execute similar missions in the future.

Science and Technology (S&T) Trends

The most salient S&T trends likely to impact the future operational environment and influence DND/CAF capability requirements out to the 2040 timeframe are: the



globalization of S&T; the affordability of technology; additive manufacturing; the emergence of socio-technical networks; cloud computing; evolving sensing and analysis technologies; the extension of the human 'frontier'; and, the potential for technological surprise. The broad diffusion of scientific and technological knowledge, the relative affordability of technology, and the ever-greater reliance on networks and sensors is rapidly leading to a situation in which it may prove increasingly difficult to ensure both the security of military systems and broad technological advantage over future adversaries. There will be an increased potential for cyber security problems but such issues will be shared by both advanced and developing militaries. Scientific and technological advances illustrate the huge potential of S&T to generate opportunities and risks. Organizations that are agile enough to seize technological opportunities when they arise will be able to develop new means to increase and maintain capability advantage and to deter and defeat adversaries.

Military Trends

The final chapter considers the implications of the analysis conducted throughout the document. The CAF, when called upon to help ensure Canada's interests, will most likely conduct expeditionary operations in a coalition context. As an important part of the GoC comprehensive approach to conflict resolution, the CAF will have to remain able to operate across the whole spectrum of conflict. Weapons proliferation will allow more actors, including adversarial non-state actors, to forcefully attempt to promote their own interests and potentially hinder successful conclusions to allied military campaigns. The trend of urbanization and the requirement to minimize collateral damage during many military campaigns suggests that the evolution towards ever more precise weapons will continue, but that the ability to generate mass will also remain important. The requirement for precision in all aspects of military operations indicates that the reliance on space based or space enabled systems and the cyber domain will only increase. Given these and additional factors it is clear that militaries must be adaptable and flexible in order to face the uncertainties of the future operating environment (FOE).

Conclusion

The analysis of trends conducted within this document has identified a number of major and overarching conclusions. Firstly, economic, political and military power will be more diffuse than in the recent past. Secondly, sophisticated scientific and technological knowledge will be available to more people and states. Lastly, while trans-national non-state actors will not replace states as the principal political



agent in the international system, they will continue to influence events. In summary, the fielding of flexible and adaptable forces will require a training and professional development system that can react rapidly and efficiently to ensure that CAF members are physically and intellectually prepared for the challenges they may face.



INTRODUCTION

The purpose of the *Future Security Environment* (FSE)

The purpose of this document, which supersedes the original Future Security Environment (FSE) published in 2009,¹ is to provide a pragmatic assessment of important trends to inform Canadian Armed Forces (CAF) Force Development (FD) over the period to 2040.² Specifically, the intent is to provide security environment context for long-term Force Development. It is but one of a suite of documents meant to inform Department of National Defence (DND) and CAF efforts to prepare for the future.³ It is only meant to provide context for internal activities and does not represent an approved Government of Canada view of long term security environment issues.

The CAF exist to protect Canada and Canadians and to support the Government's broader national security and foreign policy objectives. Three enduring objectives stand out; the CAF must deliver excellence at home, be a strong and reliable partner in the defence of North America, and be capable of projecting leadership abroad by making, when required, meaningful contributions to operations overseas.⁴ Each of these presents an array of challenges that the CAF must meet in the coming decades if the domestic security of the country and its interests abroad are to be assured. Indeed, Canada exists within a complex and mutable global environment that will continue to present very real security challenges in the coming decades; some of these challenges are known and some are not. Defence is therefore presented with a dichotomy: the future cannot be predicted with certainty yet analysis must occur if the CAF is to be adequately prepared. To help prepare for the future, the FSE identifies those enduring and emerging trends most likely to influence the conditions leading to, and the character of, future operations.

The requirement to be prepared to conduct these operations will endure because, in an uncertain world, developments abroad can have a profound impact on the safety and interests of Canadians at home.⁵ However, providing clarity for what types of uncertainty may affect future military operations is difficult to achieve. Often, this problem can be broken down into a few core questions: Who are the likely adversaries? Where might conflict occur? Why would conflict come about? In sum, what are the likely key characteristics of future conflict? These may seem to be intractable questions and complete answers are unlikely, but steps can be taken to

provide at least partial answers to the questions. It is here that the FSE places the weight of its analysis in order to provide an increased level of understanding for the defence institution of likely future challenges, within a global context.

The FSE has four chapters: chapter one covers geopolitical trends, chapter two explores economic, environmental and social trends, chapter three discusses current trends in science and technology, and chapter four covers trends in military affairs. Chapter one is arrayed to provide a broad geopolitical context of trends that overarch the more specific topics covered in the chapters that follow. The concluding chapter will provide a summary discussion of conclusions and discuss, as a whole, the implications for the DND and the CAF. All the chapters are inter-related and to properly gauge military implications the reader must consider the topics as a whole. Indeed, failure to view the FSE as an inter-related whole would lead to erroneous conclusions.

This document has been tailored to the needs of strategic level force development and is not intended to inform nearer-term planning or policy development. This document does not comprehensively cover all possible trends or ‘alternate futures’ that may occur in the future.⁶ Rather, the topics and trends discussed have been selected for their salience, bearing, and import to Canadian security, defence, and military challenges. The document does not speculate on potential future trends as such an exercise would necessarily rest on minimal evidence. Trends are only identifiable from events that have occurred. As such, some of the trends discussed below are rooted in many decades, if not centuries, of history whilst others have more recent origins. Pragmatic constraints have also dictated that the detail provided is not exhaustive, however those requiring in-depth information are recommended to explore the sources that buttress the analysis. Finally, this document is not a threat, risk, or intelligence analysis. It therefore does not speculate on who future adversaries may be nor their potential objectives. Beyond noting current adversaries, any attempt to discern who might act against the interests of Canada in the 2040 timeframe would rely on a negligible evidentiary foundation. Neither should this document be seen as a guide to CAF contingency planning. In short, this is a survey document that provides analysis and military implications of current trend trajectories of importance to Force Development.

NOTES

1 Government of Canada, “The Future Security Environment 2008-2030,” Part 1: Current and Emerging Trends, National Defence, Chief Force Development, Ottawa, 2009.

2 As a strategic planning activity, Force development (FD) is a part of a continuum of strategic level planning tasks that ultimately allow the Department of National Defence and Canadian Armed Forces to



execute the mandate set by government. This is “the link between the policy of [government] and the operational designs of its armed forces. In the ideal model of civil military relations, the democratic head of state sets out his or her policy, and armed forces coordinate the means to enable its achievement.” Hew Strachan, “The Lost Meaning of Strategy,” *Survival*, Vol. 47, No. 3, October 2005, p. 52.

3 In particular, this FSE will drive the development of Force Development (FD) scenarios that will cover the full spectrum of operations in accordance with Canada First Defence Strategy (CFDS).

4 These enduring objectives can be identified in all Canadian National Defence Policy since 1945. For further information see “Canada’s National Defence,” Vol. 1 Defence Policy, Edited by Douglas L. Bland, School of Policy Studies, Queens University, Kingston, 1997. Also see extant policy direction: Government of Canada, “Canada First Defence Strategy,” Ottawa, 2008.

5 Government of Canada, “Canada First Defence Strategy,” Ottawa, 2008, p. 6.

6 An alternative future is a logical, coherent, detailed, and internally consistent description of a plausible future operating environment. The trends portrayed in this document represent what is assessed as the most probable evolution of the future security environment.



CHAPTER 1

GEOPOLITICAL TRENDS

Introduction

Geopolitics concerns the distribution of power among states in the international system, particularly in relation to the interplay of politics and geography. Geopolitics involves both bilateral and multilateral relationships between and among states, including groups of states coordinating efforts to further common interests. However, because perceptions of threat and security are subjective, fluctuations in state power and attempts to further strategic interests often lead to friction and in some instances, to armed conflict.

State power and, by extension, the behaviour of state governments, is also influenced by political and strategic culture, material resource availability, economics, and geography.¹ Simply put, the power of a state, or its ability or capacity to do something, act in a particular way, or direct or influence the behaviour of others or the course of events, is influenced by many tangible and intangible factors.² Given the many dimensions of power and those factors which must be considered in any calculus of it, there should be little surprise that uncertainty represents a central and enduring feature of the operational environment as well as a fundamental reality for strategic-level decision-makers.

Geopolitical trends are often based on comparative calculations of state power but, due to the number of factors contributing to or limiting state power, such calculations can be notoriously difficult and frequently inaccurate. Although simple explanations, such as the “DIME” (Diplomatic, Informational, Military, Economic)³ or “PMESII” (Political, Military, Economic, Social, Infrastructure, Information)⁴ constructs are often used to explain the essential components of state power, such constructs fail to properly account for the intangible character of many variables affecting state power and the vagaries of human behaviour. For example, the interconnectedness and interdependence engendered by globalization has become a defining characteristic of contemporary global economic and financial activity. This complicates efforts to quantify and calculate state power, attempts to forecast the behaviour of state governments, or potential future events.⁵ Thus, the problem being grappled with in this chapter, that of attempting to gauge current trends to discern geopolitical conditions out to 2040 is, at the outset impossible to do with precision or any certainty. Thus, caution must be exercised in extending identified

trends to linear conclusions. However, the trends identified and discussed below will offer some insights to those tasked with considering future defence force planning requirements.

This chapter will provide a pragmatic analysis of current geopolitical trends of greatest relevance to the DND and the CAF. One fundamental assumption upon which we can rely with certainty is that the state will remain the principal political agent in the international system out to 2040. This assumption does not assert that non-state actors or international organizations will not be important, simply that there is nothing to suggest a viable alternative to what is commonly referred to as the Westphalian system.⁶

Relative Distribution of Power

Generally speaking, one result of globalization is that economic power is now more diffuse than in recent decades and that the increasing diplomatic and military power available to rising regional powers suggests a trend towards a more multi-polar international system.⁷ The longer term consequences of this are, at present, uncertain. Structural weaknesses in key rising economies, most notably China, India and Brazil, global economic interdependence and interconnectedness, and the impossibility of truly calculating the latent cultural, intellectual, and other aspects of United States (US) (and Western) power mean the geopolitical situation will remain fluid and difficult to discern out to 2040.⁸ Adding to this already complex environment, non-state actors, some with very sophisticated strategic outlooks and advanced financial and technological means, might also increasingly possess capabilities to challenge existing governments. In some cases, it is conceivable that they might be able to influence the relative distribution of power on the global stage.⁹

The current fluctuation of power within the international system will result in increased geopolitical competition, including amongst regional actors.¹⁰ In many cases, this will result in an intensification of efforts to obtain favourable diplomatic advantages or it will be expressed in terms of economics. Although trends suggest that the likelihood of war among the major powers has declined, major shifts in the balance of power have historically been accompanied by systemic conflict.¹¹ Therefore, given the degree of uncertainty that will accompany the flux that the international system is now experiencing, armed conflict cannot be excluded as a possibility. Much will depend on future assessments by governments of the likely costs associated with a resort to armed force to resolve disputes (as well as, in some cases, the costs associated with not doing so). At this point, it seems probable that mutual interests



will obviate large-scale conventional conflict between major powers.¹² However, crises, miscalculations and conflicting national goals are inevitable, and war between states can never be ruled out.¹³

The nature of geopolitics makes it inevitable that state spheres of influence will abut one another and may overlap. Overlapping spheres of influence and sometimes competing national interests can generate frictions that have the potential to develop into regional or international crises. Such situations can be currently witnessed between Japan and China, competition amongst China, Iran, Pakistan, India, and others for influence in Central Asia, and the potential for misunderstanding over the dangerous situation on the Korean peninsula. It is in such geographic areas, where influence is contested, that the potential for conflict between states can be high. Some of these areas may coincide with areas where states with weak or failing governance exist, exacerbating the potential for misunderstanding and increasing the likelihood of conflict. Thus even in an emerging multi-polar world it can be seen that many important states tend to more or less align in various ways with the major powers. In the current era these powers are the US, European Union (EU), China, and Russia.

MILITARY IMPLICATION

1 Fluctuations in geopolitical power and the increased diffusion of economic power has the potential to cause friction between competing states. However, the potential for sustained conflict between major powers is lessened by the very large degree of interconnectedness and interdependence that currently characterizes the international system. States will use all their instruments of power to ensure their own sovereignty and pursue their own national interests. As an instrument of Canada's national power, the CAF must be able to deploy globally, often in unstable areas to contribute to the Government's foreign policy and national security objectives in order to defend Canada and Canada's interests.

For purposes of this document it is impractical to examine all actors, or states, that will influence the geopolitical environment out to 2040. Yet a brief examination of identified global powers, and other significant actors, allows the geopolitical environment to be expressed in terms that will benefit the defence institution. An examination of wider trends, all of which will affect the emerging geopolitical environment to various degrees, is conducted in separate chapters.

Major Global Powers

The United States

While the US, because of the ability to project power to every region of the globe, will most likely remain the pre-eminent military power in the coming decades, it is also likely that the gradual increase in Chinese, and regeneration of Russian diplomatic and military power will increasingly constrain US freedom of manoeuvre in the political, economic, and military fields.¹⁴ Moreover, the current constraints the US faces, such as political polarization or fiscal balance challenges, could continue and restrict the use of its national power.¹⁵ However, much of the current US malaise is self-induced and the US itself possesses the means to address many of the constraints it faces.¹⁶ Thus, no suggestion is being made that the US is in a state of inevitable decline. Rather, it is to point out that the myriad factors contributing to the totality of a state's latent or potential power, not to mention the historic resilience of the US, make any firm supposition on the timeframe or characteristics of a recovery from current circumstances impossible. It is extremely unlikely that the US will willingly concede its dominant position in the face of other rising international challengers.¹⁷ It follows therefore that if the US is able to redress its sustainability issues, the longer-term projections will be substantially different than some trend analysis suggests. Moreover, to counteract potential geopolitical constraints, the US will almost certainly continue to strengthen its key alliances by maintaining and building partnerships and by seeking to develop innovative ways to sustain global US presence and power.¹⁸

The US, and indeed the entire international system, benefits from global stability and while it may become increasingly selective when and where it engages militarily, many countries will continue to look to the US to provide leadership when crises arise. However, the ongoing fluctuations in the geopolitical balance of power suggest that effective containment and mitigation of crises will require shifts in US global posture and presence. Recent US Department of Defense (DoD) strategic guidance reflects this and notes that enduring planning priorities will require the US to continue to work closely with its allies, possess a smaller and leaner joint force that is increasingly agile, flexible, ready to deploy, innovative and technologically advanced in order to sustain US global leadership in the 21st century.¹⁹

Such a stance is accompanied by serious problems though, with perhaps some of the most significant tied to the capability of the US Navy (USN) to underwrite US strategy. It is historic fact that sustained global economic growth requires largely unfettered access to international waters.²⁰ The US role in enabling access to the



maritime component of the global commons cannot be overstated. As one expert has written: "American maritime strategy has played a major role in binding together the international system that US foreign policy has aimed to establish since the beginning of the twentieth century."²¹ Since 1945, when, broadly speaking, US national defence considerations became a function of international order, and in the absence of any others able to do so, US naval capabilities became critical to upholding that order.²² As a major component of US power, the USN alone provided "the potent combination of mobility, flexibility, striking power, and logistical staying time for the task of international policeman."²³ "An overwhelming ability to successfully project power worldwide" by means of the USN meant that, throughout the latter half of the twentieth century, Washington could dominate just about any region of strategic interest.²⁴ US power projection, support to allies, deterrence of adversaries, humanitarian intervention and disaster relief – all components of US naval policy – are dependent upon the command of the maritime global commons. Thus, "freedom of the seas is the central planning assumption for the conduct of US overseas ground, naval, and air operations."²⁵ The problem is that the fiscal pressures affecting US defence budgets combined with things such as sustained high operational tempos, aging platforms, and other issues combined with the development or expansion of many state coastal naval forces, powerful regional navies, and Chinese and Russian general military and blue water naval capabilities suggests that the ability of the US to guarantee unchallenged access to international waters might be ending.²⁶ In traditional regions of US interest that are predominantly maritime, such as the Western Pacific, these trends have potentially critical implications for relations with, and the security of, US allies that rely on US security guarantees to buttress their national interests.

Despite this, it remains reasonable to assume that in the coming decades, the US will remain the single most powerful actor in the international system. It will probably continue to be the single largest national economy within the forecast time horizon, its aggregate military capabilities will be unrivalled, and its global influence will be unparalleled.²⁷ However, the US ability to act will, in comparison to the period from 1945 to approximately 2000, be more constrained.

As Canada's largest trading and most significant defence partner, the close, indeed, inextricable, social, economic, and political linkages between Canada and the US will endure.²⁸ Due to these geographical and historic socio-cultural and economic ties, Canada will continue to maintain a unique position as a key ally of the US. Bi-national defence agreements between the two countries will continue, primarily under the banner of continental defence epitomized by NORAD.²⁹ The decision to renew the NORAD agreement on a permanent basis demonstrates a long-term commitment by

both Canada and the US to the joint defence of North America. The enduring nature of NORAD will continue to strengthen the already extensive relationship between the two countries. In a larger context, Canada and the US will continue to be active members in the Five Eyes intelligence community which includes Australia, Canada, New Zealand, the United Kingdom (UK) and the US.³⁰

MILITARY IMPLICATION

2 Ensuring Canada's sovereignty and defending the North American continent are two separate tasks assigned to the CAF.

3 The future defence of North America will continue to require permanent bi-national CAN-US defence arrangements as part of the overall continental security architecture. Thus, combined-joint interoperability with US armed forces, along with continued mature institutional ties will be necessary to ensure that US and Canadian military forces are able to interact seamlessly.

4 While the US interest in upholding the freedom of the global commons is not likely to change in the near to mid-term, the reduction in forces will increasingly tax the military and place a new emphasis on Washington seeking international cooperation.

5 Interoperability with the US will place burdens upon CAF Force Development (FD) to ensure future capabilities the ability to integrate with its armed forces despite the continued development of innovative and technologically advanced military capabilities. Interoperability with the US will remain a primary consideration for CAF FD to facilitate integration with US forces on operations.

European Union (EU)

The countries comprising the EU, and other like-minded states, will continue to be affected by the diffusion of geopolitical power within the international system. The Euro zone crisis that began in 2011 and other fiscal challenges highlight some of the fundamental issues affecting the EU endeavour, suggesting that there still exists an inherent tension between national self interest and the compromise borne of belonging to a supranational entity. Indeed, the EU is currently at a crossroads and faces the potential consequences of further political and economic integration or possibly a breakup of the monetary union. Even in the event of greater EU integration, such integration will likely require the passage of considerable time to truly temper nationalism to the point where deeper political union and a European constitution are possible.³¹



Regardless, levels of national debt will almost certainly continue to have profound consequences for the EU over at least the next decade.³² Additional stresses such as declining birth rates and an ageing population will impact the EU which, unless balanced by significant immigration or migration, will result in a shrinking tax base.³³ The possible outcome of such stresses, when balanced against the requirement for many EU states to maintain expected levels of social welfare, may see further discretionary budget cuts in areas such as defence. In the absence of a significant economic recovery, such pressures may limit the ability of the EU to match foreign policy ambition with national priorities.

It is unlikely that European security initiatives such as the European Security and Defence Policy and European Security Strategy will displace the North Atlantic Treaty Organization (NATO) as the primary instrument of collective defence in Europe. However, the EU seeks the capacity to conduct independent crisis management, and will almost certainly continue efforts to do so.³⁴ Moreover, 21 of the EU 27 states are NATO members and therefore the pool of military resources made available to EU defence corresponds almost exactly to those offered to NATO, meaning that European military capacity is not enhanced to any significant degree. The core EU states may be reluctant to take steps that would marginalize NATO as, even if only as a last resort, the individual members tend to use the organization as a means of furthering their individual interests.

Traditionally the most powerful countries within the EU, the United Kingdom, France and Germany will continue to significantly influence and shape future EU foreign policy direction and any actions taken to implement that policy. Several factors differentiate these nations from the remainder of the EU bloc; they are the only truly global actors among the 27 partner nations, because they possess sufficient weight to influence developments and they are able to be less reliant on multilateral institutions should the government so choose. Together, they represent more than 40% of the EU's population,³⁵ almost 50% of its GDP³⁶ and almost 60% of the EU's military expenditure.³⁷ They have the largest, most capable and most expansive diplomatic networks³⁸ available to the EU.³⁹ Given the delicate balance between national priorities and EU commitments which may be increasingly stressed for the next decade and beyond, these states will almost certainly continue to remain significant actors in their own right on the international stage. However, it is likely that their power will come under increasing pressure through economic and diplomatic challenge from rising powers.

MILITARY IMPLICATION

6 Interoperability with European countries will continue to be fostered by Canada's NATO commitment. However, the impact of reduced defence spending among NATO countries will continue to reduce interoperability and challenge joint-combined operations. Nevertheless, the UK, France and Germany will likely remain the most influential countries in Europe. The CAF continued priorities on interoperability could remain the US, NATO, and the Five Eyes community.

China

The impacts of China's recent phenomenal economic growth will almost certainly help to define its future defence policies. Generally speaking, Chinese defence policy states it is committed to a peaceful rise and a rules-based multi-polar world in order to foster a security environment conducive to China's peaceful development.⁴⁰ The Chinese growth in national and international power is fundamentally based on its economic growth, which itself has been driven by the characteristics of globalization (see Chapter 2). In particular, Chinese growth has been predicated on the partial transition from a command to market economy, the inflow and outflow of foreign direct investment, demand for Chinese manufactures, the maintenance of large foreign currency reserves, and the controlled valuation of Chinese currency. Therefore, China is unlikely to jeopardize its rise and economic might by entering into a sustained military conflict with existing powers.⁴¹ As a consequence, sustained conflict that disrupts the globalized economic core will likely be viewed as more of an obstacle rather than the path to economic prosperity.⁴²

Historically, China has had broad international interests. In the current era, furthering those interests has been the result of a multifaceted strategy predicated on economic success, policies meant to enable the latent potential of its people, and the development of military capabilities. Traditionally the main elements of Chinese diplomatic efforts have been offering states aid and development funding, expertise to build (but not necessarily operate or maintain) infrastructure, military exports and some access to domestic Chinese markets.⁴³ In exchange, Chinese influence has been increased by ensuring greater diplomatic allegiance of recipient countries, access to natural resources and the opening of markets for Chinese investment. China has repeated this pattern in South Asia, Africa, Latin America, the Caribbean, and throughout the Pacific. This is a trend that is likely to continue in the coming decades as Chinese growth continues.



China's rise is, however, challenged by internal complications such as growing levels of inequality, regional imbalances, a migrant labour crisis, increasing wages, extraordinary environmental degradation, corruption and the absence of institutional checks and balances; all of which may combine to present significant socio-economic problems.⁴⁴ Not the least of the issues are those related to demographics—an aging population and the consequences of the 'one-child' policies. Indeed, the ability of the Chinese government, meaning, the Communist Party of China, to address or at least control some of these very significant problems is critical to the party's ability to maintain legitimacy with the population. However, if current trends persist and China is able to successfully address or mitigate at least some of these issues it will likely surpass US Gross Domestic Product (GDP) by 2050.⁴⁵ If such assessments are correct, China will almost certainly have cemented itself as an enduring global power. Thus, even with these challenges, the question regarding the rate of China's economic development is one of degree of growth rather than a question of sustainable growth itself. This means that China will continue to increase its global diplomatic, financial, and economic influence and that such development will also allow significant opportunity to fund the enhancement of its military instrument of power.

While it is difficult to fully gauge China's military ambition, there is no doubt that it seeks to exert greater regional influence. China will continue to develop military capabilities specifically meant to create conditions that will limit US ability to act in the Western Pacific. Specifically, the development of integrated anti-access/area denial (A2/AD) capabilities (discussed in Chapter 4) and the "long-term comprehensive military modernization program designed to improve the capacity of its armed forces to fight and win short-duration, high-intensity regional military conflict" have the potential to alter the decades-long security balance in the region.⁴⁶ The purpose is to appreciably increase Chinese regional influence by possessing military capabilities greater than those of its regional neighbours and, more fundamentally, to "raise the cost of power-projection operations in the Western Pacific to prohibitive levels, thereby deterring any American effort to meet its defence obligations to allies in the region."⁴⁷

Evolving Chinese military capability and the concomitant increasing difficulty of the US military to maintain presence in the region have enabled much greater assertiveness by the Chinese government. The decades-long disputes between states bordering the South and East China Seas continue to pose intractable problems and have led to recent confrontations between vessels and groups from China, Japan, Vietnam, South Korea and the Philippines.⁴⁸ Rivalries in the region, particularly over

resources, have led to numerous “policing incidents, military clashes, and arrests of fishermen.”⁴⁹ Chinese interpretation of international law and, in this case, particularly the law of the sea is both a function and result of increasing Chinese strength. The manner in which states adhere to or employ international law tends to be a reflection of power. Since ratifying United Nations Convention on the Law of the Sea (UNCLOS) in 1996 China has interpreted UNCLOS provisions, specifically those regarding Exclusive Economic Zones (EEZ) in a manner it deems necessary to ensure national interests are safeguarded. However, this interpretation asserts the right to restrict access and activities within its EEZ and the right to enforce Chinese interpretation of these provisions.⁵⁰ One assessment of this is that “Beijing has the most expansive security and sovereignty EEZ claim on the planet.”⁵¹ The point to be taken here does not regard international maritime legal regimes; the point is that China feels sufficiently confident to assert itself in such a unilateral and potentially confrontational manner. Therefore, while these tensions are not likely to lead to large-scale regional war, it seems likely that the general character of the dispute on and around the disputed claims will continue.⁵² The tensions that have resulted from these issues will shape the future of the regional security environment in much of the Asia Pacific region.⁵³

Taiwan’s contested status will continue to be a significant variable in regional security that also has larger security implications.⁵⁴ Indeed, there is little to suggest that the Taiwan issue will not continue to be the preeminent Chinese diplomatic and defence policy planning issue. Many analysts believe that the growth in the Chinese Navy is, in large measure, informed by a desire to prevent the US from projecting power into the Taiwan dispute.

In addition to developing military capabilities for specific regional purposes, it is expected that, in the coming decades, China will continue to bolster its force projection capabilities, particularly through continuing diplomatic efforts to gain port access for naval purposes.⁵⁵ This, in concert with the further development and refinement of naval capabilities, will allow China to project power throughout more of the Asia Pacific region than in the past.⁵⁶ Therefore, although geopolitical trends do not indicate that a multi-polar world will lead to an arms competition similar to that during the Cold War, it is probable that China will continue to demonstrate, and buttress, its increasing influence through the deployment of scaled military forces around the world.



MILITARY IMPLICATIONS

7 Increasing Chinese influence will alter the global balance of power in the coming decades. China could be a challenger to the global pre-eminent position of the US in the longer term; primarily through increased economic influence which it will almost certainly use to support its national interests. At the very least, China will remain a regional challenger to US military power in the Asia-Pacific region.

8 Regardless of the actual rate of Chinese growth and influence, or the evolution of its security and defence capabilities out to 2040, it is clear that the Asia-Pacific region will be of increasing geo-strategic importance. Therefore, the CAF could be required to project and maintain forces in that area as it may serve future GoC interests.

9 China may increase its deployment of forces for a variety of reasons such as protection of their EEZ, humanitarian operations, or even stability operations. The CAF could be required to operate alongside, or within the same geographic regions as the Chinese armed forces.

Russia

By virtue of its geographic size, positioning astride Europe, Asia, and the Arctic, historic military accomplishments, and latent potential, Russia has, for several hundred years, exerted influence on global affairs. For various reasons, the extent of Russia's influence has fluctuated over time. The current regeneration of Russia's influence is the result of a number of factors, not the least of which is high global natural resource commodity prices. Indeed, Russia's oil and gas resources have given it considerable leverage among its neighbours. Russia has successfully employed the energy dependency of others as a means of achieving economic and political influence in the past and will likely continue to do so.⁵⁷ Yet, this trend may not persist. *The World Energy Outlook 2012* by the International Energy Agency suggests that "the global energy map is changing" due to the emergence of new extraction technologies and methods that have the potential to reduce some of Europe's dependence on Russian energy sources.⁵⁸ Nonetheless, Russia will remain a global power wielding significant influence on international affairs out to 2040.

Current demographic trends may prove problematic for Russia. The country faces a disturbing decline in the health of its population.⁵⁹ Endemic corruption, woven into many of the governance systems that precipitated the construction of the 'new' Russia may remain an impediment to the resurgence and growth of Russian power and influence.⁶⁰ Indeed, an important uncertainty is the degree to which the Russian political climate will

shift towards or away from democratic principles. However, historical precedent and its position as both a regional and a global power mean Russia will remain concerned about the influence it possesses on its periphery.⁶¹ Lying within a geographical area that Russia views as its traditional sphere of influence, political developments within Ukraine, Belarus and the Trans-Caucasus are closely monitored by Moscow. On occasion, events have led to direct intervention by Russia such as in Georgia in 2008. These trends suggest that the character and manner of Russia's response will be proportional to the perceived threat from those countries within its traditional sphere of influence.⁶²

Russia will almost certainly continue to make efforts to bolster its military power, indeed Russian government statements show manifest desire to modernize its military forces. Concurrent with modernization and professionalization initiatives, Russia will almost certainly continue to seek defence and security technological advancements in an attempt to maintain at least a perceived military parity with Western militaries.⁶³ Despite the global economic crisis that began in 2008, Russian defence budgets have steadily increased in recent years and, if the demand for Russia's resources remains firm, this trend will likely persist.⁶⁴ However, a stated goal of the Russian state arms program to achieve 70 percent new weapons and equipment for the military inventory by 2020 appears to be a target that is "increasingly unrealistic."⁶⁵ This is because the Russian defence industrial enterprise, while still able, in certain cases, to design and produce advanced weaponry, is burdened by inefficient processes, low productivity, obsolete manufacturing tools, and a dearth of specialized scientific defence expertise.⁶⁶ These are either legacy problems remaining from the Soviet era or the result of uncertain or very low state investment in the years after the collapse of the Soviet Union. It is plausible to assert that Russia's continued objection to US missile defence programs is partly the result of its technical and financial inability to directly counter that program. In the Arctic, Russia, like other states, will continue to foster Arctic ambitions; indeed the opening of the Northern Sea Route will continue to allow Russia to move military vessels from one coast to the other while staying in national waters in order to reallocate forces or to escort merchant ships.⁶⁷

Russia will likely continue to utilize its military and technological expertise to bolster diplomatic and economic influence through the export of military capabilities. For example, the defence partnerships with India will likely continue. The Russian arms industry will remain an important source of weapons and military technologies for willing international customers.⁶⁸ Russian military systems will therefore be utilized by other nations, potentially passing from original state buyers onto others, or even non-state actors which will almost certainly be encountered by military forces conducting international operations.



MILITARY IMPLICATIONS

10 As Russia continues to reassert itself internationally, and since Canada has shared interests with this country, the CAF and allied forces will likely continue to encounter, or be called to cooperate with, Russian expeditionary forces on stability and intervention operations. However, Russia's ambitions are generally focused on the near abroad. As such, Russian military forces are likely to take part in operations closer to their own territory.

11 Contemporary Russian and Chinese arms sales are significant and this trend will likely continue. Therefore, the CAF will almost certainly continue to face opponents (both state and non-state actors) who possess Russian or Chinese military equipment and weapons out to 2040. Therefore, the CAF could orient its intelligence, technical analysis and Research and Development (R&D) force planning activities to consider this circumstance.

Significant Global and Regional Influencers

There are a number of countries who, by virtue of increased economic influence or their role in regional security, may figure in GoC planning in the coming decades. While the list of countries discussed in this section could be much lengthier, the intent is to highlight a number of the more significant actors to orient and substantiate emerging trends of interest to the defence institution.

KEY TOPIC: North Korea

The behaviour of the North Korean government and the stability of the country itself has been a perennial concern for North Korea's neighbours, the US, Canada and its allies. However, despite the geostrategic importance of the Korean peninsula, which is astride major maritime shipping routes, there is a dearth of public information or much understanding of the conditions within the country: "Despite recurring news headlines referring to nuclear crises, famine and food shortages, natural disasters, and human rights violations, we seem to be lacking any reasonably concrete knowledge about this nation, and we are left with a variety of judgmental and at times derogatory labels."⁶⁹

All commonly accepted scenarios for the evolution of North Korea (status quo, collapse, or reunification) would have significant implications for the region. In all of these, North Korea will represent a destabilizing factor in North-East Asia. It has been stated that North Korea is likely to be of the greatest concern to the

international community because of its conventional and nuclear capability.⁷⁰ North Korea's domestic challenges are used as evidence that it is "likely to become increasingly brittle over time and suffer political collapse, most likely resulting in a reunified Korea."⁷¹ However, its collapse is not certain; indeed few have forecasted this. Rather, the most commonly examined North Korean trend is its continued "regional military provocations; proliferation of military-related items; long-range missile development; Weapons of Mass Destruction (WMD) programs including tests of nuclear devices in 2006, 2009, and 2013." Its massive conventional armed forces are also a major concern for its neighbours and the international community.⁷²

North Korea relies heavily on international aid to feed its population.⁷³ In fact, dependence on direct Chinese economic, energy, military, and diplomatic support to North Korea is so great that any substantial withdrawal of such aid would likely result in the collapse of the government. However, given that North Korea provides a strategic bulwark against any direct US presence along the Chinese border, China has traditionally favoured policies meant to maintain the status quo. In addition, all interested parties maintain an interest in mitigating any potential collapse of the North Korean regime as such a collapse would likely lead to massive population migration towards China, South Korea, and even Japan. It has been estimated that up to 3 million would attempt to flee.⁷⁴ The humanitarian assistance problem would be significant. In the long-term, if Korea reunified it may change regional power dynamics. However, this would take decades to occur.⁷⁵

Of specific international concern is the North Korean nuclear weapons and ballistic missile development programs. The three nuclear tests it has conducted have changed the security dynamic on the peninsula. North Korea is a nuclear aspirant because it sees these weapons as "compensation for other political and security weaknesses."⁷⁶ But as a result of these tests, China has experienced growing frustration with North Korea, causing Beijing to apply various means to temper the behaviour of the North Korean government.⁷⁷ The denuclearization of the Korean peninsula will continue to be the primary objective of the international community.⁷⁸

In the short to medium term, North Korea will remain unpredictable. Diplomatic efforts will focus on minimizing the risk of conflict in North-East Asia. For as long as Canada continues to be one of the Sending States to UN Command Korea, it would also be prudent for the CAF to be cognizant that a response to a crisis in the region is a possibility out to 2040.



India

India is the largest member, in population terms, of the Commonwealth and possesses common ties with other member states, such as Canada, through shared history, language and institutions.⁷⁹ Like China, India will almost certainly continue to gain power through its economic growth. If current economic and demographic trends continue, India will be an increasingly significant power and will have almost certainly strengthened and enhanced its regional and international influence. However, India remains cautious about formal alliances or treaties as successive governments have upheld the principle that India must possess strategic autonomy through self-reliance, to both ensure independence of thought and to minimize any perceptions of threat that might be elicited in China if India were to align with any particular power.⁸⁰

As the world's most populous democracy, India faces many domestic developmental obstacles that may slow the growth of its power. Current and future difficulties include institutional challenges, economic disparity, poverty and social challenges. At the end of 2009, Indian Prime Minister Manmohan Singh described the five main challenges facing the internal security of his country in the coming decades as terrorism, naxalism, communalism, corruption, and regionalism.⁸¹ From this list, corruption ranks as one of the most challenging problems because of its potential to undermine the legitimacy of India's government and its major state institutions.⁸² While internal problems may slow India's likely rise in global influence and power, it is unlikely to disrupt its long term growth.

India intends to continue the development and modernization of its armed forces. Much of this is driven by unresolved border disputes with both Pakistan and China, and the seemingly intractable problem of terrorist activity tacitly or actively supported by elements within Pakistan. Between 2006 and 2010, India surpassed China as the world's largest importer of weapons systems, reflecting the country's intent to modernize its armed forces and project military capabilities beyond the subcontinent. It is expected to maintain this position in the coming years, with plans to spend an estimated \$80 billion on military modernization programs by 2015.⁸³ India's military capability is presently heavily reliant upon foreign systems and technology, but its ability to develop advanced indigenous military equipment will almost certainly improve by 2040. The Indian Ministry of Defence has stated that the country's economic wellbeing is the foundation of its future military strength and that, by extension, India's ability to assure open sea lines of communication to facilitate trade is fundamental to the development of military capabilities.⁸⁴

MILITARY IMPLICATION

12 India has substantial challenges to overcome in the coming decades. However, it will likely continue to assert its role as one of the world's most influential states and, as a Commonwealth nation, could be considered a likely non-traditional partner with which the CAF may operate in the future.

Brazil

Brazil will remain the largest and most populous country in South America. The population of the country is now 196 million and it is expected to peak at 224 million in 2040.⁸⁵ Brazil's rapid economic growth, vast natural resources and dominant position on the South American continent will almost certainly continue to ensure its increased regional and international influence. It has adopted a leadership role in organizations such as the Union of South American Nations (UNASUR), the India-Brazil-South African (IBSA) dialogue forum and, more informally, with the G-77 nations.⁸⁶ However, Brazil remains somewhat challenged in attracting foreign investment, for example a World Bank index measuring how conducive a nation's regulatory environment is for business, ranks Brazil 130th out of 185 countries in 2013.⁸⁷ Additional internal problems such as crime, poverty (Gross Net Income per capita of 10 720 USD) and corruption also exist and will remain internal areas of concern.

However, Brazil is the major emerging power on the South American continent. The nation, fuelled by its economic potential, is forecast to increase defence spending and has stated a desire for permanent membership on the United Nations Security Council (UNSC); both of which indicate a desire for increased regional and international influence.⁸⁸ Internal security problems, largely related to the presence of powerful and regionally influential transnational criminal groups creating and trafficking narcotics, and latent border disputes with some neighbours, are partially driving the development of military capability. The US acknowledges Brazil's regional influence, has shown interest in warming ties and is seeking closer defence cooperation.⁸⁹

MILITARY IMPLICATION

13 Brazil is the major emerging power on the South America continent and will continue to have considerable influence in the region. Brazil's defence capabilities and influence will continue to grow out to 2040. Future CAF planning and activities in the Americas will need to consider Brazil's regional influence.



Middle East and North Africa (MENA)

The MENA region encompasses a number of established regional powers such as Saudi Arabia, Egypt, Iran, and Israel.⁹⁰ These, and the other states in the region, all exert regional influence to varying degrees. Bridging the geographic divide separating Europe, Africa and Asia, and sitting astride critical global trade routes, any instability in the region will continue to have the potential to affect wider international geopolitical and economic stability. The typical complex web of international alliances normally associated with critical regions, as well as historic cultural, political, religious and social sensitivities particular to the MENA will ensure that it remains of interest to the international community out to 2040.

Possessing diverse cultural, religious and political groupings, MENA is currently undergoing an era of significant upheaval that is challenging the foreign policies of global powers and virtually all regional states.⁹¹ (See Key Topic below) The region also continues to face numerous enduring challenges, such as the long-standing Israeli-Palestinian conflict, the presence of armed and active Islamist extremist groups, and Iran's pursuit of a nuclear research and development program with somewhat opaque goals.⁹² Longer term stability is also likely to be heavily affected by environmental and population trends. For example, MENA is one of the world's most water-scarce regions.⁹³ Although, on its own, water scarcity is an unlikely driver for inter-state conflict (See Chapter 2), it can contribute to political frictions leading to war. When combined with other factors such as population growth (especially of the youth bulge), economic disparity and poverty, it is clear that the resulting strain on water sources may heighten domestic and regional tensions.⁹⁴ Given the wide number of geopolitical, socio-economic, environmental and resource drivers that could affect MENA, it is almost certain it will continue to provide security challenges over the forecast time horizon.

KEY TOPIC: The Arab Spring and Governance in the MENA Region

The political upheaval that began in Tunisia in December 2010 and now commonly referred to as the "Arab Spring," has wrought many changes to the governance of a wide swath of states across the MENA. In the most notable cases authoritarian governments have been overthrown or challenged by prolonged insurrection. In others, governments have had to act quickly to suppress or otherwise mollify protestors seeking political change. The question at hand is what these events

signify for governance in the region over the long term, out to 2040. This question is difficult to answer given the lack of consensus amongst experts and commentators.

One opinion is that authoritarianism, with perhaps an exception or two, will persist as the predominant system of governance in the region.⁹⁵ Another is that events portend a sea change in the region that bring “new challenges and uncertainty” and “conditions that are conducive to” heavy Islamist influence in the emerging political order.⁹⁶ Others disagree with the viability of long-term fundamentalist Islamic governance, noting the generally fair elections and liberal expectations of many people in affected countries.⁹⁷ Another perspective is that the Arab Spring signifies a trend of democratization, noting the uncertainty of the outcome is understandable but a reflection of both the legacy of decades of political repression and the particularly messy nature of nascent democracy.⁹⁸ Finally, some note that the trend of authoritarian governance may finally be broken but are noncommittal in terms of outcome.⁹⁹ If commentators agree on anything it is that the variables that will influence the outcome are illustrative of the complexity of the problems in the region. These include a general lack of liberal political traditions, suppressed ethnic and religious minorities, tribalism, religious division, extremism, demographics, economic problems, and, save for certain Islamist parties, a lack of political organization. It is also likely there will be little consistency between states on how issues of governance are addressed.

Strategic forecasting is challenging even when trend indicators are strong. Moreover, the MENA region inevitably elicits such remarkably disparate assessment and interpretation of trend lines that there is no clear long term trend. The best that can be said with regard to governance in the MENA region is that a trend (authoritarian governance) has been disrupted at least temporarily. What this trend means is impossible to discern; it may very well portend greater political liberalism and a broad move towards democracy. The point is that any one of the analysts cited above might be proven correct; perhaps several will be partly so. It simply remains to be seen. At times, the best that long-term strategic forecasting can achieve is to note a broken trend and conclude that it is simply too early to tell what might come.

Iran

Iran is home to one of the world’s oldest continuous major civilisations and owes its geostrategic importance to its location in the Middle East and central Eurasia.¹⁰⁰ Its predominantly ethnic Persian population are also Shia Muslim and tend to be highly



educated.¹⁰¹ Possessing the fourth-largest proven reserves of oil and the second-largest reserves of natural gas, Iran is one of the top-four exporters of natural gas and oil in the world.¹⁰² These factors combine to create a strong sense of nationalistic pride or at least a stronger sense of identity than often attributed to the populations of other states in the Persian Gulf region.

Iran's surfeit of fossil fuel reserves suggests that its quest for nuclear capacity is based not on domestic energy concerns, but reflects regional power ambitions.¹⁰³ Iran, with nearly 900,000 regular and reserve force personnel, possesses the largest armed force in the region but this suffers from significant problems of obsolescence, serviceability, and growing technological disadvantage relative even to its Arab neighbors.¹⁰⁴ While there is some debate on whether Iran is currently developing the capability to produce nuclear weapons, and while the government's actual intentions are unknown, much analysis points to Iran certainly doing so over the long term. This suggests that Iran is in agreement with Henry Kissinger's well known argument that "by acquiring nuclear weapons, a nation becomes able to change the regional or global balance of power without an invasion or a declaration of war."¹⁰⁵ It is possible that Iran will achieve a nuclear weapons production capability in the next decade. The consequences of this are not that Iran would necessarily manufacture and employ such weapons, but in the possibility that Iran's neighbours would feel compelled to acquire similar capabilities to safeguard their own security.¹⁰⁶ As noted by one expert, "the Islamic government has been most reluctant to abandon those aspects of its ideology most damaging to Iran's national interests, notably its excessively antagonistic posture on Israel and Arab-Israeli relations, which has gone beyond the position of even radical Arab regimes, and its unwillingness to deal with the United States in an open manner and in accordance with the rules of international diplomacy."¹⁰⁷ In fact, the pursuit of nuclear weapons, Iran's uncompromising stand on the Arab-Israeli conflict, and its extremely aggressive rhetoric toward the existence of Israel, has, in the past, caused Israel to consider unilateral attack on Iran as a possibility.¹⁰⁸

Other Iranian policies, notably the sponsorship of terrorist activities, has regional destabilising effects. The US State Department has noted that recent developments have demonstrated a "marked resurgence of Iran's state sponsorship of terrorism."¹⁰⁹ Iran supports terrorism for strategic, ideological and domestic reasons. For example, Iran supported Islamist Palestinian groups such as HAMAS and Palestine Islamic Jihad (PIJ) in the late 1990s as a way of undermining the Middle East Peace Process and striking at Israel. "Iranian leaders also had a genuine desire to help their fellow Muslims in their struggle, but this sympathy paled before Tehran's strategic interests."¹¹⁰ In the near future, this tendency is unlikely to change. Therefore, in the near term,

it seems unlikely that Iran will deviate from its current course and continue to adopt “a posture of defiance toward nearly all major international players.”¹¹¹

Turkey

Turkey, due to its geostrategic location, NATO membership, and historical links with both European and Islamic cultures has considerable pan-regional political influence. Arguably, Turkey has emerged as a regional power center rivalling Israel, Iran and Saudi Arabia.¹¹² In the last decade, the Turkish economy has expanded and diversified and, while there are some worrying indicators (i.e., national debt), GDP has tripled with most of this economic growth achieved through continuing links with the EU, although it has also pushed for closer ties with Middle Eastern countries to maintain its own economic growth rate.¹¹³ Turkey has also consciously sought to play a regional leadership role due, in part, to a belief that its size and heritage make such a role appropriate. As a consequence, it has been supportive of the regime changes brought about by the Arab Spring uprisings (despite previously close relations with many of the deposed regimes) and is one of the most active governments in supporting Syria’s opposition. Depending on the longer term governance trends following the Arab Spring, it is possible that Turkey, as a regional power, may continue to involve itself increasingly in regional affairs. If this occurs, its involvement may be viewed by many regional actors as less than neutral and could be accompanied by a rekindling of old rivalries, many of which predate the collapse of the Ottomans.¹¹⁴

KEY TOPIC: The Arctic Powers¹¹⁵

Eight states, Canada, Russia, Denmark (Greenland), Norway, and the United States, as well as Iceland, Sweden, and Finland have identified primary interests in the Arctic.¹¹⁶ Natural resources and the perception of diminished sea ice coverage allowing for potential regular transit of the Arctic region by ocean-going vessels are the major drivers of current Arctic-related discussions.¹¹⁷ Politically, much of the Arctic has been subdivided without much fanfare although many territorial and EEZ claims have not been verified by broad international consensus. However, there are certain areas where national claims overlap or are disputed for various reasons.¹¹⁸ EEZ are areas where adjacent states have legal authority over the resources, but cannot claim sovereignty over the waters ensuring freedom of navigation and overflight.¹¹⁹ Other concerns, particularly environmental, have been, and will continue to be, a major issue in any diplomatic, academic, and political discussions in the coming decades. Beyond these eight states noted above, others, including China, have demonstrated interest in the region.¹²⁰



Canada's interests are, in the first instance, driven by its sovereignty over the islands and territory of the Arctic Archipelago which includes some 162,000 linear kilometres of coastline and 25% of global Arctic territory.¹²¹ To ensure that sovereignty continues to be demonstrated and exercised in the region, the CAF will be required to conduct operations within the Canadian Arctic. From that basic starting point Canada's interests include major economic, social, environmental, and scientific concerns. Major diplomatic concerns for Canada include the claim by some states that the waters comprising the 'Northwest Passage' as international for trans-navigation purposes; disputed Canada-US boundaries in the Beaufort Sea; and, certain areas in the central portions of the Arctic regarding interpretations of continental shelf limits. Canadian media analysis has frequently warned of growing competition and tension over issues concerning the Arctic, suggesting greater potential for military activity.¹²² It is expected, however, that any overlapping claims will be peacefully resolved as boundary disputes commonly are, through negotiations, and/or arbitration.¹²³ Canada and the US continue to cooperate in the defence of North America, which obviously includes their respective Arctic regions.¹²⁴ Within this context, the question at hand is what military capabilities are required for the GoC to continue to exercise sovereignty over Canada's Arctic territory?

Canada's Northern Strategy identifies three main thrusts that will ensure that sovereignty is exercised. These include "[...] maintaining a strong presence in the North, enhancing our stewardship of the region, defining our domain and advancing our knowledge of the region."¹²⁵ Preparing for the increasing economic activity and vessel traffic will be prudent. "As it stands, the technology and infrastructure needed to clean up a spill in the Arctic should the worst happen are inadequate."¹²⁶ One analyst has described the core activities of the CAF in the Arctic as: "Maintaining situational awareness throughout the region, cooperating with allies in monitoring (and as necessary responding to) the military activities of other nations in the Arctic, and conducting joint operations throughout the whole of Canadian territory are all essential military functions crucial to the defence of national security, national identity, and Canadian sovereignty."¹²⁷

It is obvious that the CAF must conduct these activities across the entirety of Canadian territory. Thus the capability implications of increased CAF presence in the Arctic clearly require a focus on environmental considerations. Regardless of any potential climate-driven or economic effects on the region the Arctic will remain a remote, vast, and hostile environment. The terrain will remain

inhospitable, requiring special skills and equipment for most humans to survive for any period of time, and most foodstuffs and essential supplies will have to be transported at considerable expense from other areas. Populations may increase but people will still, for the most part, be grouped in relatively small communities or work sites. In short, Canada's Arctic region will continue to represent a challenging operating environment.

It is also important to consider what governance changes might affect CAF capability development considerations. It has been long-standing GoC policy to use 'Devolution,' "the transfer of province-like responsibilities from the federal government to the territories," as a core driver of northern economic and social development.¹²⁸ The continued success of this policy implies greater territorial government capabilities. Potentially this could result in greater local reliance on non-federal capabilities for certain functions. For example, there is nothing suggesting that local SAR capabilities such as those which exist in other regions of Canada, might not lessen the burden on CAF SAR capabilities in certain areas. Greater territorial government capabilities will alter the type of comprehensive GoC response required in case of crisis.

The massive size, remoteness, inhospitable natural environment, and sparse population of Canada's Arctic region will continue to represent a challenging operating environment for the CAF. These realities will not change despite economic development, potential climate change, or any other factors indicated by current trends. Thus the CAF will continue to be a major enabler for the Federal and Territorial governments and will need to plan for this role to continue out to 2040.

Role of Alliances and Multi-Lateral Organizations

Multi-lateral cooperation and alliances will remain an enduring feature of the international environment. Many governments will continue to rely upon such organizations and alliances to further their own national interests, or garner support for their actions to provide a level of legitimacy that would be more difficult to develop independently. For the Canadian defence institution, such cooperative efforts will likely take place under the umbrella of established collective defence arrangements such as NATO or less formal 'like-minded coalitions' that are formed to address specific challenges. The scope and scale of challenges expected in the



FOE, many of which will not be able to be met by any single nation, and the ever-increasing requirement to have any action seen as legitimate by the international public, mean that coalitions of various forms will remain important out to 2040. In addition to 'traditional organizations' analyzed below, it is conceivable that new multi-lateral organizations could be formed by 2040 that circumvent a perceived Western dominance of some current multi-lateral organizations. In such cases Western states may have little influence. Nevertheless, the perceived utility of alliances and multi-lateral organizations will remain directly related to how membership in such groups benefits individual states. In short, national interests will determine how states engage in multi-lateral activity.

North Atlantic Treaty Organization (NATO)

NATO will likely continue to play an important role in Western security affairs so long as it remains capable of effective action when required. While its principal role will remain collective defence, NATO will likely continue to broaden its involvement in so-called 'out-of-area' operations, such as that in Afghanistan, that are seen as relevant to the security and defence interests of the core members. Transformation of the alliance is likely to be an ongoing effort which seeks the "continuous improvement of Alliance capabilities."¹²⁹ This evolution may require collaboration with non-NATO democracies or other states that have not traditionally been NATO partners.¹³⁰ The recent conflict in Afghanistan has shown NATO's ability to deploy capabilities beyond the borders of its member countries and may be reflective of the operation types the alliance will conduct in the future. However, there are unquestionably challenges on the horizon. For example, US Secretary of Defense Robert Gates warned of NATO becoming a "two tiered alliance of those who are willing to fight and those who are not."¹³¹

It is probable that the organization will become increasingly focussed on a requirement to build an evolved and accepted understanding of contemporary challenges and needs. Many future operations may be conducted on a case by case basis by limited NATO member coalitions that possess niche capabilities and who deem discretionary action to be in their own national interest.¹³² For the Alliance, a significant battle will be in this diplomatic area; the size of the organization may continue to affect its capability to conduct operations quickly and effectively. Economic pressures as well as the political differences typical of organizations reliant on consensus are also expected to challenge its ability to intervene in a timely manner. However, NATO is likely to endure, and will probably continue to act as the principal forum for trans-Atlantic security discussions, and as a useful mechanism for the generation of

coalitions. The 2007 cyber attacks in Estonia and the 2008 Russia-Georgia War are two recent conflicts that illustrate the difficulty NATO will likely have in navigating the complexities of the FOE.

The US will remain the key member of the alliance despite its stated strategic “shift” of emphasis away from Europe to the Far East.¹³³ Indeed, were this to change there is little probability that the Alliance would continue to exist. Thus, for the foreseeable future, NATO is projected to remain the pre-eminent military organization and probably the preferred umbrella organization for European military activity.

MILITARY IMPLICATIONS

14 NATO will continue to play an important role in Western security affairs. It is, however, probable that ad hoc coalitions, under the banner of NATO, will be deployed on missions considered politically sensitive or urgent.

15 Notwithstanding potential new ad hoc coalitions, Canada’s primary military allies will remain extant and NATO will continue to play a role in Canada’s defence commitments. Interoperability will be an important component of future military capability since it is promoted by NATO through Standardization Agreements (STANAGs), Allied-joint Doctrine and training exercises.

United Nations (UN)

The UN will remain a unique organization because of its global membership and the range of responsibilities addressed by its subsidiary organizations. The demand for reform of the most prominent institutions, namely the General Assembly and Security Council, will persist both because advocates wish to see a strengthening of the UN system, and due to the interests of individual states.¹³⁴ Countries with less influence may wish to use a stronger UN to more effectively constrain the major powers, while stronger states also view reform as a means of enhancing their own international prestige. Alternatively, stronger states may block reform if it suits their interests. Regardless, reforms do not guarantee a more effective UN since the organization will always be affected by the often conflicting wishes and interests of its membership.

The UN, through its Agencies such as the World Food Program and the World Health Organization, has significantly reduced some humanitarian suffering through relief interventions and has improved the standard of living through development programs. It is likely that non-contested programmes such as these will continue to have positive effects in the future global environment.



MILITARY IMPLICATION

16 Canada's historic tendency to support multi-lateral organizations will continue. In support of some United Nations Security Council Resolutions (UNSCR), CAF participation in multilateral military operations may be directed by the GoC.

Organization of American States (OAS)

The OAS, with 35 member states and 67 permanent observer states, will continue to offer a forum for discussion and cooperation on matters such as economic development, democratization, security and human rights.¹³⁵ For example, the Inter-American Committee on Terrorism facilitates training for port, airport, customs, border security, information exchanges, the strengthening of cyber security, and the upgrading of identification and travel documents.¹³⁶ Similarly, recent OAS initiatives have focused on developing alternative approaches to mitigating narcotics trafficking and, by extension, the influence of transnational organized criminal groups in the region. Initiatives such as these will remain important for improving social conditions and maintaining regional stability. However, the lack of policy consensus amongst a large group of states, and the persistence of some authoritarian dictatorships, may hamper the OAS's ability to expand and extend its influence region-wide during the forecast time horizon.

Shanghai Cooperation Organization (SCO)

Founded in 2001, the SCO is primarily designed to further the economic development of the 6 member nations.¹³⁷ It is an example of a large non-Western multilateral organization with member states covering a geographical area that contains nearly a quarter of the global population.¹³⁸ Although some member states have dissimilar cultures and political goals, the SCO could have some influence out to 2040. It is unlikely that the SCO will mature into a military alliance as China has clearly stated its desire that the SCO not evolve into a NATO-like collective defence bloc.¹³⁹ While some of the members enjoy a considerable trading relationship they are, nonetheless, competitors. This competition may affect how the SCO evolves and ultimately, its very existence.¹⁴⁰ This may be primarily so because of Sino-Russian competition.¹⁴¹ To date, these factors have minimized the broader importance of the SCO but given that the organization has existed for only slightly more than a decade it is not possible to determine what level of influence, if any, the SCO may have out to 2040.

MILITARY IMPLICATION

17 The SCO is unlikely to mature into a military alliance capable of challenging NATO. It is however representative of a new multi-lateral organization within which Western Powers have little influence. New powerful multi-lateral organizations, reflecting ongoing shifts in geopolitical power, may be formed by 2040 that further circumvent perceived Western dominance of some multilateral organizations.

Association of Southeast Asian Nations (ASEAN)

Increasingly integrated economies and shared transnational security threats have resulted in growing institutional cooperation in the Asia-Pacific region. As the most influential multilateral organization in the region, ASEAN has driven many of the existing cooperative structures helping to improve economic and other ties between countries in the area.¹⁴² In response to China's rising power, some ASEAN nations have been increasingly drawn to the US as a counterbalance to China. Certain actions, such as the invitation extended to the US to join the East Asia Summit (EAS) in 2010 are emblematic of the desire to balance China's regional influence.¹⁴³ The US, which tends to view ASEAN as the fulcrum of the region's emerging multilateral architecture, accepted the invitation to join the EAS. Russia, motivated by its own re-energized Far East and Pacific policy, also joined the EAS. Both Russia and the US became full partners in the EAS in 2011.

Member states intend for the forum offered by ASEAN to encompass regional issues such as security, non-proliferation, trade, investment, and development. When considered as a whole, the economic potential of the ASEAN member states and the geographic positioning of those states mean the association will be of significant geopolitical relevance out to 2040 and probably beyond. While the military implications for the CAF may be minimal over the next several decades, it is likely that the organization will increasingly feature in Canadian government, and almost certainly private interest, efforts to engage in the Asia Pacific region.

Potential for Instability

The drivers for instability within the FSE are many and varied. Fundamentally, the world continues to "get smaller."¹⁴⁴ Poverty, economic disparity, resource scarcity, severe weather events and natural disasters, extremism, over-population, urbanization, fragile states, weak and poor governance, WMD proliferation, and the emergence



of fault lines between the areas of influence of global and regional powers may all contribute to instability. While it is very difficult to anticipate where significant instability may occur, areas of concern where two or more of these factors may combine to create instability include the Middle East, Sub Saharan Africa, Central and South Asia and Latin America.¹⁴⁵

Fragile and Failed States

Fragile and failed states will almost certainly remain a condition of the global environment in the coming decades; not all nations will be able to successfully cope with the challenges that face them.¹⁴⁶ Some fragile states may fail completely, with a number of geographical regions representing a long term concern. It is highly likely that some weak states, faced with severe environmental, demographic, economic and political pressures, will fail to attain the necessary level of development to compete successfully in the global economy and ultimately to meet the demands of their national populations.¹⁴⁷ The consequences of this will affect future regional and international stability to varying degrees.

The presence of fragile and failed states in the future geopolitical environment has, potentially, serious ramifications. Within a failing state, where state institutions and the rule of law may be ineffectual, the political allegiance of the population is easily transferred to tribes, warlords, mercenaries, paramilitary groups, guerrillas, foreign militaries and other groups that offer to provide security and meet other basic needs. Organized crime and terrorist networks benefit from these chaotic situations because they are able to operate and recruit with impunity. Desperate individuals also welcome any source of income and represent a pool of ready recruits and, because national institutions are too weak to drive out illicit organizations, such states are ideal safe havens for training and operations.¹⁴⁸ Additional pressures, such as refugee flows, civilian casualties and outbreak of civil war have the potential to elicit international intervention in order to contain the spread of destabilizing effects to adjacent areas.¹⁴⁹ Military responses to weak states are likely to include humanitarian, containment and stabilization operations.

Ultimately, the degree to which fragile and failed states impact on others is likely to depend on the supply of strategic resources to the globalized economy and whether internal instability spreads to neighbours, either through migration or conflict.¹⁵⁰ In line with the current geopolitical environment, not all states will participate in operations to re-establish stability in troubled areas. This is unless choosing inaction would negatively impact their national interests. As a consequence, contributing

nations, in an era of power rebalancing within the global state system, will tend to favour ad hoc coalitions, conducted under the umbrella of multilateral organizations and alliances.

MILITARY IMPLICATIONS

18 In those cases where the GoC chooses to become a coalition member seeking to stabilize a fragile or failed state, a comprehensive approach to the mission is likely best-suited to advance that aim. Such a response will require a comprehensive approach that entails operating efficiently with other departments and agencies.

19 The CAF will have to adapt the level of combined-joint interoperability required to undertake and sustain expeditionary missions, with either allies, trusted international partners (such as the Five Eyes community), or non-traditional partners.

Ungoverned Spaces

Few places in the world will be entirely ungoverned.¹⁵¹ Where state structures fail, or underperform, power is likely to be wielded by non-state entities (i.e. warlords, armed criminal gangs, or tribal or religious structures). Therefore, it should not be assumed that a central government's lack of control over an area implies that the area is ungoverned and a safe haven for destabilizing threats in the FSE; some of the entities mentioned above can be effective at curbing instability.¹⁵² However, the balance of probability suggests that such areas will be subject to destabilizing effects that could affect the local, regional and the wider geopolitical environments. The risks associated with these spaces, including endemic criminal activity, the basing of terrorists, irregular activity and conflict will add to the challenges of maintaining the integrity of the international system.¹⁵³ Similarly, states that are unwilling or unable to invest sufficient resources to secure their sovereignty, across all physical environments, may require international action to prevent and contain instability. Areas of increasing importance such as the space environment and cyber domain will be discussed in detail in following chapters.

MILITARY IMPLICATION

20 Where state structures do not exist, there will invariably be alternative forms of governance control existing within the operational environment. In seemingly ungoverned spaces, the CAF must be capable of developing situational awareness in order to facilitate mission success.



Transnational Non-State Actors

The presence of non-state actors will remain an enduring feature of the international environment.¹⁵⁴ Indeed whether such actors are malicious, neutral or otherwise, they have always been present and able to have an affect on geopolitical relations. While states will almost certainly remain the principal brokers of power within the international system, identified trends indicate an ongoing, or at least perceived, diffusion of power to unconventional, non-state, or transnational actors and this represents a destabilizing factor within the FSE.¹⁵⁵ The diffusion of power is particularly true for less stable environments¹⁵⁶ where the consequences of non-state actor actions are often magnified, allowing them, in some cases, to challenge or replace state structures and influence international events. At the very least, non-state actors will remain a concern due to their ability to act, in the worst case, in an unpredictable manner with little or no regard for international law, borders or agreements. In the best case they can also provide positive outcomes that, either intentionally or otherwise, may meet some government's interests within a specific geographical area. For this reason some non-state actors may be empowered or supported by national governments or multilateral organizations.

The term 'non-state actors' covers a complex and diverse number of organizations with different motivations, aims and *modus operandi*; some of these will have the capacity to affect the geopolitical environment in different ways out to 2040 and beyond. Non-state actors are therefore discussed in greater detail, from a defence perspective, in chapter 4 - Military Trends.¹⁵⁷

MILITARY IMPLICATION

21 Transnational non-state actors influence the geopolitical arena and will affect future CAF operations. CAF must continue to consider the implications of non-state actors in the planning and execution of operations.

Conclusion

This chapter has sought to highlight current trends that will likely influence the character of geopolitical behaviour out to 2040, focusing on those areas and issues of most relevance to Canada and the CAF. The number of factors contributing to, and constraining the power of states and the vagaries of human behaviour mean any deliberation on the trajectory of geopolitical trends (and, indeed, the identification of

trends at all), is an extremely difficult task. Recent upheavals, such as those ongoing in the MENA region, further complicate any attempt to discuss possible geopolitical characteristics in the 2040 timeframe.

Nevertheless, the strength of certain trends can help provide insight into some characteristics of geopolitics out to 2040. The broad diffusion of economic and financial power will almost certainly continue. This in turn offers opportunities for non-Western countries to play an increasingly important and, potentially, forceful role, in both regional and global politics. Many past shifts in the overall balance of power in the international system have been accompanied by the potential for tension and conflict as states compete for influence. Furthermore, while past prognostications on the demise of the state have proven to be mistaken, it is undeniable that non-state actors of all kinds tend to play an increasingly important role. Thus, while the ability of state governments to act may be increasingly constrained by the actions of non-state actors, the state will remain the primary political unit of geopolitics and the vast majority of humans will continue to look to state governments for security.

NOTES

1 Political and strategic culture can be as difficult to define as it is to determine the effect of the same on geopolitics. Political culture has been simply described as the effect of a nation's history and experiences on the manner in which its leadership deals with others. (Brad Gladman and Peter Archambault, "Advancing the Canada-US Alliance: The Use of History in Decision Support," *Journal of Military and Strategic Studies*, Vol.14, Iss. 3&4, 2012, pp.5-6). With greater import to security and defence, "Strategic culture refers to "the traditions, values, attitudes, patterns of behaviour, habits, symbols, achievements and particular ways of adapting to the environment and solving problems with respect to the use of force." It is rooted in a country's history, geography, political culture and the attitudes of contemporary political elites. In other words, strategic culture provides a framework in which a country approaches the questions of war and peace, but also more generally with regard to the usability of military power in the conduct of its relations with other international actors." (Ben Lombardi, "Strategic Culture," in DND, *Strategic Assessment 2003*, pp.120-124; The quotation used within this description by Dr. Lombardi is from Ken Booth, "The Concept of Strategic Culture Affirmed" in Carl G. Jacobsen (ed), *Strategic Power: USA/USSR*, MacMillan, London, 1990, p. 121). Gladman and Archambault list some of the more pertinent publications regarding both political and strategic culture as well as some useful cautionary advice when using considerations of the same in any analysis. For a specific case study examining differing perceptions and the effect on defence and security decisions by state governments see Shu Guang Zhang, *Deterrence and Strategic Culture: Chinese-American Confrontations 1949-1958*. Cornell University Press, 1992.

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3 Government of Canada, Canadian Forces Joint Publication-01, Chapter 2, Generation and Application of Military Power.

4 Unites States Army, *Operations*, FM 3.0, 27 Feb 2008, chap 1.

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6 Named after the Treaties of Westphalia that ended the Thirty Years' War in 1648, this system characterizes the interaction and interrelation between countries where the interest of the state supersedes the interests of its population. This realist view of the world promotes the State as the only actor on its sovereign territory and that the head of state and its government have the monopoly of power (through diplomacy or military force) on the international arena.

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CHAPTER 2

ECONOMIC, ENVIRONMENTAL AND SOCIAL TRENDS

Introduction

The economic, environmental, and social trends discussed in this chapter are of importance when considered in the context of the broader problem being addressed in this document – how will evolving trends affect DND/CAF in the period out to 2040? When considered in conjunction with the topics and trends discussed in Chapters 1 (Geopolitical) and 3 (Science and Technology), it becomes clear that issues such as the availability of certain natural resources, demographics, urbanization, and the effects of globalization ultimately have repercussions for how military forces are funded and staffed, where those forces might operate, in what kind of conditions, and to a degree, perhaps why.¹

The purpose of this chapter therefore is to bring greater fidelity to specific economic, environmental, and social topics that were identified or implied to be of significance in the previous chapter. The intent of this chapter is not to provide a comprehensive discussion on every topic that might fall out of a general discussion of global economic, environmental, or social trends. It intends to discuss select topics deemed to be most relevant to the purpose of understanding the future environment in which operations occur. Furthermore, the level of detail provided is only meant to be sufficient to introduce and make clear the relevance of the topic and deduce military implications relevant for DND/CAF. Those seeking greater detail should investigate the reference material supporting the discussion.

Globalization

Globalization is, perhaps, the single overarching factor that has enabled many of the trends discussed in this document and particularly those within this chapter. Although the term globalization emerged in the 1980s the core ideas encompassed by that term have been a constant throughout history.² Nevertheless, the term has proven notoriously resistant to succinct definition. As one group of authors have put it:

Globalization is not a single concept that can be defined and encompassed within a set time frame, nor is it a process that can be defined clearly with a beginning and an end. Furthermore, it cannot be expounded upon with

certainty and be applicable to all people in all situations. Globalization involves economic integration; the transfer of policies across borders; the transmission of knowledge; cultural stability; the reproduction, relations, and discourses of power; it is a global process, a concept, a revolution, and an establishment of the global market free from socio-political control.³

This particular description of globalization is not completely accurate; but the scope of activities covered in the description illustrates why there is so much variation in the definitions of globalization in the media, academia, government, and the business world and why the impacts of globalization have proven uneven and difficult to forecast.⁴ Contemporary globalization has been driven by many factors, such as the development of air travel, but two drivers are most significant. First, maritime commerce and the trade, communication, and interaction this has facilitated, has been an historic constant.⁵ The second driver has been the progressive evolution of communications technologies over the past 150 years or so. The economic, environmental, and social trends that are discussed below are, in some cases the result of globalization, and in others positively or adversely affected by globalizing influences.

Economic Trends

The characteristics of globalization have helped enable an exponential growth in economic development. Recent GoC analysis suggests that global GDP is likely to nearly triple from approximately 50 trillion USD to 130 trillion USD over the next 30 years.⁶ As indicated in Chapter 1, a critical related factor is that economic strength has, and is forecast to continue to become more diffuse with much of the diffusion benefiting countries in the Asia-Pacific region such as China and India.⁷ It is highly likely that the economies of both countries will continue to grow and that both states will become even more influential drivers of the global economy. In addition to the expected development of China and India, the weight of global economic activity will continue to evolve and continue its shift toward emerging economies in Asia and Latin America. This trend is expected to accelerate over the coming decades with economic growth driven by a number of factors such as population growth, improvements in productivity and greater integration of the global economy.⁸ It is assessed that developing and emerging countries (non-members of the Organization for Economic Co-operation and Development (OECD)), who presently account for 49% of world GDP, will increase their global GDP share to account for nearly 60% of global GDP by 2030.⁹



While the difficulties of making detailed future economic forecasts are numerous, general trends forecast a bright future for emerging and developing economies.¹⁰ Some forecasters assess that many emerging economies will overcome current internal challenges and grow significantly over the next decades.¹¹ However, as described in the previous chapter, these varied challenges are significant and defy simple solutions. Despite these challenges, forecasts generally agree that by around 2025 the major developing economies should mature from rapid, investment-intensive ‘catch-up’ growth to a more balanced model.¹² These economies are also likely to continue to increase trade with the least developed countries around the globe (including South-South trade).¹³ The economies of the “Next 11,” (Figure 1) which currently account for just more than one tenth of the combined GDP of the G7 countries, will also gradually increase, potentially growing to approximately two thirds of the G7 GDP over the coming decades.¹⁴ If this occurs and there is not similar significant growth in G7 GDP, this greater economic power and influence will likely have an effect on the geopolitical balance of international power. That said, although globalization offers significant opportunities for many states, not all countries will grow at the same pace and the benefits of globalization will continue to be unevenly shared.¹⁵

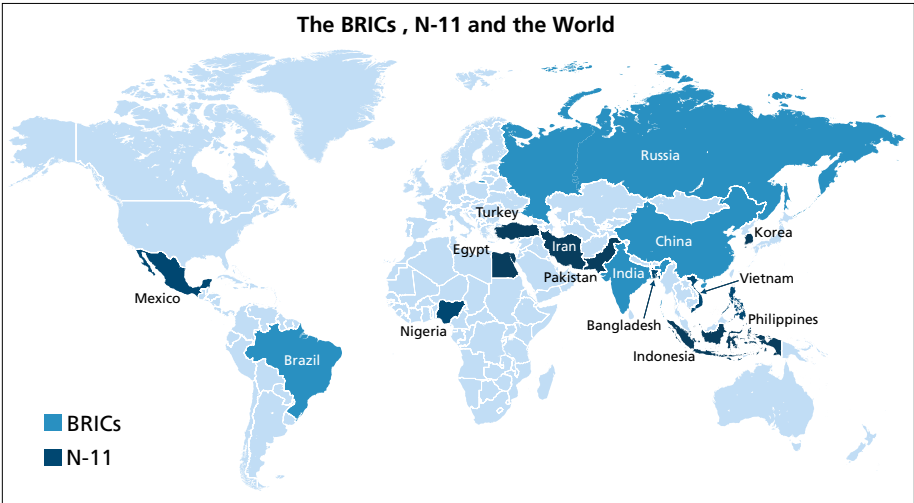


FIGURE 1: MAP OF BRAZIL, RUSSIA, INDIA AND CHINA (BRIC) AND THE NEXT 11

SOURCE: DND¹⁶

What are the effects of economic globalization on Canada? In 2011, Canada exported \$456.5 billion of goods, which accounted for roughly 26.3% of its GDP (\$1.736 trillion). Over that same period, Canada imported \$455.6 billion of goods.¹⁷ The country’s most important trading partner is and will almost certainly remain the US.¹⁸

Geography matters and proximity is, and will remain, important.¹⁹ Preserving the free flow of goods and services across the border, as well as maintaining mutual trust and confidence, will therefore continue to be critically important to both countries.

However, the diffusion of global economic influence has made China, specifically, and the other developing economies of the Asia-Pacific region, increasingly important to Canada's economic strength. China is currently Canada's second largest trading partner after the US.²⁰ China will likely remain in this position but its share of Canadian exports is likely to grow since it sits at one end of the fastest growing global trading corridors.²¹ Like other developed economies, Canada is increasing trade with emerging economies. Thus, the trade routes between these economies are expected to become more significant over the next twenty years.²² All of these countries are outside of North America and therefore the capabilities, such as adequate port facilities, interior transportation corridors, and domestic and cooperative international security measures, necessary to facilitate overseas trade will only increase in importance over the coming decades. The assurance of cyber-related infrastructure is also critical to maintaining Canadian economic strength and prosperity. It is clear that the continued protection of both inter-continental and international maritime trade routes from disruption will be essential to Canada's economic well being.

MILITARY IMPLICATIONS

22 Emerging powers with prosperous and growing economies are likely to strengthen their militaries commensurately. Such build-ups could disrupt (either intentionally or inadvertently) the security of Canada and its partners. Accordingly, Canada could seek new alliances and increased military co-operation with those emerging economic powers that are strategically aligned with Canadian interests.

23 The assurance of Canadian cyber related infrastructure will remain critical. DND/CAF must maintain a robust and resilient cyber defence capability to ensure the security of defence-related systems, shaped by and responsive to emergent threats and operational activities. Given that the vast majority of defence assets reside in Canada, and to ensure interoperability with other Government Departments (OGD) and Security Intelligence partners, DND/CAF can benefit from and contribute to the cyber defence led through a wider GoC effort.

24 The continuing globalization of industrial supply chains will pose security and self-sufficiency implications for western militaries, including the CAF. Attention must be paid to mitigating this trend through measures aimed at assuring national self-sufficiency for critical military equipments, components and supplies.



Environment

The physical environment and the natural resources extracted from it will, in conjunction with other factors, continue to contribute to stress or friction amongst communities, regions and states. Non-renewable natural resources have finite limits. Although technology has consistently allowed for the extraction of previously unavailable reserves of non-renewable resources, conflict has been influenced, if not directly caused, in the past by perceived requirements for available resources. Even when technology allows for new reserves to be accessed, the financial costs of doing so may be unaffordable for some.

Many renewable resources such as forestry resources, agricultural crops and commodities, and natural fish stocks may also have time-specific limits to availability. Although renewable, the availability of such resources is heavily affected by the management of stocks and the time required for a resource to be replenished. The availability of other renewable resources such as fresh water can be manipulated by those who can afford large-scale desalination technology and who have access to salt water. For those who have neither of these things, fresh water, although renewable, may have very finite limits.

It thus becomes obvious that a state that possesses the economic strength to purchase required natural resources, the technological and scientific basis to extract those resources or develop alternatives, and/or is geologically blessed to have autonomous access to natural resources will be better able to satisfy the needs of its citizens and provide for its security. Those who do not possess one or more of these means may perceive the need to make more belligerent efforts to secure the state's natural resource requirements. Furthermore, the lack of basic nutritional requirements can cause such things as mass migration, intra-state strife, and other forms of destabilizing behaviour.

KEY TOPIC: Climate Change

Changes in the environment, such as climate change, may influence world events and international affairs. It is therefore important to understand how these changes might affect Canada, North America and other areas of the globe. The challenge is to provide context to the potential problem in order to understand any defence implications that may arise.

In the past decades, climate change has been hotly debated. One perspective on the debate argues that data and evidence show significant climatic change

occurring. The Intergovernmental Panel on Climate Change (IPCC) has defined the phenomenon as follows: "A change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcings [mechanisms], or to persistent anthropogenic changes in the composition of the atmosphere or in land use."²³ However, others have argued that the amount of data is too insignificant to determine trends without enough conclusive evidence. Additionally, it has been stated that current projections "are an inadequate foundation for strategic planning."²⁴ While remaining aware of the debate, it is possible to outline the trends and potential implications that have been identified.

The latest data from the IPCC has affirmed that some climate change trends are highly likely to have an impact throughout the world. One example includes an increase over most land areas of "the length, frequency, and/or intensity of warm spells or heat waves [...]."²⁵

Changing climate may influence some states through issues such as food and water scarcity or rising sea levels. Extreme high water levels in the future are "very likely" to have implications such as "coastal erosion and inundation [...]."²⁶ In certain areas, such as tropical island states, the "likely increase" in tropical cyclone maximum wind speed will have worsened effects because of the increasing high water levels.²⁷ States such as the Maldives are already considering issues such as "de-territorialization" and its citizens becoming "environmental migrants" in the event of a complete loss of inhabitable territory.²⁸

Specific examples of potential effects within Canada include: "[...] several diseases from warmer climate regions have been identified in countries like Canada in recent years. The vector-borne infectious diseases, including malaria, dengue, and viral encephalitis, are particularly sensitive to changes in climate."²⁹ Extreme weather events such as "heat waves, heavy rainfalls and related flooding, dry spells and/or droughts, and forest fires"³⁰ are also identified as possible consequences of climate change in North America. If this trend persists, North America could be exposed to natural events not regularly observed in the past.

Regardless of the debate, the impacts of climactic changes must be considered. As the phenomenon is studied further, there may be more evidence with which to better contextualize the problem and its implications.



Food and Water Resources

The demand for resources increases with accelerated economic activity and population growth. Supply of food and water resources has, at times, struggled to keep pace, and there are concerns that this could increase tensions in certain regions.³¹ Therefore, regardless of the cause, “Drops in food production could trigger regional food crises and further undermine the economic performance of weak and unstable states.”³² However, scientific and technological advances have, over the course of history, allowed for the avoidance of a Malthusian scenario.³³ Thus while it is necessary to accept that local or regional food scarcity may occur, there are simply too many variables involved in food production to assert with any degree of certainty the likelihood, or not, of sustained and widespread food scarcity. This is not necessarily the case for natural renewable resources such as water or fisheries stocks, although both of these can be manipulated by artificial means (desalination, purification and aquaculture).

The scarcity, in some regions, of fresh water combined with existing political tensions between some countries has led some analysts to call water ‘the oil of the twenty-first century.’³⁴ While this characterization may be overly shrill, it is not possible to rule-out the potential that water scarcity could be a significant variable contributing to conflict generation in certain regions.³⁵ There are 145 countries possessing territories that include at least one shared river basin. Dependence on an external water supply may force some states to re-orient their national security concerns in order to protect or preserve such availability.³⁶ States without a history of negotiated water agreements could be particularly vulnerable to crisis escalation.³⁷ Despite being a serious problem in many regions, “water stress” will likely not be a direct cause of conflict, but could be coupled with poor governance, large heterogeneous populations, societal inequalities, poor economic performance, and conflict-prone regions to explain variations in conflict risk.³⁸

The excessive exploitation of natural fish stocks could continue to prove a problem in the coming decades. Scientific perspectives differ on the sustainability and the potential for widespread collapse of stocks.³⁹ The ability to manage natural fish stocks or stimulate the development of aquaculture to supplement or replace natural fisheries requires capital, technological and scientific expertise, and reasonably stable governance to help establish and enforce local regulations. For the purposes of this document the major concern is that the areas least able to adapt to declining fisheries stocks are also those that tend to rely heaviest on those stocks as a source of protein and where governance is also weak or fragile. One example of this would be in the

Horn of Africa region. Therefore, as part of international multilateral efforts to assist vulnerable regions, Canada and other states are likely to continue to be engaged in international efforts to support fish stock and harvesting governance and regulation. The CAF will likely continue enabling operations such as DRIFTNET in partnership with the Department of Fisheries and Oceans.⁴⁰ Cooperative approaches involving many states will continue to be required.⁴¹

Energy Resources

Rapid economic growth of developing countries will significantly affect the global demand for energy.⁴² The two major worldwide trends for energy are: an increased use of all sources of energy, renewable energy constituting the fastest-growing source, and oil prices remaining relatively high.⁴³ Out to 2040, a number of sources forecast a global growth in energy demand of up to 50%, about 80% of which will likely still be based on oil, gas and other fossil fuels.⁴⁴ According to the International Energy Agency's (IEA) central future scenario, the demand for oil could grow from 87.4 million barrels per day (MBD) in 2011 to 99.7 MBD in 2035.⁴⁵

The security implications of energy requirements are very clearly affected by the ability to extract or produce energy domestically. Until very recently, it was forecast that some Western states and some developing countries would not be able to sustain this energy demand domestically.⁴⁶ However, recent technological developments have changed previous dire calculations. For example, in North America domestic and continental energy stability is likely for several reasons: Canada can be self-sufficient in oil; North-America is self-sufficient in natural gas; and the US is now less vulnerable to expensive oil.⁴⁷ Although not yet certain, recent progress in shale oil production in the US is likely to dramatically change its imports of energy to a point where it could become a net oil exporter by 2030.⁴⁸ According to one assessment, extracting gas using the new processes could become 50% cheaper than exploiting oil sands.⁴⁹ This could force Canada, which exports most of its oil sands production to the US, to find alternative markets.⁵⁰ However, public concerns about negative impacts on the environment such as water contamination, seismic inducement, and methane emissions could prevent this technology from reaching its full potential.⁵¹ Due to these developments, there is the potential that at least some key Western countries will be able to rely on access to natural, non-renewable energy from more secure sources than in the recent past.

Such will not prove the case for all states, however. A large part of the known oil reserves are located in politically challenging or geologically hard to access areas.



For at least the next decade, the Organization of the Petroleum Exporting Countries (OPEC) nations are therefore likely to remain a focal point of interest for developed and emerging economies until permanent and efficient alternative sources of energy are secured.⁵² Research and development investments will be directed to new sources of energy, including coal derivatives, hydrogen fuel cells, bio-ethanol, and nuclear fusion.⁵³

The relative importance of energy security will grow not only for more powerful states but also for emerging powers that require access to energy resources in order to close the development gap that currently exists.⁵⁴ For example, Russia's foreign and energy policies are inextricably intertwined as Russia's effort to reassert great power status partly rests upon the exploitation of its natural resources.⁵⁵ Another example is China, which is actively securing its access to energy in Africa.⁵⁶ Such states are likely to make efforts to maintain or increase their regional influence in order to protect energy access to ensure longer term growth and domestic stability.⁵⁷

MILITARY IMPLICATIONS

25 The development of initiatives to reduce energy consumption and encourage efforts to find alternate solutions will remain important for all forces. Indeed, delivering fuel and other energy resources to forward elements during expeditionary operations engenders some vulnerabilities.

26 Since domestic and continental energy supply could be assured in the coming decades, securing the lines of communication and free trade in the global commons may become more important for the export rather than the import of energy.

Nuclear Energy

Unlike Canada, most countries are not blessed with the geography required to produce various forms of energy. To meet their energy requirements, developing and mature economies may turn to nuclear power for a portion of domestic requirements. It is projected that an additional twenty countries, ranging from highly developed to still developing countries, are likely to acquire some form of nuclear power generation capability.⁵⁸ The investment required is considerable but could become increasingly attractive as the desire to minimize carbon emission grows.⁵⁹ This will have a direct impact on the supply and demand for uranium. Canada has recently lost its leading position to Kazakhstan in the global production of uranium (Canada produces 17% of the world's supply and Kazakhstan, 37%).⁶⁰ The demand is also shifting

from developed to developing economies. The US, France and Japan account today for 50% of the world's demand for uranium but China, India and Russia represent 55% of the forecast global growth in megawatts in 2030.⁶¹ Even if global growth is expected to remain at 1%,⁶² as an increasing number of emerging economies acquire nuclear capability, Western Powers' influence on the supply of uranium is diminishing. The proliferation of fissile materials around the globe will increase the potential for radioactive accidents or for malicious use of nuclear by-products.

MILITARY IMPLICATION

27 Nuclear power will continue to have civilian and military uses. DND should monitor any developments in this area. Defensive military radiological and nuclear capabilities, to allow the conduct of CAF operations in environments where radiological contamination exists, are therefore essential in order to react to domestic events and to effectively operate in regions where radiological and nuclear hazards (civilian and military) are present.

Mineral Resources

Rare Earth Elements (REE) are extensively used in civilian (hybrid and electric cars, hand-held electronic devices, fluorescent lights, etc.) and military (precision guided munitions, lasers, satellite communications, etc) technologies.⁶³ There are obvious problems in depending on a single country to provide elements that are essential to Canadian and allied military technologies. China possesses approximately 97% of the actual global supply of many REE and government policies meant to assure supplies to meet domestic requirements, in conjunction with certain policies in other states possessing REE deposits have created a de facto monopoly. This has the effect of limiting the available global supply and creating artificially high market prices.⁶⁴ Moreover, there are presently no adequate alternatives to the use of key REE in industry-specific roles.⁶⁵ While large domestic deposits of REEs have been identified within Canada, market forces make the development and extraction of these deposits unfeasible until such time that the US, as the primary Western defence manufacturer, deems REEs to be "a strategic resource deserving of protection and/or subsidization."⁶⁶ Defence applications of REE consume a minor portion of total global consumption, but these tend to be used in sophisticated, cutting-edge systems critical to the maintenance of capability advantage in certain areas.⁶⁷ If Chinese manipulation of the global market supply continues it is plausible that the US and allied countries may be required to take steps to assure access to REEs as a strategic resource out to the 2040 timeframe.⁶⁸

Social Trends Influencing State Stability

Migration and Population Displacement

Events as diverse as natural disasters or the outbreak of war can spark mass migrations of people, at times across national borders and into areas with little or no capacity to cope with sudden new stresses.⁶⁹ Such mass movements can be politically and socially destabilizing and potentially contribute, through increased pressure on fragile governments, to the onset of conflict.⁷⁰ In the worst case, this could lead to increased incidents of fragile or failed states and may require international assistance in order to ensure stability. Furthermore, refugees and internally displaced groups, often forced to live in dense and unsanitary conditions, are at increased risk from the rapid spread of infectious disease. If left unchecked, this could result in a serious international pandemic disease outbreak. Uprooted and displaced, such “stranded migrants” are vulnerable to an array of hazards and may require immediate humanitarian aid.⁷¹

Urbanization and Mega-Cities

Since the industrial revolution, populations have steadily migrated from rural to urban areas in search of jobs and an increased standard of living. This steady trend of urbanization is projected to continue and by 2040 some 65% of the global population will probably reside in urban areas.⁷² Some sources suggest that, by 2050, all new population growth will be absorbed by cities.⁷³ The trend of urbanization combined with the increase in the global population has led to the transformation of some urban areas into “mega-cities.”⁷⁴ (See Figure 2) For various reasons, many mega-cities are located in coastal areas, but as urbanization continues it is likely that many cities will emerge farther inland as key secondary hubs of commerce and industry.⁷⁵ By 2025, it is expected that the top 600 mega and middleweight cities will contribute to 60% of the global GDP.⁷⁶ Along with economic growth and education, urbanization has helped reduce overall poverty by providing new opportunities, raising incomes and increasing the numbers of livelihood options for both rural and urban populations.⁷⁷ However, this phenomenon has created socially mobilized populations who, with communications tools and higher expectations, could be activated for political purposes in ways that illiterate individuals could not.⁷⁸ Cities will have such a significant impact globally that they might become a new unit of academic analysis for international relations and social trends.⁷⁹

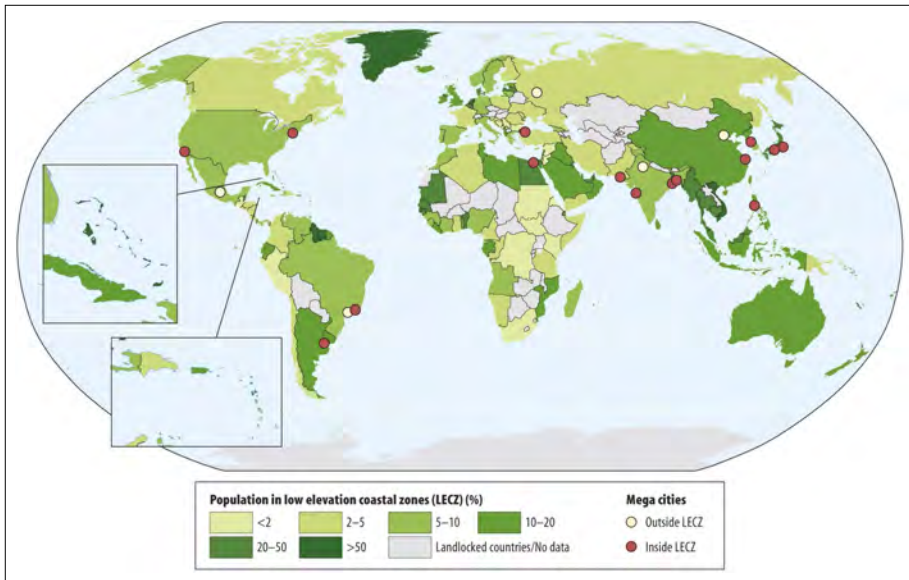


FIGURE 2: MAP OF MEGA-CITIES IN 2040

SOURCE: World Bank⁸⁰

MILITARY IMPLICATION

28 The nature of conducting operations in large urban environments will continue to challenge the CAF and place a premium on joint enablers, including Command, Control, Communication, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR), operational support, aviation and the timely application of precision effects. In addition, CAF personnel will require the knowledge and expertise to attempt to comprehend the dynamics of the physical and social environment. Effective force protection will continue to be difficult to achieve in such terrain.

Disease and Pandemics

The basic characteristics of globalization and the trend of urbanization contribute to an increased global risk of the potential for rapidly spreading infectious disease. Although there is no discernable trend of an actual increase in pandemics, the international reaction to, and the specific actions taken by countries affected by the 2003 severe acute respiratory syndrome (SARS) are illustrative of the concern for the potential effects of a pandemic.⁸¹

In a larger context, many regions of the world lack resources, including developed health care systems, which can cope with the outbreak of infectious disease. Even in highly affluent countries the potential for the rapid spread of infectious diseases



leading to epidemics or pandemics is increased in mega-cities. However, the risk is greater in less developed regions where state resources are insufficient to create and maintain the health and sanitation conditions necessary to mitigate such risk. In some cases the GoC may decide to provide assistance.⁸² In a domestic emergency or crisis, possibly involving more than one province or territory, the GoC could mobilize its resources and the CAF could have a supporting role.⁸³

In addition to the unintentional spread of communicable disease, microbial pathogens, either in a natural or purposely altered form, may be intentionally introduced into the environment. This would be a unique and very serious threat to national security. To fight bioterrorism, Canada is a member of the Global Partnership Program (GPP), which “is implementing a comprehensive strategy to Strengthen Global Biological Security.”⁸⁴ Multiple sources could be used concurrently to augment the rate of transmission of a pathogen, thus complicating both the medical challenge of bringing the disease under control as well as the security task of fixing responsibility for its appearance.⁸⁵

MILITARY IMPLICATIONS

29 It is likely that some nations will not be prepared to effectively respond to global outbreaks of infectious disease, or the release of pathogens into the environment, which by their nature, are often impossible to predict and difficult to prevent or contain. In an expeditionary context, the CAF should be capable of conducting operations in environments affected by such events.

30 Domestically, the CAF may be required to assist civil authorities in the event of a pandemic, or a release of pathogens into the environment. Adequate force protection measures, and institutional robustness, will be required to effectively support OGDs if called upon to do so.

Poverty

Globalization will bring greater economic prosperity to more nations and will pull millions of people out of poverty.⁸⁶ However, the gap between rich and poor nations and individuals will probably widen (Table 1).⁸⁷ Poverty can be a driver of instability.⁸⁸ To mitigate this effect, the United Nations Development Programme invests nearly 1 billion USD every year in fighting poverty.⁸⁹ Adopting a comprehensive approach, the program is likely to continue making progress towards the Millennium Development Goals.⁹⁰ Developing countries who work to reduce their fertility and child mortality rates will move against the identified forecast of population growth and are therefore more likely to see their overall level of poverty decline.⁹¹

MILITARY IMPLICATION

31 Since poverty is a driver for instability, it remains highly likely that the CAF will be deployed in impoverished areas where host nation (HN) support will be minimal. Therefore, the CAF require the capacity to operate in austere environments without significant HN support. For example, sustainability, as a factor in underwriting the success of an operation, will require access to local transportation facilities or, in the case of territories with coastlines, afloat (SeaBase) support.

Quality of Life Disparity Indicators						
	Somalia	Congo (D.R.)	Sudan	Chad	USA	Canada
Failed State Index ranking ⁹²	1	2	3	4	159	169
Per Capita GDP	600\$	400\$	2 800\$	1 900\$	49 000\$	41 100\$
Life expectancy	51	56	63	49	78	81
Fertility Rate	6.26	5.09	4.17	4.93	2.06	1.59
Infant Mortality Rate (deaths/1000 live births)	103.72	76.63	55.63	93.61	5.98	4.85
Internet users per 100 people ⁹³	0.11M/ <u>10.06M</u> 1.1	0.29M/ <u>73.60M</u> 0.4	4.2M/ <u>34.21M</u> 12.3	0.17M/ <u>10.98M</u> 1.5	245M/ <u>313.85M</u> 78.1	26.96M/ <u>34.30M</u> 78.6

TABLE 1: QUALITY OF LIFE DISPARITY INDICATORS

Demographics

Demographics will continue to be a significant variable that may have implications for military and security trends. The world population is expected to reach 8.9 billion people by 2040.⁹⁴ The most important contemporary demographic trend is the so-called ‘youth bulge’ developing in certain regions. Many developing countries are currently characterized by large youth bulges. A youth bulge is defined by 15 to 29 year-olds who make up close to 40-50 percent of some populations.⁹⁵ These will be strongest in places such as India, Sub-Saharan Africa, Northern Africa and the Near Middle-East (see Figure 3). The greatest concern is that youth bulges may lead to instability in regions characterized by fragile governance and weak economic potential. Fragile states are rarely able to fully provide for their citizens, and therefore, dissatisfaction may grow.⁹⁶ It is generally understood that impoverished youth without hope of economic improvement or social legitimacy provide a ready pool of recruits for extreme and radical groups and possibly terrorist organizations.



As one UN report has put it:

For every percentage point increase in the youth population (relative to the adult population), the risk of conflict increases by more than 4 per cent. When youth make up more than 35 per cent of the adult population, which they do in many developing countries, the risk of armed conflict would be 150 percent higher than in countries with an age structure similar to most developed countries.⁹⁷

The Arab Spring phenomenon of “frustrated young men [...] that turn to violence” illustrates how the demographic phenomenon of youth bulge can affect the security sphere.⁹⁸

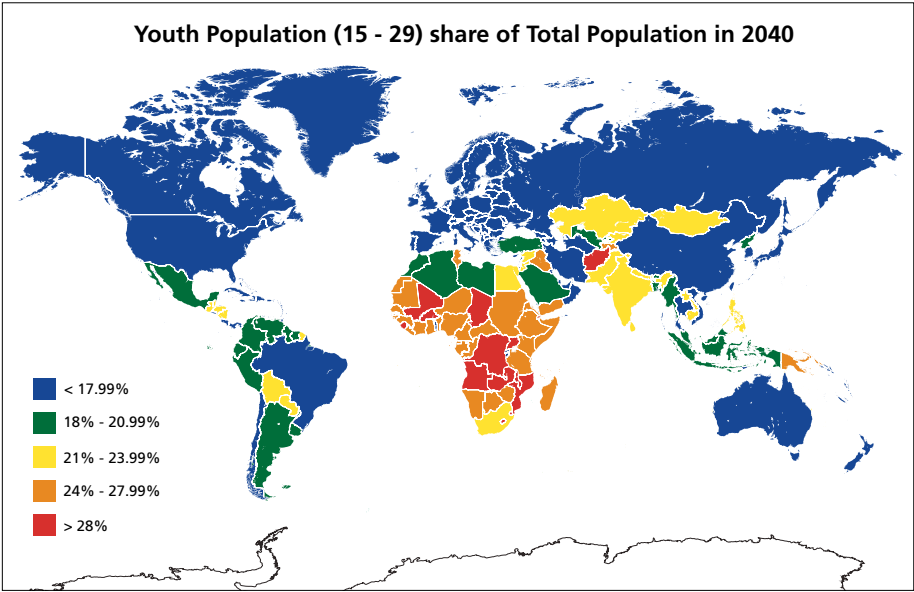


FIGURE 3: MAP OF YOUTH BULGES IN 2040

Youth unemployment is a social and economic trend related to youth bulges in developing states. Youth bulges combine with other factors such as economic and labour turmoil to increase state fragility and the possibility of intra-state conflict.⁹⁹ Even in more affluent states there have been warnings of a “scarred generation of young workers facing a dangerous mix of high unemployment, increased inactivity and precarious work.”¹⁰⁰ This phenomenon has affected some Western European states.¹⁰¹ In a defence context, the implications for developing states may be of greater interest because of the potential, as noted above, for restless, underemployed youth to foment political unrest.

Despite this, “the importance of youth bulges in causing political violence is expected to fade in most parts of the world over the next decades because of declining fertility.”¹⁰² In fact, UN trends predict that by 2050, only sub-Saharan Africa will have young adult shares above 25 percent.¹⁰³ This ageing trend has been called a “pensioner bulge” or could perhaps be viewed as a natural undulating population cycle.¹⁰⁴ This may have impacts on GDP growth and even lead to stagnation. This situation has been called the “fading of the demographic advantage” that many states have previously enjoyed. It is believed that in areas where the population ages, there will be a reduction of societal instability.

Canadian Demographic Trends

In the developed world, the ageing of the population is the dominant contemporary demographic trend. This will affect the workforce and is likely to limit the ability to support social programmes and other government programme funding. Lower fertility and birth rates are leading to an ageing labour force and population growth fuelled solely by immigration.¹⁰⁵ Canadian census data also suggests that by 2021, “one person out of four in the labour force could be aged 55 or over.”¹⁰⁶ Based on the 2011 Canadian census, the population will grow from 34.8 million in 2012 to an estimated 42.5 million in 2056.¹⁰⁷ However, Statistics Canada projections suggest that the workforce of the future will be defined by “higher proportions of foreign-born people and people belonging to a visible minority group.”¹⁰⁸ This indicates that about a third of Canada’s population, some 14.4 million people, will be a visible minority by 2031.¹⁰⁹ The labour market in Canada will evolve and present recruitment challenges for the CAF. The Chief of Military Personnel identifies the following risks which concern economic and social trends; youth, the demographic realities of an ageing population and diversity:

- Competing for skills in a shrinking youth pool may leave the CAF with limited access to highly skilled candidates;
- The ageing demographics of the CAF raise concerns over an impending loss of talent and experience;
- As Canadian society becomes increasingly diverse, the CAF may fail to reflect Canadian cultural, linguistic and religious diversity, thereby calling into question institutional credibility.¹¹⁰



In addition to the composition of the labour pool, notions of work, career, and the relationship between employer and employee may evolve. Attracting and retaining recruits is likely to become more difficult.¹¹¹

MILITARY IMPLICATION

32 The CAF will continue to require robust and adaptive recruitment, employment and retention strategies. The impacts of demographic trends will challenge CAF human resources.

Conclusion

This chapter briefly explored the most salient, for FD purposes, economic, environmental, and social trends. Any military implications drawn from the discussion above can only be done so in light of the wider trends discussed throughout this document. Perhaps the major point to be taken from this chapter is that the characteristics of globalization, particularly greater global interconnectedness, complicates the ability to draw strong conclusions from observable trends. However, from a defence perspective, observable trends indicate that single potential areas of stress, such as water scarcity, population growth or resource competition, are unlikely by themselves to be the trigger of conflict. However, such issues matter because they may magnify wider drivers of instability, such as weak governance, that have the potential to make instability and conflict more likely. The defence institution should be particularly cognizant of these stresses when considering potential operational scenarios in an expeditionary context; it is here the CAF is most likely to directly face the potentially negative issues discussed.

NOTES

1 Urbanization in itself is not necessarily a worrisome trend. Many trends have both positive and negative aspects. Urbanization and mega-cities are not an issue if one is a tourist; these are only an issue if one is a military commander tasked with operating against adversaries in such terrain.

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CHAPTER 3

SCIENCE AND TECHNOLOGY TRENDS

Introduction

Science, technology, and warfare have always had an intimate relationship.¹ When pondering current science and technology (S&T) trends to discern potential future S&T evolution it is important to understand the nature of the relationship between science and technology, on one hand, and warfare on the other. Scientific and technological advances constitute one set of enablers that may drive change but the problem of surviving in combat and subduing one's adversaries in the battlespace constitute the determinant.² The characteristics of the determinant, "steadily increasing lethality, range, and surveillance capabilities," are longstanding and now over a century in being.³ "The problems of firepower, exposure, movement, and concealment have not lessened with changing technology" and the solutions to those problems continue to define key issues for defence in an era of precision guided weapons, networked information, and stealth aircraft.⁴

Simply put, S&T are one of the factors contributing to the modern military forces' best understanding of what is necessary to deter, fight, survive, and win against adversaries in combat. The relationship between technological advancement and adaptation is the critical starting point for considering the military implications of future scientific and technological evolution. This chapter addresses two questions: what are the major technological trends likely to enable the CAF to successfully survive and win in the future and what characteristics of those same technologies might concomitantly allow Canada's adversaries to counter or undermine those solutions?

There can be no definitive answers to these questions, not least because attempting to peer twenty-plus years into the future from an era where science and technology seems to be evolving ever-more rapidly provides, at best, an opaque perspective. However, history offers insight to help understand how military theorists and professionals have dealt with technological change. For instance, although the possibility of a scientific or technological breakthrough or adaptation that causes a fundamental break from the past cannot be dismissed, it is important to understand that "technological change that looks very rapid has been a constant throughout

modern history” and “there is always a temptation to view one’s own era as a critical fork in the road, or as a period of unusual change relative to what has come before.”⁵ The dilemma lies with determining what level of scientific and technological sophistication is necessary.

It is axiomatic that in many circumstances it will be necessary to apply cutting-edge science and technology to help maintain a competitive military advantage. However, in order to be effective, a military must possess the coherent concepts, doctrine, education, training, and mindset that allows for such technology to be applied effectively.⁶ Considering these attributes of the modern, professional military, it becomes very clear that the dilemma of understanding how to apply current and emerging technology is both difficult and critical to future military operations. Further, it indicates that careful, balanced thought is necessary to properly understand, within the context defined by the profession of arms, the importance of any particular scientific or technological advancement.⁷ As one expert has written: “What matters in technological adaptation as well as technological innovation is how well new and improved technologies are incorporated into effective and intelligent concepts of fighting: it is not the technological sophistication that matters, rather it is the larger framework.”⁸ Similarly, while adversaries adapting high technology to target Canadian and allied forces will pose a challenge in the future, the experiences of the past decade (not to mention more distant history) tell us that the use of less sophisticated means can pose significant problems.⁹ The possession and application of sophisticated, science and technology may perhaps be the major enabling factor contributing to success in the battlespace. However, one should remain mindful of military experience, which demonstrates that proper consideration and integration of S&T into overall capabilities has often proven more important than having the most advanced equipment.

This chapter presents some of the most salient and enduring trends likely to impact the operational environment and influence future DND/CAF capability requirements and investments. These are organized around eight themes: the globalization of S&T; affordability of technology; additive manufacturing; socio-technical networks; cloud computing; evolving sensing and analysis technologies; extension of the human ‘frontier’; and, the potential for technological surprise.

Globalization of Science and Technology

As the geopolitical landscape evolves S&T knowledge and power are being redistributed. Data published by the United Nations Educational, Scientific, and



Cultural Organization (UNESCO) in 2010 shows the emergence of strong research and development players in the global economy.¹⁰ A world in which science and technology was dominated historically by the EU, Japan and the US has given way to an increasing number of public and private research hubs spreading across many states. Those states that have progressed fastest in recent years are the ones that have adopted policies to promote science, technology, and innovation. Out to 2040, countries such as China and India are expected to make significant contributions to innovation due to the size of their educated workforce and the scale and diversity of their domestic markets. They will also drive the development of many new products for export to the West.¹¹ Given current international trends in R&D investments, several new technologies are likely to be discovered and marketed by China in defence, security, agriculture, food production, information and communication technologies.¹² Increasingly, states such as Brazil, India, and other developing countries will play a larger role as designers, manufacturers, and providers of sophisticated defence and security related technology. More and more, Canada and its traditional allies will need to access off-shore non-US technology, for defence and security capabilities, with potential impacts on the evolution of International Traffic in Arms Regulations and Controlled Technology Access and Transfer agreements.¹³

Established and emerging economies alike are expected to maintain innovation-oriented strategies to stimulate growth and national interests.¹⁴ The private sector and academia, rather than government-run entities, will continue to dominate the technological cutting edge in many areas.¹⁵ Geographical barriers to the propagation of advanced technologies are already fewer and have become harder to control. Agreements between states for the removal of impediments to trade further ease the diffusion of technology on a global scale and indeed, maintaining competitiveness will likely continue to require the outsourcing of major elements of design and manufacturing.¹⁶ As a side-effect, detailed knowledge of the pedigree of foreign technology components will become increasingly blurred and difficult to certify. Moreover, given uncertainty of how long current global economic problems may last, underinvestment in basic and early applied research, which often appears to have little relationship to ultimate economic benefits, may lead to decreasing industrial financial support to innovation sectors that require long-term research investments.¹⁷

Internationalization of science remains an enduring trend, fostered by easy access to the internet, collaborative megaprojects (such as the International Space Station), the creation of dispersed research and development centers by the private sector, and the nature of venture capital markets that increasingly fund new S&T ventures in developing states. In terms of research collaboration, data shows an

increase of partnerships and international co-authorship in scientific publications.¹⁸ Complementary trends include the acceptance of open universities, online distance learning courses, and open-access to scientific and technical peer-reviewed publications. Collectively, these trends will contribute to accelerate the diffusion of knowledge and alter the traditional organization of academic and industrial research.

One potential effect of the globalization of S&T is the ‘levelling of the playing field’ between state and non-state actors since the same devices or devices with similar capabilities will be globally available. Combined with the advent of additive manufacturing (discussed further below) and expandable commercial autonomous systems, the result will be the continued development and use of low-tech but effective weapons by opponents with relatively high technical and technological skills who otherwise would be unable to threaten Western military forces. In specific instances the application of such weapons by technically savvy opponents may cause to undermine the effectiveness of Western military capabilities for various lengths of time.

A further result of the globalization of S&T is that certain instruments of war such as various cyber-based instruments, non-lethal weapons, bio-engineered weapons, and, in the worst case, WMD, may become increasingly accessible to a wider variety of actors.¹⁹ States will continue to seek the prestige and deterrent value of WMD systems to reinforce their regional power. Efforts to ensure the security of nuclear weapons and related technology, radiological material, biological pathogens, and toxic chemical agents and their precursors will continue to be essential to reduce the risk of proliferation and incompetent handling.

The fast pace of advances in devices and systems will increasingly challenge capability-based planning cycles, particularly the decision-making process necessary to understand what level of technological sophistication is necessary to maintain capability advantage.²⁰ While rapid obsolescence of devices will continue to characterize the commercial market, technological and scientific advances must not be considered for their own sake but in light of entire capabilities. Nevertheless, life cycle and maintenance of specific DND/CAF systems may require shorter cycles with modular sub-systems and ad hoc devices being plugged-in and then replaced by new ones.²¹ Such rapid developments will both stimulate and challenge the continued evolution of the current capability development model. As a potential second-order effect, early adoption of new technologies could increase the risk of unintended consequences on humans and legacy systems.²²



MILITARY IMPLICATIONS

33 There will be increased demand on both national and allied defence and security institutions to ensure control and integrity of platforms and systems, as well as an increased requirement to certify the reliability of foreign sourced systems and integrated components. DND will need to carefully choose which elements cannot be outside Canadian control and continue to develop trusted relationships with defence industrial partners.

34 In order to leverage S&T trends, speedier, more agile and flexible military procurement strategies and programmes will be required to ensure defence is able to maximize the benefits of technological change.

35 A decrease of basic fundamental S&T research by Western governments may lead to a larger long-term applied science gap between Western nations and other countries such as China. The military risk is one of reliance on non-allied technologies or of an inability to access technologies that may be critical to fielding effective military forces in the future.

Affordability of Technology

The increased affordability of sophisticated, cutting-edge technologies such as three dimensional (3D) printers, electric vehicles, and smart communication devices benefits large parts of the population. The economies of scale behind such affordability typically do not exist for many specialized defence systems. The costs associated with the development of advanced military systems and platforms will continue to be high and challenge militaries faced with the reality of small production runs and finite budgetary resources.

The military technical superiority enjoyed by the West since the Second World War shows progressive signs of erosion, and may be eclipsed in some niche areas.²³ According to one source, the diffusion of advanced technologies in the global economy enables some 'middle-weight' militaries and non-state actors to muster weaponry, such as precision munitions and cyber and space capabilities, which were once available only to superpowers.²⁴ The subsequent costs associated with the identification, development, fielding and operation of emerging and advanced military technologies may push nations towards greater technical development cooperation to offset the extreme costs likely to be involved.²⁵

As advanced military systems become increasingly expensive and perhaps unaffordable, the problem of determining what level of technological sophistication is necessary to counter the capabilities of the most challenging likely opponents will be increasingly difficult. It is notoriously difficult to compare military capabilities in a manner that reflects the true effectiveness of a military force.²⁶ Indeed, some knowledgeable commentators have already argued for a greater focus on more adaptable, less sophisticated systems based on the understanding that it is the entirety of a capability and how it might be applied that has proven to lead to success in warfare.²⁷ It is also important to remember that in some scenarios, mass could matter more than technological sophistication in the future operational environment. Achieving the appropriate balance between technological superiority, quality, quantity and affordability will therefore pose significant challenges if military capability advantage as well as interoperability with traditional allies is to be maintained.

MILITARY IMPLICATION

36 The CAF will continue to face a key challenge in establishing the appropriate balance between technological sophistication, mass, interoperability, and affordability.

Additive Manufacturing

Additive manufacturing technologies are the result of the evolution of work in 3D printing and stereo-lithography.²⁸ In time, it could revolutionize many sectors of manufacturing by reducing component lead time, cost, material waste, and energy usage. Additive manufacturing has emerged through a process of making three-dimensional solid objects, one layer at a time, from digital models using 3D printing technology. Additive manufacturing is already altering global design and prototyping, and production logistics, pressuring intellectual property, patents, legacy licensing models, as well as fee and royalty business models. In the future, designers may be able to email their 3D model data files to a local manufacturer who will then print and ship the part within days.

Open-source crowd-manufacturing²⁹ may challenge the ability of states to maintain technological superiority because blueprints of original and counterfeit parts and devices will rapidly spread through open or rogue networks. Attempts to access proprietary or industrial construction codes through cyber means or the black



market could increase, calling for cyber defence policies and capabilities to safeguard trade secrets and intellectual property.

The design and manufacture of materials at the molecular level may result in 'designer' materials and intelligent clothing, with built-in capabilities to sense and modify their behaviour or functionality. Smart nano-materials could lead to the development of textiles that detect biotoxins in the environment and protect the wearer against infection. New materials will enable operations in hostile environments such as space, deep underground, deep underwater, heavily contaminated sites, and extreme cold weather. Advanced materials will also have significant impact on concealment and countermeasures, providing opportunities to manipulate visible light.

Additive manufacturing already provides new and affordable means to design and build 'one-off,' customized, and personalized objects such as prosthetics, dental implants, hearing-aid earpieces, jaw or bone replacements, and human skin. Out to 2040, advances in human stem cell research and additive manufacturing will likely deliver custom replacement organs and tissue for patients, reducing dependence on organ donation. The transformation to digital additive manufacturing and fabrication will likely impact public health, settlement patterns, labour, education, transportation, the environment, and warfare.³⁰

MILITARY IMPLICATIONS

37 Additive manufacturing has the potential to dramatically change the sustainment function. The CAF could seek to reduce its logistical tail with the ability to build spare parts and other supplies in the joint operational area.

38 As digital blueprints of weapons and dual use technology will be harder to protect from espionage, the CAF may seek more capabilities in intelligence and cyber defence to safeguard technological data.

39 Advanced materials will impact concealment and countermeasures, providing opportunities to manipulate visible light. New developments in smart nano-materials and textiles will affect the sense and the shield functions.

40 Military health systems will likely be impacted by advances in bio-technology and additive manufacturing through the delivery of customized replacement organs, bones, and tissue.

Socio-technical Networks

Socio-technical networks will continue to change how people and devices cooperate to achieve goals. Nevertheless, in the 'internet of things,' the increasing role and pervasiveness of networked technological devices in day-to-day life, like embedded radio frequency identification tags, and the risks of their malicious use will likely create new vulnerabilities and raise policy issues with respect to their control and security.³¹

In the military context, the technologies that have led to the creation of socio-technical networks may allow for alteration of traditional Command and Control (C2) structures that enable efficiencies to be realized. Such technologies may be exploited to allow for such concepts as decentralized C2 hubs. The use and exploitation of personal smart devices and social media in operational environments will impact the conduct of influence activities, C2 and intelligence. However, without proper cyber security, smart devices will increase the potential for operational security breaches. According to IBM, social networking has become the primary activity on the web, and social networks are being used on workplace devices with or without authorization.³² With ever more devices connected to socio-technical networks, these will continue to generate ever growing arrays of data demanding more automated analytical power to produce actionable information for decision makers. Advances in artificial intelligence, big data analytics³³ as well as cognitive and human behaviour sciences will likely provide reliable means to better exploit and understand such data.

Socio-technical networks will continue to facilitate the organization of protests. They will also offer new means to monitor and sense social grievances. Groups will proliferate and realize objectives that are more complex and nuanced than those arising from social networking today. However, the long-term effectiveness of such ephemeral groups beyond addressing specific issues for relatively short periods of time remains in question. Socio-technical networks could also enable attacks to occur rapidly in both the physical environment and cyber domain, without forewarning, by groups or individuals seeking to achieve symbolic effects through the greatest media impact. Governments at national, regional, and local levels will need to adapt to a growing array of non-state actors and social movements, some of which will emerge, mobilize, and vanish rapidly using connective technologies.³⁴ Lastly, socio-technical networks will continue to offer opportunities for foreign states to perform influence activities against the interests of Canada and its allies.



MILITARY IMPLICATIONS

41 Socio-technical networks will continue to have a direct impact on C4ISR architectures and systems and on the execution of C2. The CAF might have to continue to adapt its tactical authority delegation and eventually use artificial intelligence and automation to enhance and speed up decision-making.

42 Big data analytics will create opportunities and challenges for militaries. Exploiting data in such a way may allow for more effective conduct of military operations, particularly cyber and influence activities.

43 The use of personal smart devices and social media by CAF members, OGDs, Non-Governmental Organizations (NGOs), and Private Military Contractors (PMCs) in operational environments will continue to challenge operational security and put greater demands on cyber security.

Cloud Computing

By 2040, the world will be one of increased connectivity where individuals, communities and groups, governments, academia, corporations, as well as sensors, weapon systems, critical infrastructures, and everyday objects are seamlessly networked into the digital world.³⁵ For several reasons, including economies of scale, much of the information and processing power will be residing in clouds.³⁶ Education, work, and services will be increasingly performed online, impacting labour markets, retail models, urban design, and transportation systems.³⁷

Protecting information in the cloud will require carefully balancing economic value against risk. Several issues and opportunities related to cloud computing have been documented and reported.³⁸ Governments may be compelled to take the lead in standardizing and securing clouds.

Societies and economies are linked together by networks, cables and Internet Protocol (IP) addresses of computers and smart devices. Owing to globalization, most parties involved in conflict will likely use comparable or identical networking technology. Maintaining military information systems capability advantage may thus center on conceiving clouds that provide differential advantages, whether in information content, processing, speed, organization, robustness or security. As well, new cloud-enabled C2 technologies are expected to provide commanders and their staffs with improved ability to build situational awareness, reconcile operational pictures, devise plans, and direct operations in a seamless manner.

Ensuring credibility and reliability of information will become increasingly challenging. Assessment of information and identification of original sources will become more difficult. The vast majority of the content will be either raw sensor data – including citizens' sensors broadcasting over the Internet – or opinion-based information, difficult to distinguish from objective, validated products.

A shortage of the analytical and managerial talent necessary to make the most of big data may be a significant and pressing human resource challenge in the coming decade. According to one study, the US alone faces a shortage of 140,000 people with deep analytical skills and 1.5 million managers and analysts to analyze data and make decisions based on their findings.³⁹ The number of computer science and computer engineering graduates is shrinking in the US while the number of foreign graduates increases.⁴⁰ In comparison to those in other OECD countries, relatively few Canadian students are completing graduate and doctoral programs in areas required to drive discovery and innovation.⁴¹

The evolution of new forms of intelligence in cyber-technologies through means such as scripts, bots, and machine learning code and agents, will introduce radically different computational processes that could be deployed seamlessly in ever smarter computing clouds. With potential for concealment in the cloud, those potentially disruptive forms of intelligence could constitute a new weapon in cyber warfare.

In the digital world, some actors identify cyber vulnerabilities of potential adversaries and assess that exploiting such vulnerabilities in times of conflict is more affordable and less risky than the employment of munitions – while being more difficult to detect, attribute and prove. It is thus likely that adversaries will continue to attack in the cyber domain, where military networks and critical infrastructure could be vulnerable and actions remain difficult to trace.⁴² Cyber-attacks for military intelligence purposes have taken on a new dimension, as evidenced by the disabling of Iran's nuclear centrifuges by the Stuxnet computer worm and by a recent US report on China's Cyber Espionage Units.⁴³ With foreseen shortages in cyber experts, highly trained and motivated attackers constitute a growing threat to security.⁴⁴ Cyber security is one issue which is likely to define future relationships between the western world and Russia, China, and on a lesser scale, India and Iran. To manage cyber security, state governments must accept the fact that all advanced states will use cyber capabilities to carry out espionage against which they have a right and an obligation to protect themselves.⁴⁵

Offering low-signature and small-footprint characteristics, offensive cyber domain capabilities will likely continue to be used to penetrate and attack information-rich or



critical systems, networks, and infrastructures. Under such conditions, defeating an adversary's power projection networks and capabilities at all levels and denying access to our own power projection capabilities will require active defence capabilities. Maintaining unbreakable cryptographic security will be imperative for commercial, financial, defence and security requirements. Developments in S&T areas such as quantum cryptography could enhance secure communications.

MILITARY IMPLICATIONS

44 Secure clouds will impact future C4ISR architectures. Maintaining military advantage will require higher performance, more secure and more robust clouds than those possessed by opponents, since all parties involved in conflicts will likely use comparable networking technology and devices.

45 Very high levels of technical knowledge and skills will continue to be required to operate effectively in the cyber domain. Actions taken using this knowledge and skill must be well integrated within the overall military operational planning and execution functions.

Evolving Sensing & Analysis Technologies

In either the physical or the digital world, advances in sensing technologies will increase the ability to detect, characterize, and engage platforms, systems and individuals. Proliferation and deployment of new sensors will exponentially expand the big data pool and impact availability of timely intelligence to support operations and decision making.

With advances in big data analytics technologies, vast quantities of sensor data have the potential to provide a more refined and perhaps comprehensive view of the battlespace. Such advances will likely influence the interpretation of the battlespace and the development of alternate courses of action. Advances in human-machine interfaces, cognitive sciences, and more direct brain-machine interfaces may provide new means to exploit sensor data and generate more immersive C2 networks.

Improvements in biotechnologies, nanotechnologies, and micro-electromechanical systems will allow the development of multifunctional devices that will be able to detect very small amounts of any chemical or biological agent.⁴⁶ Advances in lab-on-a-chip devices⁴⁷ integrate and scale down biomedical and other analytical laboratory functions and processes to a miniaturized chip format. These devices offer possibilities for moving many diagnostic and analytical activities out of fixed, centralized facilities

and provide real-time information, with potential enhancements to Chemical, Biological, Radiological, Nuclear, and Explosive (CBRNE) sensing capabilities.⁴⁸

All-source intelligence will be of the highest importance to maintain situational awareness, increase understanding of human terrain dynamics, and providing support to decision makers. As illustrated in recent CAF expeditionary operations, scientific and technical exploitation of physical and digital evidence will provide an advantage in the battlespace. Advances in spectroscopy and forensic sciences will continue to provide military personnel with devices enabling better scientific and technical exploitation and the production of biometrics enabled intelligence and forensic enabled intelligence.⁴⁹

Combined with advanced nano-sensors, greater availability of miniaturized platforms such as autonomous vehicles and satellites will increase space situational awareness and make it more difficult to manoeuvre without being detected by potential adversaries. Platform and sensor developments will continue to erode military force concealment capabilities. Stealth aircraft technology is possibly more expensive than counter-stealth sensing coupled with guided surface-to-air missiles, which are already generally more affordable than manned combat aircraft.⁵⁰ Moreover, the proliferation and miniaturization of sensors will make it harder to identify breaches to concealment and to “detect the detection.” Sensor proliferation will continue to create problems for those seeking concealment in the battlespace.

MILITARY IMPLICATION

46 Given the proliferation of sensors, camouflage and concealment will be challenged by the integration of Intelligence, Surveillance, and Reconnaissance (ISR) assets, big data analytics, cyber-security, and human terrain understanding.

Extension of the Human Frontier⁵¹

Science and technology is now pushing the boundaries of “the human frontier” along cognitive, psycho-social, physiological and physical axes. Whereas agents and weapons designed to render ineffective or incapacitate adversaries have always existed, looking ahead, the most significant changes may be related to the design and use of human performance enhancers for tactical advantage. The primary focus of performance enhancement research involves the augmentation of the human mind and body. It is likely the most significant performance enhancement may be achieved through advances in man-machine interfacing, cognitive enhancement,



pharmacological interventions, and tissue/limb/prosthetic replacement. Resultant improvements will occur in cognitive performance (situational awareness, decision-making), sensory performance (visual, auditory, etc.), and physical performance (strength, endurance, speed). However, little is known of the potential long-term effects on human behaviour.

Human performance enhancement is a subject of active research. Advances in medicine, biology, brain imagery, cognitive and neuro-sciences, miniaturization of electronics, computation, and robotics,⁵² will continue to enable an increasingly sophisticated ability to modify or replicate the human body, its sensory systems, and capabilities. Such innovations will undoubtedly be adopted by some military forces, with potential consequences for both sides of a conflict.⁵³

Advances in life sciences, nanotechnology, and biotechnology could yield both new biological warfare threats as well as more efficient countermeasures against biological and naturally occurring infectious agents. They are expected to deliver better means to detect and monitor the human body, new biomarkers, surgical implants, and regenerative medicine through stem cell and tissue engineering applications.⁵⁴ Stem cell and tissue engineering research and development will offer new forms of treatment for missing, damaged, or diseased tissue. These sustained trends in life sciences will deliver innovations that will likely impact military and veteran health care systems, casualty management and novel biological agent countermeasures. They will also provide better force protection to deployed military personnel as well as better treatments and low-cost medicine. New and reliable low-cost medical devices are on their way, driven by increased demand for cost-effective health care.⁵⁵

New scientific developments in prosthetics will provide enhanced connectivity between neuronal feedback and artificial limbs. This will allow much easier and smoother control of prosthetics. This will be further advanced by returning tactile sense to damaged limbs that will allow wearers to actually feel or sense by producing electrical signals that mimic the biological sense of touch.⁵⁶ Such advances will contribute to increase the quality of life of wounded CAF members and veterans, and possibly even enable injured military personnel to return to the battlespace more rapidly.

The role of unmanned systems is changing from supporting to fully participating with humans. For example, artificial intelligence may one day make combat decisions.⁵⁷ The role and responsibilities of unmanned system operators could change to a supervisor role, tasking and managing several collaborative autonomous systems. Automated

systems may move too fast and the factors involved may be too complex for human comprehension.⁵⁸ Reliance on fully automated machine-driven decision making will have a wide range of effects and implications in the societal, legal, ethical, and policy spheres.⁵⁹ Some have cautioned that there will be an increased demand for the development of an international “robot’s code of ethics.”⁶⁰ There may be a call for an update to the LOAC, perceived by some to be inadequate to address weapon autonomy.⁶¹ Through programming humans will continue to control the ethical boundaries of automation. The increased use of unmanned weapon systems, will exacerbate the moral and ethical challenges of using lethal means “at a distance.”⁶²

Developments in the cognitive, behavioural, and social sciences will continue to deliver means to enable more effective generation, support, readiness, recruitment and selection practices, agile and flexible training, and psychological and physiological resilience. They are also expected to provide innovative options for organizations to work smarter.

MILITARY IMPLICATIONS

47 Extension of the human frontier will have a direct impact on the command, sense, act, shield, sustain and generate functions. However, the integration of human performance enhancement capabilities into the CAF portfolio will be challenged by ethical, legal, and policy considerations which might not be the case for adversaries. The CAF must establish those parameters before those technologies are fielded.

48 Advances in life sciences will likely impact military and veteran health care systems, casualty management and novel biological agent countermeasures. Developments in biotechnology may provide better force protection to deployed military personnel, better treatments and low-cost medicine.

49 Advanced unmanned systems will become increasingly autonomous. Eventually, military personnel may be challenged by increased participation of autonomous systems making tactical decisions.

50 Complete integration of new technological means will continuously require the Rules of Engagement (RoE), and the development of associated policies to evolve. Examples include the collection and exploitation of biometrics in theatres of operation, cyber warfare and persistent surveillance systems affecting privacy, the use of human performance enhancers, and the use of non-lethal weapons.



Technological Surprise

From a military perspective, being surprised by the behaviour of an adversary, including how technology is applied on operations implies a degree of unpreparedness. While historically there is little consistent correlation between strategic, operational, or tactical surprise and the ultimate victor in war, being surprised in the battlespace is often costly and can result in significant operational, if not strategic disruption.⁶³ Therefore, it is important to take steps to minimize the potential for surprise. In the broadest sense, surprise is the consequence of an adversary taking unexpected action to produce unforeseen consequences.

Technological surprise may result from new technologies or from the innovative, disruptive application of existing technologies in new ways.⁶⁴ As stated in the introduction, preparing for low probability, high impact events, or 'Black Swans,' presents major challenges given the likely substantial investment required for indeterminate benefits.⁶⁵ The problem for military force development, of course, is making judgements on which potential black swans warrant investment based on the potential threat to national interests.

Currently, allied programs for dealing with capability surprise all include research and technology foresight and development, modeling and simulation, expert staff, acquisition and industrial capability, and testing infrastructure.⁶⁶ It is not coincidental that such things are, in general, necessary for effective capability development. Some reliance on reactive measures to mitigate surprises will always be necessary. However, proactive preventive measures such as the use of foresight and scientific and technical intelligence to identify emerging and potentially disruptive technologies can also minimize the impact of such surprises.⁶⁷

One of the effects of the globalization in systems design, manufacturing and inter-connectivity is potentially greater vulnerability. The World Economic Forum assesses that critical systems failure, cyber attacks, massive cyber incident of data fraud and digital misinformation, are among the major technological risks developed countries will continue to face in the coming decades.⁶⁸

Given the potential of adversaries to disrupt, degrade, or destroy cyber and space systems, it is highly likely that the CAF will have to operate when these systems or others are compromised or unavailable. Resilience and robustness must be built into systems architectures, and the force must be ready to operate in "worst case" degraded operational environments.⁶⁹ Moreover, as new technical means

are available to adversaries, new systems integrity validation techniques will be equally required to rapidly identify and mitigate compromised systems and maintain operations security.

Weaponization of the increasingly cluttered space environment may increase by 2040. Technologies to counter low-earth orbit systems are already available. Advances in novel weapons technology and the spread of conventional technologies will result in greater access to capabilities to deny, disrupt and destroy satellites in low-earth orbit. Allied space-based systems may face greater risk from kinetic and non-kinetic counter-space systems proliferation whereas nations' interests will continue to stimulate advances in global and persistent intelligence, surveillance, and reconnaissance, including electronic and communications intelligence activities. Ground components and radio frequency communications with satellites will be essential and could also be subject to disruption, denial, and destruction.

Development of novel weapons will continue, particularly in the field of Directed Energy Weapons. These are expected to be capable of discrete target discrimination, and to cause disruptive or damaging effects to operational systems. The pace at which such systems will move from the laboratory into operational service is unclear and could result in technological surprises.

While developments in the life sciences continue at a rapid pace, there are those who will attempt to exploit such advances for strategic advantage. According to the US National Security Council,⁷⁰ the nature of biological threats continues to evolve. In particular, the risk is evolving in unpredictable ways, advances in enabling technologies are becoming globally available and increasingly accessible to those of ill intent as technical barriers fall and cost decline. Similarly, the US Department of Homeland Security states that despite lower likelihood, CBRN attacks pose a far greater potential for catastrophic consequences than those conducted with more conventional or common means, and particular attention must be paid to the security of dangerous CBRN materials, weapons, and technology proliferation.⁷¹ As mentioned recently, "refusing to think about dreadful outcomes will not prevent them; it just assures we will be unprepared to cope with them."⁷²

MILITARY IMPLICATIONS

51 The CAF will have to continue to operate when systems are compromised, unavailable, or access to systems is denied. Maintaining sufficient resiliency to be able to operate under various conditions and with a broad spectrum of partners – some with low-tech interfaces – will help prevent mission failure.



52 As national and allied space systems will face greater risks, the CAF may need to seek more mitigation strategies and collaborative approaches to space capabilities to gain robustness and redundancy, and, therefore, resilience.

53 Technological advances will require DND/CAF to innovate in Defence Project Management in order to leverage its upside benefits in a timely manner and to create the organizational process and climate necessary to innovate military technology.

Conclusion

This chapter identified what are considered to be some of the critical S&T trends most likely to impact the FOE and influence future DND/CAF capability requirements, investments, and policies. Science and Technology advances will continue to impact many dimensions of human life through an increasingly intertwined global scientific and technological landscape. Scientific and technological advances illustrate the huge potential of global S&T to generate opportunities and new challenges. Organizations that are agile enough to recognize and seize opportunities to apply new and old technology in innovative ways will be able to increase and maintain capability advantage and ultimately to deter and defeat adversaries. Out to 2040, Canada and its allies will continue to face the challenge of creating and maintaining effective and affordable defence systems. When considering the relationship between technology and the military problem of surviving and winning in warfare, the most important judgment facing those tasked with making future force decisions is deciding what adaptations are necessary and the level of sophistication necessary to succeed in warfare against those adversaries that represent the greatest threat to national interests.

NOTES

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2 Williamson Murray, *Military Adaptation in War*. Alexandria VA: Institute for Defence Analyses, June 2009. p. 8-15. The one caveat Murray allows in this particular analysis is that of the advent of nuclear weapons which created fundamental new strategic problems.

- 3 Stephen Biddle, *Military Power: Explaining Victory and Defeat in Modern Battle*, Princeton: Princeton University Press, 2004. p. 197.
- 4 Ibid, p. 196.
- 5 Ibid, pp. 198-199.
- 6 Biddle, *Military Power*, p. 203.
- 7 See Biddle, pp. 196-206; Murray (2009) pp. 8-12 to 8-16. See also H.R. McMaster, "On War: Lessons to be Learned," in *Survival: Global Politics and Strategy*, Vol. 50, No.1, March 2008.
- 8 Murray (2009), p.8-15.
- 9 The resources and effort expended to counter the problem of IEDs by Canadian and allied forces in Afghanistan and US and allied forces in Iraq are but one example that can be referred to. Many of the IEDs that have been encountered in these campaigns employ relatively unsophisticated technology. The effective use of RPGs against tactical rotary-wing aviation and the use of unsophisticated sea mines to hinder access to areas are further examples.
- 10 Susan Schneegans (Ed.). *UNESCO Science Report*.
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- 12 "2013 Global R&D Funding Forecast". *R&D Magazine*, vol. 54, no 7, Dec 2012.
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- 15 Lemnios, Zachary J., Shaffer, Alan. "The Critical Role of Science and Technology for National Defense," *Computing Research News*. Vol. 21, No 5, November 2009.
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- 17 President's Council of Advisors on Science and Technology, *Transformation and Opportunity: The Future of the U.S. Research Enterprise*. Report to the President. Nov 2012. p. 29
- 18 See for example Figure 5-25 of National Science Board. 2012. *Science and Engineering Indicators Digest 2012*. Arlington VA: National Science Foundation (NSB 12-02).
- 19 NIC 2012, p. 8.
- 20 Richard Danzig, *Driving in the Dark: Ten Propositions About Prediction and National Security*. Washington D.C.: Center for a New American Security. pp. 19-20.
- 21 For example, new non-lethal weapons, handheld devices, ECM components, night vision goggles, software, etc.
- 22 See Done, Adrian. *Global Trends. Facing Up to a Changing World*. IESE Business Collection. Palgrave Macmillan. 2012 (in particular chapter 3 on Technological Challenges).
- 23 *Military Balance 2012*. Chapter Two: Comparative defence statistics, 112:1, 31-38. International Institute for Strategic Studies. <http://dx.doi.org/10.1080/04597222.2012.663211>. See also: United Kingdom, *Regional Survey – South Asia out to 2040*. Ministry of Defence, DCDC, 2012, p. 13: "Technological parity with leading Western states may be achieved by India and China before 2040, with parity being achieved in many niche areas as soon as 2015." China is likely to attain and sustain global leadership in a number of areas such as computer science, space science, genetic engineering, materials science, chemistry, electrical engineering, mathematics, robotics, optics, biology, and nanotechnology.
- 24 Government of the USA, Capstone Concept for Joint Operations: Joint Force 2020, 10 Sept 2012, p. 2.
- 25 See for instance the Annual Report 2012 from the Australasian Joint Agencies Scanning Network: "The government's long-range plans for Australia's defence capabilities as spelled out in the 2009 White Paper are clearly unaffordable." January 2013, p. 35



26 See for example the problems noted by the editors of the *Military Effectiveness* trilogy in their updated introduction in the 2010 edition. See Williamson Murray and Allan Millett, "Introduction: Military Effectiveness Twenty Years After," in *Military Effectiveness*, 3 Vols. NY: Cambridge University Press, 2010.

27 Danzig, pp. 23-28.

28 Additive manufacturing is defined as: "The process of joining materials to make objects from 3D model data, usually layer upon layer, as opposed to subtractive manufacturing technologies." In, Ian D. Harris, *Development and Implementation of Metals Additive Manufacturing*. Columbus, OH, 2011

29 Open-source crowd-manufacturing is an emerging concept that is based on crowd sourcing. It will allow for the open source development of additive manufacturing blueprints.

30 David Rejeski. *The next industrial revolution: How we will make things in the 21st century and why it matters.*, Wilson Center. Nov 2012

31 Simply described, the 'internet of things' can be understood as the networks created by sensors and actuators embedded in objects that are also able to communicate – send and/or receive data – with computers. For example, some automobiles are designed to collect, store, and transmit data to the manufacturer's network to help facilitate maintenance, emergency roadside service, and other functions.

32 IBM, *Emerging Trends in Security*, 2011, [https://www-950.ibm.com/events/wwe/grp/grp004.nsf/vLookupPDFs/5%20Emerging%20Technologies%201145AM%202/\\$file/5%20Emerging%20Technologies%201145AM%202.pdf](https://www-950.ibm.com/events/wwe/grp/grp004.nsf/vLookupPDFs/5%20Emerging%20Technologies%201145AM%202/$file/5%20Emerging%20Technologies%201145AM%202.pdf). p. 24, accessed November 2012.

33 "Big data" refers to datasets whose size is beyond the ability of typical database software tools to capture, store, manage, and analyze. This definition is intentionally subjective and incorporates a moving definition of how big a dataset needs to be in order to be considered big data. As technology advances over time, the size and number of datasets that qualify as big data will also increase. In many sectors today, big data will range from a few dozen terabytes to multiple petabytes (thousands of terabytes). McKinsey Global Institute. *Big Data: The next frontier for innovation, competition, and productivity*. June 2011. Big Data Analytics is the process of examining large amounts of data of a variety of types and sources, including social media. The aim is to uncover hidden patterns, unknown correlations and other useful information using different techniques such as statistical analyses, natural language processing techniques (including sentiment analysis), data visualization techniques, etc.

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36 Cloud computing is defined as "A model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction," DoD Chief Information Officer, *Cloud Computing Strategy*, July 2012, p. 2.

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- 47 Lab-on-a-chip devices are characterized by their small size, low power requirements, and the speed at which they provide results.
- 48 *Technology and Innovation Futures: UK Growth Opportunities for the 2020s*. 2012 Refresh. Foresight and the Government Office for Science. 2012.
- 49 See for instance: U.S. Department of Defense Forensic Enterprise Directive NUMBER 5205.15E (26 April 2011) that "establishes policy and assigns responsibilities within the DoD to develop and maintain an enduring, holistic, global forensic capability to support the full range of military operations."
- 50 Wong, Wilson W.S. *Emerging Military Technologies. A Guide to the Issues*. Contemporary Military, Strategic, and Security Issues. Praeger. 2013.
- 51 The aim of Human Frontier research is to move beyond the current limitations of capacity in cognitive, psycho-social, physiological, and physical axes of human ability. Frontier research is research at the cutting-edge of any given scientific field. The word "Frontier" may be associated with the exploration of the land beyond boundaries, the land of the unexpected and of unlimited opportunities. Frontier research takes enormous risks to step into the unknown. (Human Frontier Science Program, Strategic Outlook 2010-2016. <http://www.hfsp.org/sites/www.hfsp.org/files/webfm/Executive/HFSP%20Strategic%20outlook%20Final.pdf>.)
- 52 For instance, research is being pursued in the field of wearable exoskeletons as human performance enhancers.
- 53 Committee on Assessing Foreign Technology Development in Human Performance Modification; Board on Behavioral, Cognitive, and Sensory Sciences; Division on Engineering and Physical Sciences; Division of Behavioral and Social Sciences and Education; National Research Council. *Human Performance Modification: Review of Worldwide Research with a View to the Future*. National Academy of Sciences. 2012.
- 54 Battelle and R&D Magazine. *Global R&D Funding Forecast*, Dec 2011.
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65 A black swan is "a highly improbable event with three principal characteristics: It is unpredictable; it carries a massive impact; and, after the fact, we concoct an explanation that makes it appear less random, and more predictable, than it was." For additional reading on black swan events see, Nassim Nicholas Taleb, *The Black Swan: The Impact of the Highly Improbable*, Random House Press, New York, 2007.

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69 USA, *Capstone Concept for Joint Operations...* See also *Preparedness in the Private Sector: 2012 Report*, Conference Board of Canada, in particular the Joint Resilience Planning section (p. 10-11).

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CHAPTER 4

MILITARY TRENDS

Introduction

The fundamental purpose of any military is to defend its country's people, sovereignty, and interests. To accomplish this, a military must prepare for domestic and expeditionary operations, including war. By doing so, the CAF is able to fulfil the broader national security and foreign policy objectives of the GoC. However, such preparations are inherently difficult. The constant demand for improved situational awareness of global political, security, and defence affairs, the pressure of balancing capability requirements with fiscal resources, technological change and its potential impact on military strategy and operations all upset even the most careful considerations of what the character of future conflicts may be. "No matter how clearly one thinks, it is impossible to anticipate precisely the character of future conflict," a prominent military historian asserts, adding that "[t]he key is not to be so far off the mark that it becomes impossible to adjust once that character is revealed."¹ This maxim is useful guidance for FD. To assist that process, this chapter describes trends in military affairs, including the enduring nature of conflict and the character of future operating environments in the 2013 to 2040 timeframe. The chapter should not be read in isolation, the subject matter is inter-related with, and a reflection of, analysis of the material in the preceding three chapters.

The CAF Approach to Operations

Preparing for future conflict and contingencies requires more than contemplating new trends; it also requires understanding what has remained constant over longer periods. Strategic traditions related to defence and security issues can help "provide context to the decisions made in the realm of warfare."² These long standing elements can be used as guides to the future for many defence related decisions, including force development.³ This is what has been called a state's or a military's 'concept of war.' The concept of war of a military institution is an amalgam of its history, perception of current and future threats, and its conception of future conflict.⁴ "It encompasses tactics, operational methods, strategy, and all other factors that influence the preparation for, and conduct of, warfare."⁵ Stated simply, the concept of war can be understood as the method by which a military approaches operations and includes all that is required to field and sustain an effective force.

The concept need not necessarily exist in a formal sense, although attempts at articulating it are often made. A military's conceptual approach to operations is more than contemporary policy or doctrine and is applicable across the spectrum of conflict. It also includes and is influenced by tangible and intangible factors such as national cultural and social considerations that affect how a military might be used in the protection and furtherance of national interest.⁶ Indeed, such strategic considerations have a far greater impact than are often acknowledged.

An understanding of the CAF approach to operations allows for the identification of historically consistent trends that can provide guidance and balance when pondering how the CAF must adapt to meet the challenges of conducting military operations out to 2040. This is not a complete discussion of the subject as many considerations, such as tactical and operational factors, perceptions of threat, and calculations of risk do not fall within the scope of this document.⁷ The material presented here are the identified long term historic trends or traditions that have coloured the use of military force by Canada. These trends have had, and will continue to have, force development implications because they affect perceptions of how the CAF would prepare for future conflict, even if the trends are only subconsciously recognized. These trends help establish a framework for developing CAF-specific military implications of long-term global military trends.

Historically Consistent Trends

The Canadian Armed Forces

For more than a century the armed forces of Canada have relied upon a core professional regular force and a robust, adaptable reserve force to fulfill Canada's military requirements, particularly over the course of longer campaigns or when any degree of mobilization has been required.⁸ While the overall size, structure, and capabilities of both components have fluctuated over time, the reliance on this basic structure to generate forces for operations is unlikely to change out to 2040.

Coalition Operations

Although Canadian military forces have been deployed independently, the CAF has historically most often conducted expeditionary operations in a coalition or alliance context.⁹ This pragmatic strategic tradition has seen Canada "work within alliances and coalitions [to] contribute salient and effective military forces to generate operational and, hopefully, strategic influence."¹⁰ This strategic tradition is likely



to endure regardless of the character and composition of the specific coalition Canada participates in. For example, the CAF may contribute to coalitions primarily consisting of core NATO members as in Operation Unified Protector; to broader NATO-led coalitions such as International Security and Assistance Force (ISAF); or to UN-led coalitions or mission-specific coalitions composed of various traditional and non-traditional allies. The nature of each coalition will create specific diplomatic and military leadership requirements, operational practices, and strategic considerations, particularly in those formed outside of any formal treaty structure.

The CAF has primarily gained influence on expeditionary operations through the provision of competent staff to coalition and alliance command structures and the fielding of credible, highly skilled forces. Such means have allowed for Canadian national interests to be better served and for Canada to often have an influencing role during coalition planning processes.¹¹ This has meant striving to develop, generate, and deploy forces that are mobile and interoperable. Consistently, when larger commitments have been involved, this has forced certain assumptions to be made regarding reliance on allies for certain capabilities. Although the likelihood of the CAF operating alongside non-traditional partners may be strong in 2040,¹² it will likely remain militarily more closely aligned to the US and the UK in the first instance, and the remainder of the “Five Eyes” (US, UK, Australia, New Zealand) group than with any others. The charter members of NATO will also continue to have close relationships with the CAF. There is nothing suggesting that the CAF will not continue to participate in, and benefit from, the various allied standardization programs that drive much allied interoperability.

The Defence of Canadian National Interests

The GoC has deployed the CAF under a variety of justifications but the defence and furtherance of Canadian national interests has always formed the core purpose of Canadian military operations. A recurring, if often unspoken, strategic tradition has been the concept of forward security.¹³ “Forward Security,” one Canadian historian has accurately written, “involves the deployment of Canadian military forces overseas to ensure that violent international activity is kept as far away from North America as possible and that Canadian interests overseas are protected.”¹⁴ Making meaningful contributions to larger coalitions has historically been one means by which Canada has conducted forward security. There are no strong indications suggesting that this strategic tradition will change out to the 2040 timeframe. Therefore, recognizing that Canadian economic prosperity and security rests partially on the shoulders of Canadian political influence abroad, the CAF will be deployed by the GoC in reaction

to events that threaten Canada's sovereignty, national interests, key allies, or in an effort to contribute to regional and global security.

There is no visible trend to indicate at what stage the CAF may be called upon to deploy, or for how long they may remain involved in a conflict. CAF commitments to NATO forces in Europe during the Cold War, the various deployments to the Balkans in the 1990s and 2000s, and the commitment to the various missions in Afghanistan clearly demonstrate that the GoC is prepared to commit, when the situation warrants, military forces for long periods. The GoC has also shown a tendency to commit the CAF during the early stages of conflicts to keep them from spreading or growing more violent. Similarly, the CAF is often amongst the first to respond during humanitarian crises in the Western hemisphere and as appropriate (normally when a meaningful contribution can be made) elsewhere. If a trend can be identified, it is that successive Canadian governments have often sought strategic influence through the contribution of military capabilities to coalition efforts at a time, and with the level of force, best suited to Canadian national interests.

Just as Canada tends to deploy the CAF as part of coalition forces to maximize influence, Canada in general has supported bilateralism, multilateralism, and international institutions to maximize political and diplomatic influence. As a result, having international or broad-based legitimacy for the use of military force has been a defined trend since at least the end of the Second World War. It is almost certain, therefore, that the GoC will seek some form of international legitimacy to underpin CAF involvement in a conflict. Closely related to this is that the rule of law, which includes both domestic and international law, will continue to guide, enable, and constrain all CAF activities. Indeed, in general, the Canadian public expects that these fundamental pillars are satisfied before popular support for the use of the military instrument is attained.

The Character of Future Armed Conflict

War & the International System

Despite recent developments in international law and the integrating force of globalization, it is axiomatic that the possibility of armed conflict is ever-present in a system of sovereign states. To think otherwise ignores both the insight of history and the current uncertain international security environment.

War is best understood as an activity, in which political actors attempt to advance their objectives using armed force. The Prussian military philosopher, Carl von



Clausewitz, captured this aspect in his oft-quoted passage that “war is not a mere act of policy, but a true political instrument, a continuation of political activity by other means.”¹⁵ Nevertheless, if the basic nature of war as a violent, purposeful political activity is unchanging, it is important to recognize that as a result of its natural dynamic the character, scope, and scale of war is forever in flux.¹⁶ The characteristics of a conflict are a reflection of a society and social conditions, as these define the characteristics of the will, or the political intent, that one group is seeking to impose upon others. Technology, economics, demographics, geography, and other variables play important roles in rounding out the characteristics of a conflict but all are much less important than the social factors in understanding why a belligerent is fighting and what their actual intent and goals may be. War will continue to be affected by subjective factors. In considering the future of armed conflict, it is essential that the dangers of ethnocentrism be avoided. Not all countries or societies view armed forces or the use of military power similarly.

Strategic culture refers to “the traditions, values, attitudes, patterns of behaviour, habits, symbols, achievements and particular ways of adapting to the environment and solving problems with respect to the threat or use of force.”¹⁷ It is rooted in a country’s history, geography, political culture and the attitudes of contemporary political and military elites. While it cannot explain everything or offer certainty in looking to the future, the framework in which a country approaches questions of war and peace, but also more generally the usability of military power in the conduct of its relations with other international actors, nonetheless offers useful insights.¹⁸ A failure to appreciate that others view the utility of military force, the nature of threat, and the calculus of defeat differently will lead to misunderstandings at both the strategic and operational levels. This in turn will generate vulnerabilities that can be exploited by adversaries, and it might even precipitate strategic defeat. It therefore matters less what military means an adversary may employ than it does to understand why they might employ those means, and to what end. As in the past, how future conflicts commence is in no way a certain indicator of what direction they will take or how they will end.

The sources of future conflict will, for the most part, likely resemble those of earlier eras. It is generally accepted that conflict and political instability are in part the products of disputes arising over the distribution of scarce resources – land, food, water and minerals. These tangible resources are necessary for personal, as well as social security, and it is impossible to imagine human existence without their possession. Many armed conflicts in the coming decades will continue to be rooted in such disputes, although some believe such disputes will be more intense, arguing

that guaranteed access to necessary resources will become more difficult in certain regions.¹⁹ Nevertheless, humanity has never been only concerned with the material world. The desire to fulfill a nation's destiny, to protect the identity of a people, to pursue salvation or to construct the 'just' society, creates other sets of essential social values that are subject to, and are deemed to require protection from, threat. This second category involves intangible security concerns that have frequently contributed to instability in the past and led to both civil and international conflict. It will continue to do so throughout the coming decades.

The geopolitical changes described in Chapter 1 underscores the continuing strategic relevance of interstate conflict. Some studies of conflict trends argue that the likelihood of interstate war has declined: some go so far as to suggest that the era of state-on-state violence might be nearing its end.²⁰ Alongside empirical evidence of such a trend, there are indications to the contrary. Perhaps the most salient is that governments themselves do not seem to accept that the trend-line is certain to continue and, indeed, some very powerful states have deviated from what the trend indicates. As the 2003 invasion of Iraq and the 2008 war between Russia and Georgia demonstrate, states will wage war when it is determined that the ends justify the means.²¹ So, while the frequency of interstate armed conflict has declined in recent years, these wars demonstrate that interstate conflict is far from an extinct variant of war.²² Large armed forces establishments in Asia and the Middle East further testify to the belief that governments see utility in possessing military strength and that the threat of state-on-state war remains a major security concern. This focus will not diminish in the next few decades and, indeed, is likely to become more pronounced. In many areas of the globe, reduced influence by traditional powers may be accompanied by the reassertion (already evident) of traditional rivalries that challenge existing borders. While future armed conflict between states, including major regional Powers, does not portend an inevitable systemic war (as it often did during the last century) it does suggest that small-scale border clashes could easily escalate, despite recognized socio-economic consequences for the belligerents.

Regardless of advances in information technology, uncertainty will continue to affect strategic and operational planning. The imperfect knowledge of adversaries' intentions and capabilities combined with the inability to completely understand the impact of one's own actions will persist, negatively affecting situational awareness. However, the level of uncertainty will be magnified if the current environment of persistent armed conflict, a situation that commenced with the ending of the Cold War, endures. Thus the normal cycle of military innovation in peacetime and adaptation in wartime that has already been upset in recent years will continue,



affecting force development most obviously, but also deployment decisions as generally smaller military forces contend with the problem of avoiding overstretch and potentially diminished readiness.²³

Lessons from recent conflicts indicate that clear political-strategic direction is critical now more than ever because of the myriad actors and political interests affecting the operational environment.²⁴ Military leaders will continue to require political direction (as much as this is possible in a given circumstance) and strong strategic thinking abilities coupled with institutional structures and dialogue to allow for establishing effective correlation between political and diplomatic activities and military planning.²⁵ In other words, the development of effective “strategy is typically made by a process of dialogue and negotiation” between political authorities, civilian public servants, and military authorities.²⁶ Along with suitable organizational structures, this process requires effective professional development, education, and inter-departmental and cross-governmental exercises and training. These are essential to ensure deep understanding between national security partners and governmental authorities to ensure that military forces are employed in such a manner that allows capability advantages to be exploited.²⁷

A further, well established historical trend is that “military forces that study their activities, those of allies, and those of foes, both in peacetime and during war, tend to be more effective and improve the odds of success in battle. Those that don’t may fail outright or might still achieve success but generally at greater cost in blood and treasure.”²⁸ Simply put, defence institutional learning is critical. Consistently, this trend also indicates that learning at the tactical and operational levels is critical for near-term success as large numbers of casualties (or numbers perceived to be out of proportion to the justification for a mission) are the inevitable result of failure to learn in the battlespace and can immediately undermine public support for a campaign. However, strategic-level lessons identification and analysis is, over the long-term, more important because of the much larger implications of actions at those levels.²⁹ In concluding a major influential study for the US Office of Net Assessment, one set of analysts wrote that the singular most important point to be made was that strategic-level learning is critical, regardless of whether one was the victor in a conflict because “Mistakes in operations and tactics can be corrected but political and strategic mistakes live forever.”³⁰

MILITARY IMPLICATIONS

54 Career-spanning, focused, professional development and education on national security issues will be increasingly important. Understanding the mandates and capabilities of OGDs and agencies, and joint collective training, will be necessary to ensure CAF personnel are able to operate effectively as part of a comprehensive approach to resolving issues of Canadian national security.

55 The CAF must integrate the lessons learned from operations, exercises, and experiments at the tactical, operational and strategic levels in order remain ready, effective, and adaptive.

Future Conflict

The traditional categorization of war into conventional and irregular armed conflicts, already challenged by both the historical record and recent experience, will increasingly prove inadequate.³¹ State-on-state conflict employing standing armed forces, not involving the use of nuclear weapons, is termed conventional war. Conflicts involving at least one non-state actor as a primary belligerent have traditionally been described as irregular. Now and in the future, however, these classifications will likely be viewed as too restricted because of the frequency and capabilities of armed non-state actors encountered in the battlespace. Armed non-state actors have played a role in conflicts throughout history. In recent times however, the capacity of such actors to affect the political and military outcomes of conflicts is well out of proportion to the relatively small physical size of such armed groups. It is the role of armed non-state actors combined with the types of conflicts Western military forces have tended to become involved in, that serves to render obsolete the general categorization of war into 'conventional' and 'irregular.'³²

Many recent conflicts involving Western military forces could be viewed as discretionary because there has not been a direct, fundamental physical threat to the national territories of the states providing military force. In short, the direct and obvious link between threat and national interests, such as that which existed during the Second World War, is not always clear.³³ Partially because of this factor, legitimacy in the eyes of Western domestic and international publics has become ever-more important to satisfactory political outcomes from conflict. One major factor influencing perceptions of legitimacy is the ability to minimize what is perceived as collateral damage, civilian casualties, and limit friendly casualties to absolute minimums. Although the influence of these factors would likely fluctuate



depending on perceptions of threat, the maintenance of ethical and moral high ground by seeking to minimize the effects of war is essential to establishing and keeping legitimacy.³⁴ Consequently, the populations of Canada and its allies expect the use of precision strike capabilities.³⁵ This being said, there is no certainty that similar considerations will trouble the political or military leadership of an adversary that Canadian or allied forces might face in the future. As noted in Chapter One, steps can be taken to understand the political and strategic cultural factors that affect how an adversary may employ force, but even if this is done as comprehensively as possible the vagaries of human behaviour render most assumptions of adversarial behaviour and likely course of action less than accurate.³⁶ Indeed, it may prove almost impossible to make calculations of potential courses of action for non-state actors who may have no concerns about generating or maintaining popular support for their cause or actions.

Limiting the negative effects of conflict has increasingly become a basic starting point for western governments embarking on military campaigns. While perhaps generating unrealistic expectations regarding the requirement for military forces on the ground, precision strike capabilities are often understood as viable means of limiting bloodshed and collateral damage. However, certain challenges, such as those surrounding the use of armed unmanned aerial vehicles (UAVs),³⁷ mean that precision fires must not be seen as a panacea for all diplomatic and military problems. This perspective aside, precision strike capabilities have been and will continue to be more important for effective military operations in urban areas or against hardened critical adversary infrastructure.³⁸

Irregular war will continue to feature heavily in future intrastate conflicts, with “hybrid” aspects likely and, potentially, characteristics normally associated with transnational crime, international terrorist organizations, and insurgencies. For the purposes of this document, the term hybrid warfare is simply meant to illustrate the blending of conventional and irregular (or asymmetric) approaches to warfare. State and non-state actors alike will seek to combine conventional, irregular and high-end asymmetric methods concurrently, often in the same time and space through the land, air, sea, space environments and the cyber domain.³⁹ These approaches may challenge the conventional understanding and adaptability to irregular and regular military activity.⁴⁰ Adversaries applying hybrid techniques might use a unique combination of capabilities that are specifically designed to target our vulnerabilities.⁴¹ Such adversaries may possess the ability to forestall a military decision in a conflict sufficiently long that it undermines the political-strategic goals of Western coalition members.⁴² The overarching implication is that Western militaries must train to balance traditional

manoeuvre warfare capabilities with training suitable for addressing the challenges on the lower end of the spectrum of conflict.⁴³ Particularly during longer periods where a military force may be predominantly involved in a single campaign theme or a campaign predominantly on a particular section of the spectrum of conflict, it is important that broad military skill sets be preserved to assure flexibility and adaptability in the battlespace. Lessons from recent conflicts suggest that such campaigns place a premium on strategic and operational planning skills, close coordination and constant forthright communication between political and military authorities to ensure that commitments and military capabilities are matched, that diplomatic and operational activities are coordinated and synchronized, and that strategic and operational planning allows for military capability advantages to be exploited.⁴⁴

It is widely recognized that in certain types of campaigns, sustainable and effective solutions to instability require the government of the HN to assume responsibility for the effective provision of public goods and services, including the safety and security of their population, as early as practicable. This helps increase the legitimacy of HN authority and enables friendly forces to either exit from operations or ideally to prevent the necessity to deploy them in the first place. Building the capacity of the HN has always been a key element of creating the conditions that lead to a safe and secure environment. Capacity building in select countries advances Canadian foreign and defence policy interests by utilizing Canada's experience in peace, order, and good government to build similar governance infrastructures. Security force capacity building has become increasingly important over the past several decades and this trend is unlikely to change given the frequency the CAF is involved in stability operations.⁴⁵ These efforts may be bilateral or part of a multilateral agreement or coalition.

In the context of stability operations, capacity building is the process of increasing the ability of a HN to achieve self-sufficiency, typically through improved governance, security, human capital, development and reconstruction.⁴⁶ More simply, building capacity is the active state of creating the power of someone or something to perform or produce. As a holistic activity, capacity development is broader than developing human capital or organizational structure, as it must take into account the environment within which these operate and interact in order to achieve effective and sustainable results.⁴⁷

Capacity building is not exclusively a defence activity and even defence-specific programs require multifaceted whole-of-government and comprehensive approaches to be effective. Concepts and programs related to security and defence capacity



building have had a wide range of names since the 1960s. Examples are: Military Training and Cooperation; Security Sector Reform; Security Force Capacity Building; Strategic Advisory Team (Afghanistan); Combined Action Platoons (Vietnam); Operational Mentoring and Liaison Teams; Defence Diplomacy and Military Assistance; Foreign Internal Defence, and expanded conceptions of Civil Military Cooperation.⁴⁸ Regardless of the specific form, such concepts and programs require military personnel to possess not only core military skills and experience but also the ability to understand the requirements of those they are meant to support, the linkages between specific tactical level activities and broader political strategic intent, and the capability to understand how to develop individual and collective skill sets necessary to assist in creating long-term political stability and security. The demand for such activities suggests greater consideration of the educational, professional development, and training requirements for military personnel to be better prepared for these tasks.⁴⁹

Despite the frequency with which armed non-state actors are encountered by Western forces, the reality is that conventional military capabilities (regardless of the degree of professionalization) can tip the balance of power in localized, regional, and broader-ranging disputes. It is also impossible to rule out state-on-state conflict despite the fact that such conflict occurs less frequently than intra-state conflict, or conflict concerning non-state actors. Lessons from recent conflicts have shown that it is critical that conventional warfighting capabilities not be allowed to deteriorate as such capabilities have proven essential to effectively combat irregular and 'hybrid' adversaries.⁵⁰ When considering notions of 'asymmetry,' it must be remembered that professionalized, agile, conventional forces constitute an asymmetric capability when compared to non-state, irregular actors. Heavy brigades are asymmetrical compared to lone terrorists, but only when the operational context is appropriate.⁵¹ The point to be taken is that how military forces approach a conflict must take careful consideration of the strategic intent and the character of the adversary. Employing heavy armoured brigades to counter lone terrorists is just as inappropriate as a lone terrorist attempting to strike a heavy armour brigade.

It seems probable that state actors will, when it suits their interests, continue to seek to apply non-traditional means against an adversary. These are likely to include various methods of cyber interdiction and attack, the employment of irregular forces or proxies, and other similar means that should no longer seem surprising. In short, there must be no assumption made that any potential enemy will fight in a manner that is traditional, expected, or similar to the doctrines typical of Canada or any of Canada's allies. A further critical conventional warfare consideration for force development is

the intensity of combat, the inevitable attrition on combat forces, and the consequent drain on fiscal, physical (military hardware), and human resources that tends to occur with such conflicts. The difficulty of regenerating combat capabilities in light of the expense of modern military hardware must not be underestimated.

MILITARY IMPLICATIONS

56 When possible, state and non-state actors alike will seek to combine conventional, irregular and high-end asymmetric methods concurrently, often simultaneously in the land, sea, air, and space environments and the cyber domain to gain advantage in future conflict.

57 The ability to apply joint precision effects will remain an important requirement to achieve military success in the FOE. Increasing precision in all aspects of military activities has been and is currently a major Western military capability advantage. However, the global proliferation of sophisticated technology will erode this advantage over time as more actors develop or acquire lethal precision capabilities. The CAF should be prepared to field a robust defence against such capabilities.

58 Complex stability-type operations require a population-centric approach to achieve long term mission success. Such operations will likely demand greater precision in the use of non-lethal capabilities. The CAF should continue to develop and implement strategies to rapidly understand human terrain in any new operating environment. This will improve the prioritization and application of precisely targeted non-lethal effects to facilitate mission success.

59 The expected characteristics of the FOE, specifically the historic trends regarding how the CAF approaches operations, the longstanding characteristics of war and the international system, the pervasive nature of various and projected medias, and the ever-greater importance of maintaining legitimacy highlight the importance of strategic communication in planning and conducting future military operations. Trends in urbanization, socio-technical networks, cloud computing, and sensing and analysis technologies imply that the significance of strategic communication will only increase out to the 2040 period.

Weapons Proliferation

Weapon proliferation will be a challenge of growing importance. Even relatively small powers and non-state actors will be able to possess and deploy an array of longer-range and more precise weapons.⁵² The proliferation of smaller weapons systems (including such things as small arms, light man-portable and crew-served systems



and supporting technologies such as night and thermal imaging systems) means it is likely that certain operations short of high-intensity conventional conflict may be more hazardous at the tactical level. It should also be expected that comparatively unsophisticated weapons or those considered obsolete by modern militaries will be used by adversaries with great effect. Area denial weapons systems have always posed challenges but these will, as discussed below, increasingly be a feature of the FOE. In short, conflict in the future will be as uncertain as in the past and it must be assumed that belligerents will seek to acquire and become proficient in the use of what weapons and capabilities are available to them.⁵³

While the utility of WMD is widely regarded by many states as limited to the deterrent value inherent in such weapons, the proliferation of technology and material related to WMD increases the risk that those may be held and used by a belligerent, particularly if the circumstances of a conflict create the perception that ultimate survival of a government, state, or nation is at stake. Possession of WMD may allow states and groupings to pursue more aggressive policies, indeed any acceleration of their proliferation makes this more likely.⁵⁴ Further complicating the issue are considerations of strategic culture; it cannot be assumed that those who might not share the similar historical, cultural, moral, or ethical backgrounds will possess similar attitudes to the use of WMDs as Canada and its allies. Thus, while WMD and their delivery systems, since their conception, have always had the potential to undermine international peace and security, the latent threat they pose will almost certainly continue.⁵⁵ Military forces expected to execute difficult expeditionary operations in regions where potential belligerents may employ such weapons should plan for the expectation that WMDs will be used.

MILITARY IMPLICATION

60 The proliferation of advanced technologies and weapons, including WMD, has the potential to shift the balance of power in a number of regions. The CAF must be capable of operating in environments where such threats are present.

KEY TOPIC: Weapons Proliferation

The issue of proliferation is explored using three examples of weapons that may constitute a threat for the CAF in an operational area.⁵⁶ This approach is used to highlight the different types of proliferation, their scope and potential impacts. The proliferation of weapons (all types) is an issue for the CAF and

OGDs because of the impact it has on the world, regions and potentially on Canada. The value of the global legitimate trade in small arms, including light weapons and their ammunition, is estimated at more than \$ 7 billion per year. However, the value of the illicit small arms trade “cannot be determined with any specificity.” This may also run into the billions.⁵⁷

Illicit small arms found in states such as Afghanistan, Iraq and Somalia were described by *Small Arms Survey* as commonly being “early designs of Eastern Bloc or Chinese weapons that have proliferated widely and are often significantly less capable than their modern counterparts.”⁵⁸ In fact, many of the weapons have “[...] been circulating in the same countries for years, or decades” which reveals “a remarkable continuity in the model and technological sophistication of illicit weapons.”⁵⁹ Illicit small arms play a significant role in conflict throughout the world because “they are easy to use, to carry, and to conceal” and they “[...] undermine security and the rule of law, are a factor in the forced displacement of civilians, enable massive human rights violations and hinder social and economic development.”⁶⁰ The trends concerning the proliferation of arms vary greatly depending on the weightiness, notability and repute of the items.⁶¹ Quantity and potential impact matter most.

In 2002, a failed attack on an airliner galvanized support for measures to curtail the trade of man-portable air-defence systems (MANPADS). This event indicates two important factors that need to be considered when examining trends. First, that the weapons used in the attack were 10 years past their shelf-life of 10-15 years when they were fired. Therefore, weapons that are in circulation now may constitute a threat well past their designated shelf life. Second, possession of this type of weapon by a non-state actor does not mean that it will be deployed successfully because “firing [...] is not simply a matter of ‘point and shoot.’”⁶² However, the potential impact of shooting down a civilian airliner, within or outside of a declared conflict region will have significant consequences on global air travel.

Before the fall of the Gaddafi regime, it was estimated that there were (5,000 to 7,000) missile systems outside of government control worldwide. The US State Department estimated that since the 1970s, 25 civilian aircraft had been shot down with MANPADS resulting in 600 deaths.⁶³ These will continue to circulate illicitly. Countries such as the United States and Russia have taken steps to improve controls on MANPADS.⁶⁴ Despite these



initiatives, this threat will persist. For example, in 2011, after the fall of the Gaddafi regime, thousands of sophisticated weapons were abandoned; including heavy weapons and approximately 20 000 MANPADS.⁶⁵ The impact of small arms proliferation is high, yet the potential acquisition of CBRN, or 'weapons of mass destruction' in the years since the terror attacks of 9/11 2001 has generated particular attention in defence and security discussions. When examining proliferation it is important to separate myth from fact. This is especially important when considering the CBRN threat posed by non-state actors. It has been stated that "rhetoric and intent" are too often "regarded as vital indicators of future terrorism events."⁶⁶ Considering the desire to deploy CBRN weapons "without evaluation or benchmarking these declarations against capability aspects in the environment in which they may operate"⁶⁷ may lead to exaggerated threat perception. The Canberra commission warned that the possession of nuclear weapons by any state is a constant stimulus to other states to acquire them.⁶⁸ Knowledge of these weapons may proliferate, but it will not necessarily or immediately translate into CBRN capability. While putting this threat into proper context, it must be remembered that a threat does exist. Recent trends have shown that state based proliferation will continue to be a concern. Therefore, it must be taken into account through Defence planning and FD.

The development of CBRN capabilities by states will continue to increase regional tensions.⁶⁹ A number of States that do not possess nuclear weapon capabilities will continue to desire the development or acquisition of these technologies because of the deterrence, legitimacy and status these provide.⁷⁰ It can not be ruled out that those who desire the acquisition of such capabilities will not also employ them if so required by the vicissitudes of conflict. International initiatives to achieve the reduction of nuclear weapon arsenals will likely not completely eliminate these weapons.⁷¹

In conclusion, the proliferation of illicit small arms will continue unabated and have great implications. These weapons will continue to constitute a "massive threat to safety, property, stability and development."⁷² Proliferation trends in general suggest a "blurring of security and defence"⁷³ issues and that only a comprehensive approach, conducted cooperatively between many governments and organizations, can restrain the weapons trade. It will continue to be impossible to completely curtail proliferation.

Technological Adaptation

The rate and manner by which commonly available technologies may be adapted for military purposes complicates the challenges posed by threat actors who are able to develop and employ “hybrid” capabilities, and also by the proliferation of weapons. Just as it is difficult to fully understand how the general public will employ new technologies, it is almost impossible to foresee how existing or emerging technology might be applied in the battlespace. Successful state militaries have always been able to integrate new technologies and the CAF must continue this practice. However, a more difficult challenge is trying to comprehend how armed non-state actors might adapt technology in ways that will undermine the capability advantage normally fielded by Canada and its allies on operations.

There are two problems related to the adaptation of technology for military purposes. The first is the requirement to adapt rapidly and effectively in the battlespace. As noted in Chapter 3, the second problem is the larger, and in many ways ultimately more difficult problem of determining how best to integrate new and improved technologies into a military force’s concepts of fighting.⁷⁴ With both problems the key determinant is understanding combat. With the former, understanding the tactical problem is critical to formulating solutions, potentially through the rapid adaptation of commercially available technologies applied in a novel manner. With the latter, it is more about understanding that “with the possible exception of the advent of nuclear weapons—technology has been an enabler and driver of change rather [than] the determinant. Even more important than technology in innovation and adaptation has been the creation of military cultures amenable to careful historical and experiential learning, honest analysis, and imaginative, realistic thinking about the future possibilities of weapons systems.”⁷⁵ Developing solutions to both problems “requires leaders who understand war and its reality as well as the implications of technological change. Imagination and intellectual qualities will be as important as the specific technical and tactical details of war making.”⁷⁶



MILITARY IMPLICATIONS

61 Determining how technology can be applied to create and maintain capability advantage at all levels of war requires coherent and adaptable doctrines and the institutional conditions that enable and encourage imaginative but realistic thought.

62 Strong linkages with, and an openness to consider unsolicited proposals, from industry and academia are critical to militaries seeking to understand and apply current and evolving technologies in novel ways to help maintain capability advantage.

Non-State Actors

Non-state actors within the FOE will continue to add to the challenges already faced by militaries conducting operations. Put simply, the presence and behaviour of multiple non-state actors within any FOE will make it increasingly difficult to anticipate how these groups will react to the actions of, or interact with, national and international organizations.⁷⁷ It is clear that non-state actors will remain an enduring feature of the FOE, presenting both threats and opportunities to the CAF as it conducts future operations out to 2040. The term non-state actor covers a diverse array of potential groupings; it is pertinent to divide non-state actors into a number of categories to further identify the issues they present for CAF FD.

Armed Non-State Actors – Adversarial

Insurgents or armed militia have already proven the ability to forestall a successful conclusion to Western military or international efforts to create stability.⁷⁸ With increasing access to global information, technologies and the continued trend of weapons proliferation, it is likely that such groupings will continue to present significant challenge to Western military institutions.⁷⁹ A significant challenge will remain identifying such groups, discerning the key individuals in those groups, and locating where those important individuals may be in potentially crowded geographic terrain.⁸⁰ It is clear that to neutralize or defeat such groupings will require the ability to rapidly understand the terrain within which they operate to allow the precise application of lethal and non-lethal effects.

The most capable armed non-state actors will likely seek to combine various forms of warfare concurrently, often in the same time and space. They may possess capabilities similar to some state actors (for example, Hezbollah). All malicious groups will try

to negate the probable capability advantage enjoyed by professional militaries and will employ all resources and avenues open to them. Countering such activities by adversarial actors will continue to pose a difficult problem.

KEY TOPIC: Radicalization, Extremism and Terrorism

The purpose of this vignette is to highlight the difference between radicalism, extremism and terrorism. This succinct overview serves to confirm that these will remain a threat affecting Canadian security and defence activities, both in domestic and expeditionary contexts, out to 2040. For the purposes of this document these terms, often interrelated, are defined as follows:

Radicalization is defined as “the process of advocating political, ideological or societal reform that can, in some instances, lead to the generation of extremist beliefs and terrorist activity.”⁸¹ Extremists are radicalized groups and individuals who advocate for and are willing to use illegal, violent, or other extreme action to publicize their narrative or otherwise further their cause.⁸² Terrorists are the most fanatical of extremists, willing to use violence against civilians as “propaganda of the deed” or “armed propaganda” to demonstrate capability, intent, and credibility in support of the foundational narrative used to justify the group’s existence and goals.⁸³ Individuals and/or groupings can evolve or adapt over time to fit into any one of these groups as they escalate or deescalate their actions and aims. Canada’s Counter Terrorism Strategy identifies Sunni Islamic extremism as “the leading threat to national security.”⁸⁴

In a domestic context, radicals and extremists will continue to reside within Canada and some will attempt to plan, organize, and conduct terrorist attacks.⁸⁵ Over the recent past the GoC has taken progressively more sophisticated policy and legislative actions to counter terrorist activities in a manner that engages all levels of government, all necessary departments and agencies, the private sector, and the public.⁸⁶ Domestically the CAF plays a supporting role to OGDs and agencies in countering terrorist activity but the character of a specific threat may cause the CAF to be tasked with a major role. Thus, defence, primarily through specialist capabilities such as special operations forces (SOF), will almost certainly be required to provide support in many potential scenarios. In addition, the CAF and wider defence will remain, as a GoC department, a reflection of the society that it serves. It is therefore possible that some individuals recruited into the CAF in the coming decades possess radical ideals and beliefs that may be contradictory to the military ethos.



In an expeditionary context, the effects and consequences of radicalism, extremism and terrorism will continue to be faced by the CAF, particularly during missions in which stability and counter-insurgency figure heavily in the campaign. Typically, such missions occur in HN with poor or weak governance and it is the economic and political conditions, population, and geographic space typical of such situations that extremists often attempt to exploit. Regardless of the socio-political context, there is little to suggest that this trend will substantially change out to 2040. The CAF must be prepared to contribute to the broader Canadian and allied effort to identify, analyse, and counter potentially violent extremists and their supporting networks.

Armed Non-State Actors – Non-Adversarial

The presence of non-adversarial non-state actors in the operating environment, meaning, those that are neutral, friendly, or have no specific primary intent to oppose friendly forces, will persist out to 2040. Contemporary security on land and at sea now involves a “complex web of public and private players.”⁸⁷ Such contractors are commonly referred to as PMCs. Although the use of PMCs is certainly not new from an historical perspective, the prolonged wars in Iraq and Afghanistan and a host of other contemporary security issues such as maritime piracy and the desire of multinational corporations to protect interests in volatile areas, has driven and shaped the growth of this industry.⁸⁸ Indeed, Western governments and military forces have come to rely on such contractors drawn from PMC businesses and local areas, to provide basic security in many situations. In such cases, the use of PMCs is often an economy-of-force measure that may be desirable from a campaign theme or economic perspective.

Outsourcing will continue as long as there is a demand and despite the critique that the use of PMCs constitutes an “erosion of public control over the use of force.”⁸⁹ It must be remembered that PMCs do not operate in a complete regulatory void: “Rather, they are embedded in a complex web of international and domestic legal norms, market pressures, contractual obligations, and self-regulatory measures.”⁹⁰ However, it must be acknowledged that the practical constraints and restraints on the use of force by PMCs tend to be less stringently applied than those to professional military forces. Also, moral and ethical constraints on the use of force by such contractors cannot be assumed to exist. PMCs will continue to affect CAF and allied military planning and operations in the coming decades.

MILITARY IMPLICATION

63 Armed non-state actors will be an enduring feature of the FOE. Therefore the CAF must have the capability to, in collaboration with partners, identify, understand, and operate with or against them as required.

Non-Governmental Organizations (NGO)

NGOs are a crucial component of state-based and international organizational efforts to mitigate and prevent instability and to facilitate humanitarian efforts.⁹¹ Directly or indirectly, NGO influence on Western humanitarian and stability intervention policy has increased. NGOs play roles in affecting how issues are framed in the media, provide advice to policy makers, provide assistance in joint planning, and advocate for specific causes.⁹² In short, NGOs have become increasingly important to international responses to potential instability, conflict, and the aftermath of conflict.⁹³

There is little to suggest that states and international organizations will not continue to intervene in humanitarian and political crises in the future. Furthermore, there is little to indicate that current figures that show upwards of 70% of Western humanitarian aid funding being delivered via bi-lateral (state/international organization to NGO for delivery in a third country) funding mechanisms will substantially change in coming years.⁹⁴ Thus, the CAF and coalition partners will continue to encounter and, in some cases, rely on NGOs (in those cases where an NGO is amenable to direct cooperation) to implement certain portions of a campaign. The CAF and coalition partners may also need to consider the potential effects of uncooperative or neutral NGOs active in an operational theatre.⁹⁵

MILITARY IMPLICATION

64 The CAF must be able to identify those NGOs operating within a theatre, and the organizational motivations driving each, in order to understand their roles and objectives.

Flexibility

History has shown that institutional flexibility, the ability to be easily modified to respond to altered circumstances, and the organizational characteristics necessary to enable flexibility, will continue to be required in order to contend with the novel application of technology and methods to the battlespace by an adversary.⁹⁶



As always, successful combatants will integrate evolving technology into existing force structures and doctrine to gain military advantage over adversaries. However, the requirement to understand the cultural, historical, religious and ideological motivations of opponents and allies and the effects these factors have on perceptions, strategic intent and goals has, and will remain, fundamental to operational success.⁹⁷

Survival in the battlespace will continue to be a matter of the application of fires and manoeuvre and mass will still matter (in the land, air and sea environments), although the form that it takes and the method of application may appear quite different than it did as little as 50 years ago. Perhaps the safest conjecture on future warfare is that “friction in its widest sense continues to rule every action and operation.”⁹⁸ No amount of technology or planning will ever overcome the major factors of friction in the battlespace, which can be summarized as: “1) danger; 2) physical exertion; 3) uncertainties and imperfections in the information on which action in war is based; 4) chance; 5) friction in the narrow sense of the resistance within one’s own forces; 6) physical and political limits to the use of force; 7) unpredictability stemming from interaction with the adversary; and 8) disconnects between ends and means in war.”⁹⁹

If the characteristics of the current era of persistent low-intensity conflict continue in the future, traditional cycles of military adaptation and innovation will become blurred.¹⁰⁰ In the past, military adaptation took place during times of war as military forces modified means and methods to overcome actual battlespace conditions. Military innovation, meaning conceptual innovation that fundamentally alters how armed forces wage war, normally took place during times of peace or relatively peaceful periods. In the current environment of seemingly perpetual instability, there is little ‘breathing room’ to allow for peacetime military innovation. Conventional forces will therefore be required to become better able to integrate evolving technology and alternate doctrine and training to counter both conventional and irregular opposing forces.¹⁰¹

Rationalization of Capabilities to Available Resources

Many factors affect the determination of defence budgets. Factors such as the perception of threat, public attitudes towards the military, the overall health of a nation and the global economy, the specific orientation of governments and myriad other factors all bear on defence budgetary decisions. However, the mean trends suggest that Western states are likely to decrease defence spending over at least

the next decade.¹⁰² Budget rationalizations across NATO will force the alliance to optimize the management of its resources and its capabilities in order to undertake and sustain future operations.¹⁰³ This will require careful balancing and prioritization. Improving the quality and the speed of decision making within the coalition would enhance efficiency and unity of effort.¹⁰⁴

Most members of NATO are facing financial constraints that potentially limit the contribution of military capabilities to alliance missions.¹⁰⁵ Some projections suggest this could weaken the alliance as it will struggle to deploy troops in NATO led operations.¹⁰⁶ One method that has been suggested to help maintain alliance military effectiveness involves individual members developing specialized capabilities. In a NATO context this means that core alliance members may desire to carefully consider individually negotiating and bolstering specific capabilities such as strategic lift, aerial refuelling or precision fires that can lessen the reliance on US capabilities and resources during coalition operations.¹⁰⁷ The concept of *Smart Defence* that was developed at the Chicago Summit in May 2012 involves three components: aligning national capability investments with NATO's capability priorities, pooling Allied military capability among Allies to generate economies of scale and improve interoperability, and achieving a more effective division of labour through specialization.¹⁰⁸ The contribution of meaningful military capability by non-US coalition partners will remain an important factor in establishing and maintaining credibility as a close ally.

One manner of rationalizing decreasing budgets with requirements has been the expanded use of contractors. Over the last 20 years the use of defence contractors to provide goods and services in support of Western militaries increased proportionate to the rationalization of non-military tasks and activities after the end of the Cold War.¹⁰⁹ At that time, the push to reduce defence expenditures increased, forcing western militaries to focus on core warfighting capabilities partially through increased reliance on contractor support.¹¹⁰ The employment of contractors by militaries is by no means an entirely new trend. However, the reliance on contractors in direct support of deployed forces has steadily increased since during the Second World War, meaning that operational success has become ever-more reliant on the presence of contractors in theatres of operation.¹¹¹ In fact, reliance on contractors by diplomatic and development agencies and NATO to assist in the stability, reconstruction, and development portions of campaigns means that strategic success is also tied to the presence and behaviour of contractors.¹¹² The range of goods, services, and products Western militaries rely on contractors to supply is very broad and includes heavy maintenance (i.e. overhaul, mid-life extension, etc.) of platforms, professional



services, real property maintenance, research and development, various forms of security, training, education, health care, and logistics.¹¹³ Operationally, Western militaries have come to rely on contractors to conduct reconstruction, engineering, logistics and base support, equipment and systems maintenance, construction, communications support, military and civilian training, interpreters, advisors of various kinds, security, and bodyguards.¹¹⁴

Western military defence contracting has been marked by a number of problems that might continue to have implications for future military activities. These include fraud, waste, and abuse; high costs that may indicate greater efficiencies if conducted by military or other governmental personnel; a requirement for better integration of contractor considerations in training and C2 structures; foreign policy implications resulting from a range of potential problems (HN cultural sensitivities, contractor behaviour, etc.); and various legal implications of contractors acting on the behalf of governments in host and third-party nations.¹¹⁵

A further critical issue to consider is the problem of increasingly sophisticated and expensive platforms and the inevitability of attrition. The issue is perhaps most acute with naval and aviation platforms which have become increasingly complicated, have commensurately lengthy design, testing, and build phases, and require specialised technology (and skills) to operate. As a result, rising costs accompanied by reduced budgets have led many Western militaries to reduce the overall fleet size of many advanced platforms.¹¹⁶ Reduced fleet sizes, however, mean that the loss of a single platform can have serious long term effects. Indeed, when considering warships, the loss or incapacitation of a single vessel can have a strategic impact for both large and small navies. This reality will require that political authorities and force commanders more consciously factor attrition into strategic and operational planning.

MILITARY IMPLICATIONS

65 The CAF must ensure that reliance on contractors at all stages of force development, generation, and employment does not undermine or hinder, through the contracting of critical functions, the ability of the CAF to field core warfighting capabilities, or create intractable, unintended consequences to follow-on stability operations.

66 The CAF must ensure that operational contractor support is fully integrated into expeditionary force structures. This must include understanding and mitigating risk of employing such assets from military and legal perspectives and budgeting for their employment.

Future Conflict and the Law

The CAF will always conduct operations under the principle of the rule of law. This is the lynchpin to establishing and maintaining legitimacy for military operations. For the CAF, the rule of law includes both domestic legislation and such laws as prescribed under any international agreements to which Canada is a party, including internationally agreed upon LOAC. In addition, the behaviour of Western forces is often influenced by similar moral and ethical codes and beliefs. However, as noted in Chapter One, the application of international law is often a function of perceptions of a state's power. Thus, as has been true for much of the past century or so, there can be no assurance that states will abide by the LOAC or interpret those laws in a manner similar to that of Western states. Moreover, given the frequency with which non-state or sub-state actors are encountered as adversaries and given the array of international laws, the interpretation of those laws, and possible enforcement options, legal considerations and dilemmas will increasingly affect the conduct of military operations in the future.¹¹⁷

The legal constraints under which states operate may be exploited by state, non-state and sub-state adversaries to their advantage militarily, politically, and for propagandistic purposes.¹¹⁸ All bodies of law evolve over time. Societal norms, technological change, and other factors all help to spur legal thinking meant to assure the safety and security of the public. Warfare is no different. For example, vigorous legal and public debates over such security and defence issues as the rights of captured non-state belligerents, the parameters of what might constitute an act of war in the cyber domain, and consideration of what constitutes a proper balance between security, freedom, and the requirement for adequate anti-terrorism measures are recent examples of the normal process by which Western legal thought evolves. The changing characteristics of warfare and the normal process by which legal thought evolves will, as in the past, continue to affect how the CAF and its allies prosecute campaigns. It should be expected that subtle and more fundamental changes to the broad body of law that guides military activities will occur as Canada's legal system and legislators strive to balance the protection of Canadians and Canada from aggressors, with the requirement to protect Canadian rights and values, universal human rights and uphold the legitimacy of international law.¹¹⁹

Similarly, new and evolving military capabilities will require ongoing analysis to ensure that they are in compliance with applicable Canadian and international law and may suggest the need for the development of new laws. The increased use of armed UAVs is one such capability currently generating much legal debate.¹²⁰ As noted in Chapter 3, a further challenge to existing law is the trend towards greater



autonomy in the unmanned armed systems. The major moral, ethical, and legal issues are related to whether a 'human-in-the-loop' is a necessary permanent check and balance on autonomous systems to ensure that such systems "discriminate sufficiently between combatants and non-combatants."¹²¹

Thus, dealing with the legal issues sure to be encountered on future operations will require concerted efforts on the part of the CAF to ensure the Office of the Judge Advocate General is positioned to proactively deliver and, where required, coordinate whole of government advice on emerging military and security legal issues.¹²² Furthermore, there is no guarantee that any future adversary will abide by, or interpret international laws regarding conflict in a similar manner to how the CAF or any of Canada's traditional allies might. Therefore, while the CAF will rightly always operate with full consideration of the moral, ethical, and legal implications of its activities such constraints may not be shared by Canada's adversaries.

MILITARY IMPLICATIONS

67 The provision of legal advice to political and military leadership at the strategic and operational levels in real-time will be required to facilitate effective military operations in the future. Achieving this requires the Judge Advocate General to maintain a high level of expertise in all areas of military law to ensure the delivery of responsive force-enabling legal advice and to influence the shaping of domestic and international legal frameworks to facilitate CAF, Departmental and Governmental mission success.

68 The military institution will need to remain aware of the legal implications of new technologies as they are considered for integration into the CAF capability portfolio.

69 Continued education, professional development, and training in the LoAC by CAF personnel and deploying civilian representatives of the GoC are necessary for the conduct of effective operations.

The Future Operating Environment (FOE)

The FOE will feature almost nothing that is wholly new. Many of its expected characteristics will be similar to those witnessed and experienced in the past. However, how some of the characteristics become manifest and the manner in which state behaviour is affected will likely be different than that of recent decades. The following section is meant to provide a discussion of the most salient characteristics and begins with a discussion of some overarching points to consider throughout.

To begin, notwithstanding any of the trends discussed earlier in this document, there is no way to foresee the geographic region or the socio-cultural context within which operations in the 2040 timeframe will occur. For every example of recent operations in densely populated urban environments there is an example of operations in sparsely populated non-urban environments or littorals. The reality is that where a conflict occurs is a function of the character of the threat being addressed and the political goals of the belligerents.

As has been the case throughout history, belligerents will continue to exploit such geographical characteristics and advantages as might be available to them. Thus, short of opting not to engage, intervening countries will likely have little opportunity to force confrontation on geography of their choosing. While perhaps most comfortable operating in sparsely populated, open terrain, or in blue water maritime environments, the CAF and allied forces must be prepared to engage adversaries in the most difficult types of geography such as extremely large, densely populated urban conglomerations, littorals, and mountainous regions. The vagaries of such geography will continue to pose a challenge to Western military forces trying to limit collateral damage and friendly casualties.

A further characteristic of the FOE will be the possession and employment of various anti-access and area denial (A2/AD) systems and networks.¹²³ Historically, the ideas implicit in contemporary discussions of A2/AD are not new; even the major points of most recent discussions were raised several decades ago.¹²⁴ However, the rapid diffusion of advanced science and technology described in Chapter 3 and the greater economic power available to both larger and smaller states will allow for more states to develop partial or more comprehensive A2/AD systems. This will create significant operational and, by extension, strategic problems for US and Western forces accustomed to operating with more-or-less invulnerable lines of communication, operating bases, and supporting infrastructure since the end of the Second World War.¹²⁵ While much of the current discussion has a heavy maritime flavour it must be understood that A2/AD capabilities include systems meant to target military capabilities in both physical environments (Land, Sea, Air, Space) and virtual domains (cyber, electromagnetic). The most sophisticated systems will be networked to create an interdependent, redundant, and comprehensive operational capability. A2/AD is therefore not a challenge specific to one military branch or service.¹²⁶

That said, there are likely strategic consequences of advances in A2/AD. As noted in chapter one, a pillar of the current international order and a key component of US security guarantees to regional allies and partners has been the ability to project power both rapidly through the use of airpower and strategically situated facilities



and on a sustained basis using maritime assets. The current development of A2/AD capabilities by some states (particularly Iran and China) and the possible acquisition of even minor capabilities by others, including non-state actors, could, however, pose a significant challenge to that ability.¹²⁷ Contemporary A2/AD challenges have the potential to undermine many current strategic and operational assumptions.

Natural Geography

Technology will not completely overcome the difficulty of finding, fixing, targeting, and striking adversaries in all types of natural geography. For example, multiple canopy jungle, mountainous regions, and areas with complex oceanographic features will continue to provide opportunities for belligerents to evade or confound ISR systems. Moreover, it would be safe to assume that technological countermeasures to persistent ISR systems will continue to undermine any possibility of complete situational awareness for any combatant in the 2040 timeframe.

Geographic Chokepoints

Geographic chokepoints are those areas where trade routes and geographic features intersect and thereby funnel traffic in predictable, restricted patterns. It is unlikely that these will change significantly out to 2040.¹²⁸ Maritime trade routes have been unchanged, in most cases, for centuries. Aviation routes may alter somewhat more frequently but the sophisticated infrastructure necessary to support aerospace activities means that certain regional hubs will likely remain crucial out to 2040. Threat actors seeking to disrupt activity in these chokepoints will no doubt develop innovative and sometimes unpredictable means to accomplish that goal.

If some prognostications on climate change prove accurate, the outcome should not have a significant effect on CAF activities with regard to the physical environments that the forces must be prepared to operate in. For example, the CAF has always had a responsibility to assist in the protection of Canada's territorial sovereignty, including the Arctic. At a fundamental level the CAF of 2040 will be required to operate, in conjunction with local, regional, territorial / provincial, and federal government agencies, across the length and breadth of Canada's sovereign territory and its air and maritime approaches regardless of any climate or weather trends, just as it would in any other part of Canada.

Urban Terrain and Human Geography

Population growth and urbanization trends create particular challenges for military forces. Dense urban terrains have been described as contested, congested, cluttered,

connected and constrained.¹²⁹ Western military capabilities will be challenged in dense urban environments where adversaries will have the ability to blend into urban terrains within close proximity to non-combatant civilians and critical infrastructure.¹³⁰ These are spaces that would be difficult to sense and understand. Detecting adversaries in this type of terrain is complicated by the tendency for adversaries to use subterranean spaces in an attempt to avoid Western military sensors and precision munitions. Dense urban terrains will continue to limit the ability of technology to provide situational awareness on the location of adversaries and friendly forces. Some adversaries, particularly those with strong socio-cultural ties to an area, will be able to operate in such a manner that distinguishing combatant from non-combatant will remain a major challenge for military forces operating in such areas. The air environment will be increasingly congested with manned and unmanned aircraft. The FOE will feature a wide range of active participants. Particularly in regions marked by state failure, weak governance and ungoverned spaces, the quest for security will be intense and will often be marked by the use of private or informal militia forces. Other actors in such environments will include representatives of International OGDs, NGOs, PMCs and a host of others. The challenges posed by various anti-access and area denial methods in heavily urbanized areas may be particularly acute, meaning that force protection will be more difficult.¹³¹

Maritime and Littoral Regions

The period out to 2040 is likely to be characterized by increasing attention to maritime-related diplomatic, commercial and security issues. This is not surprising given the diffusion of economic power described in previous chapters and the fact that more than two thirds of the planet is covered by water, 90% of the world's trade is conducted via maritime means, and that 80% of the world's urban centers are located in the littorals.¹³² Other expected challenges in the future maritime operating environment include continued piracy, assuring access to maritime commons, and the continuation of current and new territorial disputes. Particularly in the Asia-Pacific archipelagic region, such issues will likely highlight maritime considerations in the strategic and political outlook of governments.

The ability to exercise sea control and to project national power ashore, in order to help ensure economic prosperity and to contribute to international peace and security, will continue to be the defining requirements of modern maritime power. While these historic strategic objectives of maritime power remain unchanged, much of the focus of future naval planning and operations will concern littoral areas where state and non-state actors will be operating with increasingly sophisticated sea denial



capabilities. This is not to suggest that considerations of 'blue water' operations will necessarily diminish, only that the emergence of broadly influential non-state actors, the growth of populations in littoral regions, and the development or expansion of coastal forces by many states suggests that joint operations in the littorals will be prominent in future naval activities.

In the past sea denial was often achieved by the construction of battle fleets, however an approach that is increasingly being utilized is asymmetric "delay, disruption, denial and demoralisation."¹³³ Modern technology continues to enhance the ability of smaller navies to practice sea denial. This is particularly evident with the vast proliferation of submarines among navies in the Asia-Pacific region (an increase of 50 percent in the last seven years),¹³⁴ with the growing reliance on precision-guided munitions including cruise missiles, with increasingly sophisticated sea mines and, most recently, with the ongoing development of anti-ship ballistic missiles.¹³⁵ Similar to the problem of IEDs and landmines, unsophisticated sea mines, some no further advanced than those employed early in the 20th Century, continue to pose very difficult operational challenges to naval planners. As in the past, such weapons are relatively cheap but offer an effective way of hindering and disrupting naval operations. Other technologies such as long-range maritime aircraft and cruise missiles, space-based sensors and unmanned vehicles will continue to greatly expand the geographic range in which the contest for sea control can occur.

Littorals, defined as "a coastal region consisting of the coastal sea areas and that portion of the land that is susceptible to influence or support from the sea," provide some unique challenges to military forces.¹³⁶ These regions have also been additionally described as "generally recognised as the region which horizontally encompasses the land-watermass interface from 100km ashore to 200 nautical miles (nm) at sea, and extending vertically into space from the bottom of the ocean and the land surface."¹³⁷ Operations in littoral regions have historically proven to be some of the most difficult and hazardous. The planning and execution of activities in such areas demands increased attention to the ability to operate in a joint manner and a high degree of interoperability with critical allies and partners. Therefore, despite often consisting of smaller areas of operations, the difficulties of projecting power from the sea should not be underestimated.¹³⁸ Planners will confront a "complex, dynamic and cluttered environment" in which friendly, adversary and neutral forces coexist.¹³⁹ It will be more difficult to "see" in this battlespace, as radars, sonars and optical sensors are presented with environmental, topographic and hydrographical variations that are more marked inshore than they are at sea. Similar to land operations and unlike most blue water operations, the littorals could include irregular, hybrid and state-

centric threats that will need to be confronted both at sea and ashore in a human landscape where the consequences of massive change and disruption in all its social, climatological and technological dimensions will play out in the coming decades.¹⁴⁰

Similar to urban combat, operations in the littoral involve conflict at much closer ranges than in the open ocean, significantly reducing the time for command (i.e., detect to engage) decisions, and greatly decreasing tactical freedom. Even on missions where armed conflict is improbable, navies will require offensive and defensive capabilities to signal intent to allies and adversaries alike. Just as significant, modern sea denial capabilities, as well as electronic attack, will be most aggressively employed by adversaries.

In the maritime and littoral operating environments, there will increasingly be new adversaries with sea control and sea denial capabilities. As a result, interoperability at sea with allies and trusted international partners will be of increasing importance in the future. The high-intensity, multi-threat environment that characterises contemporary naval operations will also demand a range of capabilities beyond what most modern navies possess or can afford to acquire.¹⁴¹ Future maritime operations “will require far more than the bringing together of a coalition at the time of crises. They will require ever-higher degrees of interoperability to affect a merging of allied and coalition maritime forces at the technical, tactical and doctrinal levels...”¹⁴² Above all, the sea will remain essential to business, trade, resources and security.

MILITARY IMPLICATIONS

70 The CAF must assume that situational awareness will always be incomplete and that adversaries will actively exploit the physical environment and technology to degrade friendly ISR systems.

71 It is impossible to predict either the geography or socio-cultural context of future missions. However, CAF planners can consider historic land, sea, and air chokepoints and areas where Canada has had long-standing national interests to help narrow the range of possibilities when considering FD options.

Global Commons

Commercial and military operations are dependent upon unfettered access to the global commons. The global commons are typically described to include the bulk of the air, maritime, and space environments and the entirety of the cyber domain.¹⁴³ The strategic utility of a military is proportional to its ability to respond across the



full spectrum of possible missions. These include supporting OGDs, humanitarian aid and disaster relief, establishing an authoritative presence and demonstrating resolve, coercive diplomacy, and ultimately, combat. To conduct such missions and to address the expected challenges in the FOE, military planners will continue to consider how best to achieve and assert freedom in the global commons. Regardless of the scope, this is about freedom of action through operational manoeuvre to undertake a variety of tasks. In all circumstances, it is intended to maximize strategic advantage, whether in the maritime, aerospace, land environments, or the cyber domain. Protecting the freedom of movement through spaces defined as 'global commons' – the space outside of the territorial boundaries of states – will therefore remain a major consideration in the planning and conduct of future operations.

In particular, modern military operations cannot be conducted effectively without access to the cyber domain and space environment to facilitate rapid communications, generate certain types of intelligence, logistical, strike, and other military activities. This "Precision Revolution," as one set of authors has termed it, "is predicated upon complete access to and exploitation of space for communications, intelligence, weather, positioning/navigation, missile early warning, and the like."¹⁴⁴ Civilian reliance on the space environment and cyber domain is just as critical. The international system is inescapably interwoven with the continued openness and stability of the world's common spaces.¹⁴⁵ Militarily, states rely on the commons to enable many aspects of their operations, from logistics, to command and control, to extended power projection. Economically, nations depend on the global commons to provide essential services to their citizens, connect their markets to suppliers and customers overseas, and to manage financial transactions worth billions of dollars.¹⁴⁶

The ever-increasing reliance on satellites to support many aspects of modern life has made the space environment much more critical than only a few decades ago. As society becomes increasingly mobile, the demand for precise and timely information suggests that access to space-enabled systems will only increase in importance. Space-enabled systems transmit data, voice and video and play a critical role in collecting and distributing information contributing to global communications; environmental monitoring; natural resource management; disaster assistance and mitigation; and weather (terrestrial and space) forecasting. In the military, space-enabled systems provide ISR, communications, and timing and navigation information world wide, including areas that would be difficult or impossible to obtain through other means. The critical role of space-based systems and decreasing (but still significant) costs for fielding or accessing space-based platforms means that the number of states and commercial actors involved in space will increase significantly by 2040.¹⁴⁷

Developed nations in general, and the US in particular, rely on the advantage that space enables. If current trends continue, commercial space communications, imagery and position, navigation and timing will likely be available to most, if not all, armed forces around the world allowing all states to exploit space in a force enhancement role.¹⁴⁸ CAF operating in the FSE may be at risk from these ubiquitous capabilities. Additionally, given that the US is, and will continue to be, firmly committed to strengthening its lead in space-related technologies,¹⁴⁹ partners who wish to remain inter-operable with the US will need to make appropriate choices with respect to space capabilities.

A significant and increasing salient factor influencing the FSE is space debris. The proliferation of space users and growing global space activity has dramatically increased the congestion of human-made objects in space, especially within important, widely used and strategically significant orbital regimes. The space debris problem is exacerbated by the fact that not all space users are similarly concerned with the issue. Currently, approximately 22,000 space objects are tracked, of which approximately 1100 are active satellites.¹⁵⁰ Additional pieces of debris, too small to track with current sensors, are estimated to number in the hundreds of thousands – and all of these objects put active satellites at risk of collision. By the year 2040, if left unchecked, space debris threatens to cause serious limitations in the use of space. It is possible that internationally-agreed upon legal and regulatory measures will be necessary to curb the increase of space debris.

The increasing congestion in space is even more acute in the radiofrequency spectrum. Demand for Radio Frequency (RF) spectrum is expected to grow commensurate with the rapid expansion of satellite services and applications. It is projected that 9000 satellite communications transponders will be in orbit by 2015. By 2040 that number will likely be much higher. This will increase the probability of radiofrequency interference and will strain international processes to allocate and share the limited available spectrum.¹⁵¹

Purposeful interference with space services, either in the RF spectrum or kinetically, is a demonstrated capability today. The ability to deny, degrade, deceive, disrupt or destroy space assets/services may become available to a wider range of state and possibly non-state actors by 2040. Technologies include, but are not limited to direct ascent and co-orbital anti-satellite weapons, high energy directed microwave weapons, lasers, and the full range of electronic warfare. The requirement to transmit data to and from space-based systems means that the potential for disabling cyber attacks also exists.

Alongside and inextricably related to space, the importance of the cyber domain will increase out to 2040. It is still not well understood by most laypersons. However, there is no denying the importance of the physical systems that underpin activities



in this domain or the ability for people to negatively affect activities with relative ease. While the cost of attacking in the cyber domain is relatively modest, defending this space is a complex task due to the large number of entry points.¹⁵² This is not expected to change. Limited resources will dictate that defensive efforts will have to be concentrated on the most likely targets.¹⁵³ Intelligence will play an increasing role in predicting what those targets are. Collaboration with allies will become essential to provide early warning as well as post breach strategies for mitigation.¹⁵⁴

It is expected that our adversaries will continue to seek ways to exploit our vulnerabilities in the cyber domain. Already, wired and wireless infrastructure provides a sizeable target of opportunity.¹⁵⁵ 'Spear-phishing' and other social engineering methods are expected to continue and be refined as points of entry. The cost of technology continues to decrease making action in the cyber domain very cost effective. States, insurgents, organized criminals, activist groups, and individuals can, have, and will continue to disrupt activity in the cyber domain as it suits individual interests and motivations. Although work is being done to achieve a measure of attribution, skilled actors can remain anonymous and will continue to do so into the near future.¹⁵⁶ This deniability will allow collaboration without fear of repercussion so that it is easily imaginable that adversarial states will co-opt non-state actors to work as state-proxies against Canada and its allies.¹⁵⁷ While efforts are being made to address the current legal and policy uncertainties surrounding actions in the cyber domain, there are a number of issues which necessarily impede progress in this area. By its very nature, the internet is a part of the global commons making rules that impact on it inherently international in nature. What constitutes an act of war and what are acceptable responses are difficult matters that currently defy broad consensus.

This discussion of the space environment and cyber domain highlights the importance of the global commons to contemporary and future human affairs. If state and non-state actors are able, even for a short period, to disrupt activity in the commons, the existing international political and economic order could be fundamentally undermined. Facing challenges in the global commons will require all elements of national power, including diplomacy, strategic public engagement, and economic incentives and disincentives, in a comprehensive worldwide effort. Emerging states will therefore likely desire to cooperate to ensure openness and viability of the global commons.

More traditionally, the assurance of access to geographic global commons remains critically important to global trade and commerce. For example, disruption of traffic in international waters such as the Straits of Hormuz, Malacca, or Lombok, or transit points such as the Suez or Panama canals could have regional, and even global,

impacts. It is well known that the interdependence engendered by globalization and therefore economic development and global stability would be directly, and substantially affected by the blockage of a choke point, even for short periods of time.¹⁵⁸

Military power will be important, but only one component of efforts to assure access to the global commons or, conversely, in limiting access to them.¹⁵⁹ Problem solving in the global commons and minimizing the diminution of capability advantage means that power projection and deterrence will likely not “simply involve unilateral exercise[s] of punitive threats and denial measures. Such a strategy must take advantage of the increasingly shared interests and vulnerabilities that accompany globalization in the twenty-first century.”¹⁶⁰

MILITARY IMPLICATION

72 The relationship between access to the global commons and Canadian and international prosperity means that the CAF may be called upon to contribute to efforts to protect those commons. In addition, assured access to the global commons will remain a critical factor in enabling the timely projection and employment of military capability for expeditionary operations.

Conclusion

Many military trends are longstanding continuous evolutions that have been apparent for, in some case, centuries. For example, since the industrial revolution technical skills have been increasingly important to fielding effective militaries. Ever more sophisticated military equipment and systems means that this is not likely to fundamentally change. Commensurate to the demand for technical skills has been the importance of education and professional development for military personnel. Successful militaries, meaning those best able to adapt to the realities of operations, have often been those that encourage and facilitate continual education and professional development. Canada's 21st century military will not only need to train its personnel to fight. To remain adaptable it will need to train them how to think about how to fight. The complicated character of the FOE demands highly educated personnel that are able to make sense of the vast amounts of information available to them, use that information in such a way that enables the conception of tasks necessary to achieve strategic intent, and in such a way that preserves public support for military operations. Thus the CAF must remain sufficiently adaptable, flexible, and forward-thinking to be able to retain capability advantage within the FOE. To operate successfully in the future, the CAF will need to improve its ability to adapt and integrate all of its capabilities to the future realities.



NOTES

- 1 Government of the United Kingdom, Ministry of Defence, "Understanding," *Joint Doctrine Publication 04*. London, December 2010, p. 1-3. Quote attributed to Professor Sir Michael Howard.
- 2 Sean Maloney, "The Canadian Tao of Conflict," in *Forging a Nation: perspectives on the Canadian Military Experience*, Horn, ed. St. Catharines: Vanwell, 2002. p. 272.
- 3 Ibid, p. 284.
- 4 Brian McAllister Linn, *The Echo of Battle*. Cambridge: Harvard University Press, 2007. p. 232.
- 5 Ibid, p. 232.
- 6 Murray and Millett, "Introduction: Military Effectiveness Twenty Years After," pp xiii-xviii; Bernd Horn, "Introduction," in *The Canadian Way of War: Serving the national interest*, Horn, ed. Toronto: Dundurn, 2006.
- 7 For example, see Maloney, "The Canadian Tao of Conflict," p. 282.
- 8 J.L. Granatstein, *Canada's Army: Waging War and Keeping the Peace*. Toronto: University of Toronto Press, 2002, pp. 423-427. Although Granatstein's book is specific to the land force, this point is broadly applicable to the CAF as a whole.
- 9 Maloney, "The Canadian Tao of Conflict," p. 277.
- 10 Sean Maloney, "In the Service of Forward Security: Peacekeeping, Stabilization, and the Canadian Way of War," in Horn, ed., 2006. See pp. 297-298.
- 11 Maloney, "The Canadian Tao of Conflict," pp. 277-281.
- 12 The decade long participation of Canada within the International Stabilization and Assistance Force in Afghanistan is an example where CAF members operated along non-NATO partners.
- 13 Defined as: the projection of "Canadian power (diplomatic, economic, and military) overseas to keep problems that will affect the security of the Canadian state and its people (political, economic, and military) contained and as far away from North America as possible." See Sean Maloney, "In the Service of Forward Security: Peacekeeping, Stabilization, and the Canadian Way of War," in Horn, ed., 2006. See pp. 297-298.
- 14 Maloney, "The Canadian Tao of Conflict," pp. 275-276. For an in-depth discussion of forward security in the Canadian context see Maloney, "In the Service of Forward Security: Peacekeeping, Stabilization, and the Canadian Way of War," in Horn, ed., *The Canadian Way of War*, pp. 297-323.
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25 Winograd Commission, pp 405, 548, 570-576, 595-600; Neil Chuka and Donald Neill, A Research and Analysis Framework for a Strategic-Level Lessons Learned Process, DRDC CORA TM 2011-210, December 2011, pp 11-16; Brad Gladman and Peter Archambault, "A role for effects-based planning in a national security framework," *Journal of Military and Strategic Studies*, Vol.13, No.2 (Winter 2011); Hew Strachan, "The Lost Meaning of Strategy," *Survival*, October 2005, Vol. 47, No.3, especially pp 47-52.

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28 Neil Chuka, "Re-examining the CF Joint Level Lessons Identification and Analysis (Lessons Learned) Process," DRDC CORA LR 2011-017, 25 February 2011. For greater depth of information on this trend see, for example, Williamson Murray, "Thoughts on Military History and the Profession of Arms," in Williamson Murray and Richard Sinnreich, eds., *The Past as Prologue: The Importance of History to the Military Profession*, NY: Cambridge University Press 2006; Harold Winton and David Mets, *The Challenge of Change: Military Institutions and New Realities, 1918-1941*, University of Nebraska Press, 2000; Allan Millett and Williamson Murray, eds., *Military Effectiveness* (3 Vols.), NY: Cambridge University Press, 2010 (new edition); Millett and Murray, *Military Innovation in the Interwar Period*, NY: Cambridge University Press, 1996; Peter Paret, *The Cognitive Challenge of War: Prussia 1806*, Princeton: Princeton University Press, 2009; Eliot Cohen and John Gooch, *Military Misfortunes: The Anatomy of Failure in War*, NY: Free Press, 1990. Incidentally, it should be added that the most potent non-state and irregular belligerents throughout history have also been those that were able to learn and adapt based on their combat experiences. The principle is thus applicable to both state and non-state actors.

29 The sources noted above all discuss this fact.

30 As quoted in Murray (2009), pp. 1-33, 1-34.

31 The proliferation of terms used to describe contemporary war demonstrates the difficulty of categorizing conflict into simple descriptive categories. For example, in recent years the terms 'Hybrid,' 4th Generation war, 5th Generation war, '3-Block War,' 'Traditional Warfare,' and others have been used to describe everything from the strategic to tactical level military environment.

32 The use of 'irregular' and 'conventional' as descriptors of tactical level activity may continue to have some utility.

33 Murray (2009), pp. 8-1 to 8-4.

34 For example, Glenn, *Glory Restored*, pp. 68-75.

35 Rip and Hasik, p. 422.

36 See Gladman and Archambault, pp.3-7.

37 See for example, "The Targeted Killings Debate," Council on Foreign Relations, June 8 2011. <http://www.cfr.org/international-peace-and-security/targeted-killings-debate/p25230>, accessed 11 December 2012.

38 Glenn, *Glory Restored*, pp. 81-82.

39 Frank Hoffman, *Conflict in the 21st Century: The Rise of Hybrid Wars*, (Arlington: Potomac Institute for Policy Studies, 2007), pp. 7-8, 28-29. http://www.potomac institute.org/images/stories/publications/potomac_hybridwar_0108.pdf.

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- 41 Frank G. Hoffman, "Hybrid Threats: Reconceptualizing the Evolving Character of Modern Conflict," Strategic forum, No 240, April 2009, p. 5. The term 'hybrid' is only described here because of its prevalence in much contemporary literature on the subject of non-state actors and future warfare.
- 42 Winograd Commission, pp 253-254.
- 43 Winograd Commission, p. 571.
- 44 See for example *The Commission for the Examination of the Events of the 2006 Campaign in Lebanon (The Winograd Commission)*, *The Second Lebanon War*, Final Report, Vol. 1, January 2008. See in particular pp. 405, 513, 548-571, 595-600.
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- 46 Defence Terminology Bank (DTB) Entry Record 34039
- 47 Human capital is defined as the skill sets, personnel structures, and relationships of the HN populace necessary to take on the roles and responsibilities related to their own governance and general advancement of their society. DTB Entry Record 34048
- 48 See for example ABCA Armies Group publication 369 *Security Force Capacity Building Handbook*, edition 2, July 2001; ABCA Armies Group publication 371 *Transition Planning Handbook*, 2012; DND Directorate of Military Training and Cooperation 2009-2010 *Annual Report*.
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- 50 Winograd Commission, p. 571; Russell Glenn, *Glory Restored? The Implications of the 2008-2009 Gaza War in Times of Extended Conflict*. Norfolk VA: US JFCOM Joint Irregular Warfare Center, August 2005. pp. xi, 61-62.
- 51 David E. Johnson, "Heavy Armor in the Future Security Environment," RAND Corporation, Arroyo Center, p. 6.
- 52 JOE 2010, p. 72.
- 53 Colin Gray, "Clausewitz, history, and the future strategic world," in *The Past as Prologue: The Importance of History to the Military Profession*, NY: Cambridge University Press, 2008. p. 125.
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- 116 Indeed, the problem is so acute that some have begun arguing for a greater emphasis, when possible, on shorter-lifespan, less-expensive platforms meant to be disposed of far sooner than the typical 20-30 year life cycle of current aviation, naval, and many land vehicle systems. The argument being that doing so would allow for greater flexibility because resources would be reallocated from the maintenance and life-extension of legacy systems to new, up-to-date systems. See for example Danzig, pp.25-26.
- 117 See for example *The Commission for the Examination of the Events of the 2006 Campaign in Lebanon (The Winograd Commission)*, *The Second Lebanon War*, Final Report, Vol. 1. January 2008. See in particular pp. 468-483. The phenomenon of countries operating under so-called 'universal jurisdiction' regarding alleged war crimes is one such example.
- 118 *Winograd Commission*, p. 478-480.
- 119 The conclusions of the Winograd commission in this regard are as applicable to Canada as they are to Israel. Indeed, it can be argued that this is one of the fundamental considerations of legal thought in democratic states. See *Winograd Commission*, p. 480. The type of coordinated, proactive policy and legislative efforts necessary in this regard would be very similar to those necessary to counter terrorist activities as described in the Radicalization Key Topic above.
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- 121 Sauer and Schörnig, Killer Drones, p. 374.
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CONCLUSION

This document outlined important trends which inform DND/CAF FD over the period out to 2040. Indeed, the document has shown that Canada exists within a complicated, ever-mutable international environment in which uncertainty remains a primary feature. The overarching deduction from the implications contained in this document indicates that the CAF will not only require preparation for domestic military and contingency operations, but also to be capable of conducting expeditionary operations. Warfare cannot be ruled out as a possibility.

Some of the drivers that have been analysed in this document transcend, and affect all the topics discussed in the various chapters. The Westphalian system will endure but various forms of non-state actors will, depending on the specific circumstances, wield significant influence. No suggestion is being made that there is a viable alternative to the system of states that currently characterizes geopolitical relations. The diffusion of power from 'West to East' will allow a number of states to increase regional influence. This phenomenon is a result of, and will be sustained by, the characteristics of globalization, particularly the economic interconnectedness globalization has engendered. As developing states gain economic strength, there is likely to be greater investment in military capabilities as one measure to further, and safeguard, national interests. Moreover, the diffusion of technology will likely reduce some of the advantages currently enjoyed by Western military forces.

Pondering the characteristics of future operations is a difficult task; it is necessary to consider what will change and what might stay the same. This document is meant to assist with that by identifying enduring and emergent trends, challenges that have no as-yet definable trend trajectory, and the potential implications for the DND/CAF. It is but one part of the process meant to enable the DND/CAF to prepare for the future. The implications made within are a result of research, careful deliberation with stakeholders, and the application of judgement by military and civilian staff. The trends that have been identified and the deduced military implications are not exhaustive. Rather, the implications represent the best judgement of the authors as to what is most salient for current Horizon Three (out to 2040) force development efforts. The inability to predict, with any degree of accuracy, the trajectory of current trends to a point 20+ years in the future means that this document can only ever be an informed guide.

Internationally, the CAF will likely continue to operate as part of formal and informal multinational and bi-national coalitions to achieve GoC objectives. This will continue

to involve bi-national partnerships with the US military and a continuance of the tri-command framework to assure the security of the North American landmass, airspace, and maritime approaches. Therefore, interoperability with core allies, particularly the US, will remain important. Furthermore, as joint and combined operations will continue to be the norm, whole-of-government and comprehensive approaches will continue to be important to resolve the complex issues facing the CAF. Even if only some of the trend projections described in this document eventually prove to be accurate, the FOE will be challenging to operate in. Without question, the CAF must be able to operate across the length and breadth of Canadian territory, including its maritime and airspace approaches and it is likely that the GoC will continue to assign difficult expeditionary operations. Thus, flexible, adaptive, resilient, deployable forces able to operate with a high degree of situational awareness, with precision, and the ability to minimize collateral damage and casualties will be necessary. Fielding such forces will require a training and professional development system that is similarly adaptable to ensure that personnel are physically and intellectually prepared for the challenges they will face.



SUMMARY OF MILITARY IMPLICATIONS

1. Fluctuations in geopolitical power and the increased diffusion of economic power has the potential to cause friction between competing states. However, the potential for sustained conflict between major powers is lessened by the very large degree of interconnectedness and interdependence that currently characterizes the international system. States will use all their instruments of power to ensure their own sovereignty and pursue their own national interests. As an instrument of Canada's national power, the CAF must be able to deploy globally, often in unstable areas to contribute to the Government's foreign policy and national security objectives in order to defend Canada and Canada's interests.
2. Ensuring Canada's sovereignty and defending the North American continent are two separate tasks assigned to the CAF.
3. The future defence of North America will continue to require permanent bi-national CAN-US defence arrangements as part of the overall continental security architecture. Thus, combined-joint interoperability with US armed forces, along with continued mature institutional ties will be necessary to ensure that US and Canadian military forces are able to interact seamlessly.
4. While the US interest in upholding the freedom of the global commons is not likely to change in the near- to mid-term, the reduction in forces will increasingly tax the military and place a new emphasis on Washington seeking international cooperation.
5. Interoperability with the US will place burdens upon CAF Force Development (FD) to ensure future capabilities the ability to integrate with its armed forces despite the continued development of innovative and technologically advanced military capabilities. Interoperability with the US will remain a primary consideration for CAF FD to facilitate integration with US forces on operations.
6. Interoperability with European countries will continue to be fostered by Canada's NATO commitment. However, the impact of reduced defence spending among NATO countries will continue to reduce interoperability and challenge joint-combined operations. Nevertheless, the UK, France and Germany will likely remain the most influential countries in Europe. The CAF continued priorities on interoperability could remain the US, NATO, and the Five Eyes community.

7. Increasing Chinese influence will alter the global balance of power in the coming decades. China could be a challenger to the global pre-eminent position of the US in the longer term; primarily through increased economic influence which it will almost certainly use to support its national interests. At the very least, China will remain a regional challenger to US military power in the Asia-Pacific region.
8. Regardless of the actual rate of Chinese growth and influence, or the evolution of its security and defence capabilities out to 2040, it is clear that the Asia-Pacific region will be of increasing geo-strategic importance. Therefore, the CAF could be required to project and maintain forces in that area as it may serve future GoC interests.
9. China may increase its deployment of forces for a variety of reasons such as protection of their EEZ, humanitarian operations, or even stability operations. The CAF could be required to operate alongside, or within the same geographic regions as the Chinese armed forces.
10. As Russia continues to reassert itself internationally, and since Canada has shared interests with this country, the CAF and allied forces will likely continue to encounter, or be called to cooperate with, Russian expeditionary forces on stability and intervention operations. However, Russia's ambitions are generally focused on the near abroad. As such, Russian military forces are likely to take part in operations closer to their own territory.
11. Contemporary Russian and Chinese arms sales are significant and this trend will likely continue. Therefore, the CAF will almost certainly continue to face opponents (both state and non-state actors) who possess Russian or Chinese military equipment and weapons out to 2040. Therefore, the CAF could orient its intelligence, technical analysis and Research and Development (R&D) force planning activities to consider this circumstance.
12. India has substantial challenges to overcome in the coming decades. However, it will likely continue to assert its role as one of the world's most influential states and, as a Commonwealth nation, could be considered a likely non-traditional partner with which the CAF may operate in the future.
13. Brazil is the major emerging power on the South America continent and will continue to have considerable influence in the region. Brazil's defence capabilities and influence will continue to grow out to 2040. Future CAF planning and activities in the Americas will need to consider Brazil's regional influence.



14. NATO will continue to play an important role in Western security affairs. It is, however, probable that ad hoc coalitions, under the banner of NATO, will be deployed on missions considered politically sensitive or urgent.
15. Notwithstanding potential new ad hoc coalitions, Canada's primary military allies will remain extant and NATO will continue to play a role in Canada's defence commitments. Interoperability will be an important component of future military capability since it is promoted by NATO through Standardization Agreements (STANAGs), Allied-joint Doctrine and training exercises.
16. Canada's historic tendency to support multi-lateral organizations will continue. In support of some United Nations Security Council Resolutions (UNSCR), CAF participation in multilateral military operations may be directed by the GoC.
17. The SCO is unlikely to mature into a military alliance capable of challenging NATO. It is however representative of a new multi-lateral organization within which Western Powers have little influence. New powerful multi-lateral organizations, reflecting ongoing shifts in geopolitical power, may be formed by 2040 that further circumvent perceived Western dominance of some multilateral organizations.
18. In those cases where the GoC chooses to become a coalition member seeking to stabilize a fragile or failed state, a comprehensive approach to the mission is likely best-suited to advance that aim. Such a response will require a comprehensive approach that entails operating efficiently with other departments and agencies.
19. The CAF will have to adapt the level of combined-joint interoperability required to undertake and sustain expeditionary missions, with either allies, trusted international partners (such as the Five Eyes community) or non-traditional partners.
20. Where state structures do not exist, there will invariably be alternative forms of governance control existing within the operational environment. In seemingly ungoverned spaces, the CAF must be capable of developing situational awareness in order to facilitate mission success.
21. Transnational non-state actors influence the geopolitical arena and will affect future CAF operations. CAF must continue to consider the implications of non-state actors in the planning and execution of operations.

22. Emerging powers with prosperous and growing economies are likely to strengthen their militaries commensurately. Such build-ups could disrupt (either intentionally or inadvertently) the security of Canada and its partners. Accordingly, Canada could seek new alliances and increased military co-operation with those emerging economic powers that are strategically aligned with Canadian interests.
23. The assurance of Canadian cyber related infrastructure will remain critical. DND/CAF must maintain a robust and resilient cyber defence capability to ensure the security of defence-related systems, shaped by and responsive to emergent threats and operational activities. Given that the vast majority of defence assets reside in Canada, and to ensure interoperability with other Government Departments (OGD) and Security Intelligence partners, DND/CAF can benefit from and contribute to the cyber defence led through a wider GoC effort.
24. The continuing globalization of industrial supply chains will pose security and self-sufficiency implications for western militaries, including the CAF. Attention must be paid to mitigating this trend through measures aimed at assuring national self-sufficiency for critical military equipments, components and supplies.
25. The development of initiatives to reduce energy consumption and encourage efforts to find alternate solutions will remain important for all forces. Indeed, delivering fuel and other energy resources to forward elements during expeditionary operations engenders some vulnerabilities.
26. Since domestic and continental energy supply could be assured in the coming decades, securing the lines of communication and free trade in the global commons may become more important for the export rather than the import of energy.
27. Nuclear power will continue to have civilian and military uses. DND should monitor any developments in this area. Defensive military radiological and nuclear capabilities, to allow the conduct of CAF operations in environments where radiological contamination exists, are therefore essential in order to react to domestic events and to effectively operate in regions where radiological and nuclear hazards (civilian and military) are present.
28. The nature of conducting operations in large urban environments will continue to challenge the CAF and place a premium on joint enablers, including Command, Control, Communication, Computers, Intelligence, Surveillance, and



Reconnaissance (C4ISR), operational support, aviation and the timely application of precision effects. In addition, CAF personnel will require the knowledge and expertise to attempt to comprehend the dynamics of the physical and social environment. Effective force protection will continue to be difficult to achieve in such terrain.

29. It is likely that some nations will not be prepared to effectively respond to global outbreaks of infectious disease, or the release of pathogens into the environment, which by their nature are often impossible to predict and difficult to prevent or contain. In an expeditionary context, the CAF should be capable of conducting operations in environments affected by such events.
30. Domestically, the CAF may be required to assist civil authorities in the event of a pandemic, or a release of pathogens into the environment. Adequate force protection measures, and institutional robustness, will be required to effectively support OGDs if called upon to do so.
31. Since poverty is a driver for instability, it remains highly likely that the CAF will be deployed in impoverished areas where HN support will be minimal. Therefore, the CAF require the capacity to operate in austere environments without significant HN support. For example, sustainability, as a factor in underwriting the success of an operation, will require access to local transportation facilities or, in the case of territories with coastlines, afloat (SeaBase) support.
32. The CAF will continue to require robust and adaptive recruitment, employment and retention strategies. The impacts of demographic trends will challenge CAF human resources.
33. There will be increased demand on both national and allied defence and security institutions to ensure control and integrity of platforms and systems, as well as an increased requirement to certify the reliability of foreign sourced systems and integrated components. DND will need to carefully choose which elements cannot be outside Canadian control and continue to develop trusted relationships with defence industrial partners.
34. In order to leverage S&T trends, speedier, more agile and flexible military procurement strategies and programmes will be required to ensure defence is able to maximize the benefits of technological change.
35. A decrease of basic fundamental S&T research by Western governments may lead to a larger long-term applied science gap between Western nations and

other countries such as China. The military risk is one of reliance on non-allied technologies or of an inability to access technologies that may be critical to fielding effective military forces in the future.

36. The CAF will continue to face a key challenge in establishing the appropriate balance between technological sophistication, mass, interoperability, and affordability.
37. Additive manufacturing has the potential to dramatically change the sustainment function. The CAF could seek to reduce its logistical tail with the ability to build spare parts and other supplies in the joint operational area.
38. As digital blueprints of weapons and dual use technology will be harder to protect from espionage, the CAF may seek more capabilities in intelligence and cyber defence to safeguard technological data.
39. Advanced materials will impact concealment and countermeasures, providing opportunities to manipulate visible light. New developments in smart nano-materials and textiles will affect the sense and the shield functions.
40. Military health systems will likely be impacted by advances in biotechnology and additive manufacturing through the delivery of customized replacement organs, bones, and tissue.
41. Socio-technical networks will continue to have a direct impact on C4ISR architectures and systems and on the execution of C2. The CAF might have to continue to adapt its tactical authority delegation and eventually use artificial intelligence and automation to enhance and speed up decision-making.
42. Big data analytics will create opportunities and challenges for militaries. Exploiting data in such a way may allow for more effective conduct of military operations, particularly cyber and influence activities.
43. The use of personal smart devices and social media by CAF members, OGDs, NGOs, and PMCs in operational environments will continue to challenge operational security and put greater demands on cyber security.
44. Secure clouds will impact future C4ISR architectures. Maintaining military advantage will require higher performance, more secure and more robust clouds than those possessed by opponents, since all parties involved in conflicts will likely use comparable networking technology and devices.



45. Very high levels of technical knowledge and skills will continue to be required to operate effectively in the cyber domain. Actions taken using this knowledge and skill must be well integrated within the overall military operational planning and execution functions.
46. Given the proliferation of sensors, camouflage and concealment will be challenged by the integration of Intelligence, Surveillance, and Reconnaissance (ISR) assets, big data analytics, cyber-security, and human terrain understanding.
47. Extension of the human frontier will have a direct impact on the command, sense, act, shield, sustain and generate functions. However, the integration of human performance enhancement capabilities into the CAF portfolio will be challenged by ethical, legal, and policy considerations which might not be the case for adversaries. The CAF must establish those parameters before those technologies are fielded.
48. Advances in life sciences will likely impact military and veteran health care systems, casualty management and novel biological agent countermeasures. Developments in biotechnology may provide better force protection to deployed military personnel, better treatments and low-cost medicine
49. Advanced unmanned systems will become increasingly autonomous. Eventually, military personnel may be challenged by increased participation of autonomous systems making tactical decisions.
50. Complete integration of new technological means will continuously require the Rules of Engagement (RoE), and the development of associated policies to evolve. Examples include the collection and exploitation of biometrics in theatres of operation, cyber warfare and persistent surveillance systems affecting privacy, the use of human performance enhancers, and the use of non-lethal weapons.
51. The CAF will have to continue to operate when systems are compromised, unavailable, or access to systems is denied. Maintaining sufficient resiliency to be able to operate under various conditions and with a broad spectrum of partners – some with low-tech interfaces – will help prevent mission failure.
52. As national and allied space systems will face greater risks, the CAF may need to seek more mitigation strategies and collaborative approaches to space capabilities to gain robustness and redundancy, and, therefore, resilience.

53. Technological advances will require DND/CAF to innovate in Defence Project Management in order to leverage its upside benefits in a timely manner and to create the organizational process and climate necessary to innovate military technology.
54. Career-spanning, focused, professional development and education on national security issues will be increasingly important. Understanding the mandates and capabilities of OGDs and agencies, and joint collective training, will be necessary to ensure CAF personnel are able to operate effectively as part of a comprehensive approach to resolving issues of Canadian national security.
55. The CAF must integrate the lessons learned from operations, exercises, and experiments at the tactical, operational and strategic levels in order remain ready, effective, and adaptive.
56. When possible, state and non-state actors alike will seek to combine conventional, irregular and high-end asymmetric methods concurrently, often, simultaneously in the land, sea, air, and space environments and the cyber domain to gain advantage in future conflict.
57. The ability to apply joint precision effects will remain an important requirement to achieve military success in the FOE. Increasing precision in all aspects of military activities has been and is currently a major Western military capability advantage. However, the global proliferation of sophisticated technology will erode this advantage over time as more actors develop or acquire lethal precision capabilities. The CAF should be prepared to field a robust defence against such capabilities.
58. Complex stability-type operations require a population-centric approach to achieve long term mission success. Such operations will likely demand greater precision in the use of non-lethal capabilities. The CAF should continue to develop and implement strategies to rapidly understand human terrain in any new operating environment. This will improve the prioritization and application of precisely targeted non-lethal effects to facilitate mission success.
59. The expected characteristics of the FOE, specifically the historic trends regarding how the CAF approaches operations, the longstanding characteristics of war and the international system, the pervasive nature of various and projected medias, and the ever-greater importance of maintaining legitimacy highlight the importance of strategic communication in planning and conducting future



military operations. Trends in urbanization, socio-technical networks, cloud computing, and sensing and analysis technologies imply that the significance of strategic communication will only increase out to the 2040 period.

60. The proliferation of advanced technologies and weapons, including WMD, has the potential to shift the balance of power in a number of regions. The CAF must be capable of operating in environments where such threats are present.
61. Determining how technology can be applied to create and maintain capability advantage at all levels of war requires coherent and adaptable doctrines and the institutional conditions that enable and encourage imaginative but realistic thought.
62. Strong linkages with, and an openness to consider unsolicited proposals, from industry and academia are critical to militaries seeking to understand and apply current and evolving technologies in novel ways to help maintain capability advantage.
63. Armed non-state actors will be an enduring feature of the FOE. Therefore the CAF must have the capability to, in collaboration with partners, identify, understand, and operate with or against them as required.
64. The CAF must be able to identify those NGOs operating within a theatre, and the organizational motivations driving each, in order to understand their roles and objectives.
65. The CAF must ensure that reliance on contractors at all stages of force development, generation, and employment does not undermine or hinder, through the contracting of critical functions, the ability of the CAF to field core warfighting capabilities, or create intractable, unintended consequences to follow-on stability operations.
66. The CAF must ensure that operational contractor support is fully integrated into expeditionary force structures. This must include understanding and mitigating risk of employing such assets from military and legal perspectives and budgeting for their employment.
67. The provision of legal advice to political and military leadership at the strategic and operational levels in real-time will be required to facilitate effective military operations in the future. Achieving this requires the Judge Advocate General to maintain a high level of expertise in all areas of military law to ensure the

delivery of responsive force-enabling legal advice and to influence the shaping of domestic and international legal frameworks to facilitate CAF, Departmental and Governmental mission success.

68. The military institution will need to remain aware of the legal implications of new technologies as they are considered for integration into the CAF capability portfolio.
69. Continued education, professional development, and training in the LoAC by CAF personnel and deploying civilian representatives of the GoC are necessary for the conduct of effective operations.
70. The CAF must assume that situational awareness will always be incomplete and that adversaries will actively exploit the physical environment and technology to degrade friendly ISR systems.
71. It is impossible to predict either the geography or socio-cultural context of future missions. However, CAF planners can consider historic land, sea, and air chokepoints and areas where Canada has had long-standing national interests to help narrow the range of possibilities when considering FD options.
72. The relationship between access to the global commons and Canadian and international prosperity means that the CAF may be called upon to contribute to efforts to protect those commons. In addition, assured access to the global commons will remain a critical factor in enabling the timely projection and employment of military capability for expeditionary operations.



METHODOLOGY

A Refreshed FSE

The first edition of the Future Security Environment 2008-2030 (hereafter FSE) examined current and emerging trends. Subsequently, shortcomings were identified concerning the relevance and applicability of the deductions for force development purposes. As stated in the introduction, those deductions have been replaced by military implications in order to incorporate the lessons gained since the publication of the first edition. This revised FSE is for defence, by defence. It is written to emphasize trends relevant to the CAF and the Defence institution using sound sources to ensure credibility. Most importantly, this document must be normalized as part of the CBP process and be easily updated when necessary.

The refresh project was initiated by a Vice Chief of the Defence Staff (VCDS) directive issued 4 October 2012 to ensure that it is “relevant and fit for purpose” in order to continue to “contemplate solutions to address tomorrow’s challenges.” The objective of the process was “to enable senior leaders to make informed decisions, capability or otherwise, based on common rigorously conducted future security analysis.”¹ Aligned with the approach taken in the previous iteration, the present document is a projection of current trends to a new horizon: 2040.

Approach

This refreshed FSE has been bolstered by a revised approach and a complete update of the sources. The thorough research has sought to support the argumentation and add weight to the implications. The literature review used during the preparation of this document allowed the authors to rely on the expertise of OGDs, think tanks, NGOs, academia, and the UN, to list but a few examples. A wide variety of sources were consulted and thorough footnoting used to substantiate the content. Allied equivalent publications were consulted to strengthen our analysis.

Stakeholder contributions were important throughout the preparation of this document. When possible shortcomings were identified by stakeholders, solutions were implemented. DND, CAF and OGDs were kept informed throughout the process. The level of their engagement was crucial to the success of the project. In order to further benefit from stakeholder insights, an after action review was added to the process to capture lessons. The formulation of the document also benefitted from leadership engagement.

Finally, the reasoning that motivates the preparation of this document has been described as follows: “Exploring the FSE provides the necessary context and background information to ensure military forces can establish a coherent strategy and force structure for what lies ahead.”² This has not changed. Military implications have been outlined in order to identify potential effects on DND/CAF. As the necessary first step in the CBP process, the production of this refreshed FSE document uses an inductive reasoning approach in order to create the foundational framework for capability analysis. From this FSE, FD scenarios will be deduced to cover the full spectrum of operations in accordance with CFDS.³ CFD has led and implemented the refresh of the FSE, which is the first step in the iterative three-year cycle of the CBP.

NOTES

1 VCDS Directive – Production of A Single Approved Future Security Environment Document, 4 October 2012, 2100-1 (DCI).

2 Shaye K. Friesen and Andrew N. Gale, “Slaying the Dragon: The Future Security Environment & Limitations of Industrial Age Security,” *Canadian Military Journal*, Vol. 11, No. 1, Winter 2010, p. 33.

3 Government of Canada, “Capability Based Planning Handbook”, National Defence, Chief Force Development, Version 7.0, May 2013, p. 8.



GLOSSARY

TERM	DEFINITION	SOURCE
Alliance	The result of formal agreements between two or more nations for broad, long-term objectives.	Canada
All-source intelligence	Intelligence produced using all available sources and agencies.	Canada & NATO
Ally	Country sharing a formal alliance (i.e. NORAD, NATO). For example, Norway is an ally but Sweden is a partner for Canada.	Canada
Arab Spring	Political upheaval that began in Tunisia in December 2010 and that has wrought many changes to the governance of a wide swath of states across the Middle East and North Africa (MENA).	Canada
Artificial intelligence	The capability of a computer to perform such functions that are associated with human logic such as reasoning, learning, and self-improvement	Canada
Asymmetric Threat	A threat emanating from the potential use of dissimilar means or methods to circumvent or negate an opponent's strengths while exploiting his weaknesses to obtain a disproportionate result.	Canada & NATO
Big Data	"Big data" refers to datasets whose size is beyond the ability of typical database software tools to capture, store, manage, and analyze.	McKinsey Global Institute
Capacity building	The process of increasing a host nation's ability to achieve self-sufficiency, typically through improved governance, security, human capital, development and reconstruction.	Canada
Cloud Computing	A model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.	US DoD CIO
Coalition	An ad hoc agreement between two or more nations for a common action.	Canada
Collateral damage	Inadvertent casualties and destruction in civilian areas caused by military operations	Canada & NATO
Command and control	The exercise of authority and direction by a commander over assigned, allocated and attached forces in the accomplishment of a mission.	Canada & NATO
Comprehensive Approach	A philosophy according to which military and non-military actors collaborate to enhance the likelihood of favourable and enduring outcomes within a particular situation. Note: The actors may include joint or multinational military forces, Canadian government departments and agencies (whole of government), other governments (foreign, provincial and municipal), international organizations (NATO, UN), non-governmental organizations (CARE, OXFAM), private sector entities or individuals.	Canada

TERM	DEFINITION	SOURCE
Conventional weapon	A weapon that is neither chemical, biological, radiological nor nuclear.	Canada & NATO
Counter-insurgency	Comprehensive civilian and military efforts made to defeat an insurgency and to address any core grievances. Those military, paramilitary, political, economic, psychological, and civic actions taken to defeat insurgency.	Canada & NATO
Domain	In force development, a sphere of activity or knowledge. A sphere of activity, influence or knowledge related to a specific physical or conceptual property.	Canada
Driver	An event, human activity or condition that provides impetus or motivation to sustain a trend.	Canada
Environment	The total set of all external natural and induced conditions to which a materiel is exposed at a given moment, during a specified period of time. The descriptions of the environments of an item are based on its life cycle. The synthesis of all environments belonging to a given life cycle is called environmental profile.	Canada
Extremists	Radicalized groups and individuals who advocate for and are willing to use illegal, violent, or other extreme action to publicize their narrative or otherwise further their cause	Canada
Failed State	A state that no longer possesses a viable capacity to govern effectively. Note: This is normally prompted by a withdrawal of popular support for the state in response to its inability or unwillingness to deliver at least one of its fundamental functions. Elements or remnants of governing institutions usually exist, though they are degraded and no longer functioning coherently.	Canada
Force Development	A system of integrated and interdependent processes that identifies necessary changes to existing capability and articulates new capability requirements for the CF. It is driven by changes in policy, actual or projected, changes in the security environment and lessons learned from operations. Force development comprises capability based planning, capability management and capability production.	Canada
Fragile State	A state with a reduced capability to govern due to institutional weaknesses that constrain the delivery of one or several of the fundamental state functions to its citizens. Note: Such states are vulnerable to shifts in population support from the state to other entities that are able to provide these functions in place of the state.	Canada
Globalization	The growing interconnectedness reflected in the increase flow of information, technology, goods, services, and people throughout the world.	National Intelligence Council
Gross Domestic Product	The value of the goods and services produced by the residents of a country.	Canada & NATO



TERM	DEFINITION	SOURCE
Host nation	A nation which, by agreement: receives forces and materiel of NATO or other nations operating on/from or transiting through its territory; allows materiel and/or NATO organizations to be located on its territory; and/or provides support for these purposes.	Canada & NATO
Human Frontier	The aim of Human Frontier research is to move beyond the current limitations of capacity in cognitive, psycho-social, physiological, and physical axes of human ability. Frontier research is research at the cutting-edge of any given scientific field. The word "Frontier" may be associated with the exploration of the land beyond boundaries, the land of the unexpected and of unlimited opportunities. Frontier research takes enormous risks to step into the unknown.	(Human Frontier Science Program, Strategic Outlook 2010-2016)."
Hybrid War	The incorporation of a full range of modes of warfare, including conventional capabilities, irregular tactics, terrorist acts and criminal disorder. Hybrid wars can be conducted by both state and non-state actors.	ABCA
Interoperability	The ability to act together coherently, effectively and efficiently to achieve common objectives Note: Interoperability may be achieved through the compatibility of doctrine, processes and materiel. The ability of Alliance forces and, when appropriate, forces of Partner and other nations to train, exercise and operate effectively together in the execution of assigned missions and tasks.	Canada & NATO
Kinetic	In military operations, said of destructive means used to achieve desired effects.	Canada
Lab-on-a-chip devices	Lab-on-a-chip devices are characterized by their small size, low power requirements, and the speed at which they provide results.	Canada
Lethal	Eg Lethal weapon - A weapon that can be used to cause death or serious bodily injury.	NATO
Littoral	In military operations, a coastal region consisting of the coastal sea areas and that portion of the land that is susceptible to influence or support from the sea.	Canada
Megacity	Urban agglomeration of at least 10 million inhabitants.	United Nations
Military Capability	The ability of the military to carry out an activity or operation.	Canada
Military Implication	Military estimate derived from future trends identified in the FSE. Deduction used to frame and test force development scenarios. An MI is not prescriptive and not necessarily linked to capability.	Canada
Military power	An instrument of national power that uses force, threat of force or other inherent capabilities to achieve national objectives.	Canada

TERM	DEFINITION	SOURCE
Non-kinetic effects	Said of non-destructive means to achieve desired effects.	Canada
Non-lethal	Eg. Non-lethal weapon - A weapon that is explicitly designed and primarily employed to incapacitate or repel persons or to disable equipment, while minimizing fatalities, permanent injury and damage to property and the environment.	NATO
Non-state actor	A person or organization not associated with an officially recognized government. Non-state actors may include any of the following types of groups and organizations: non-governmental organizations, multinational corporations, the international media, armed groups (rebel opposition forces, militias, warlords, insurgents and private military firms), terrorist organizations, criminal organizations, religious groups, ecological organizations, and diaspora.	Canada
Radicalization	the process of advocating political, ideological or societal reform that can, in some instances, lead to the generation of extremist beliefs and terrorist activity	Canada
Rare earths elements	A collection of seventeen chemical elements in the periodic table, specifically the fifteen lanthanides (Lanthanum, Cerium, Praseodymium, Neodymium, Promethium, Samarium, Europium, Gadolinium, Terbium, Dysprosium, Holmium, Erbium, Thulium, Ytterbium, Lutetium) plus scandium and yttrium.	IUPAC
Social media	Social media is an online domain in which content is created, consumed, promoted, distributed, discovered or shared for purposes that are primarily related to communities and social activities, rather than functional, task-oriented objectives. "Media" in this context is a domain characterized by storage and transmission, while "social" describes the distinct way that these messages propagate in a one-to-many or many-to-many fashion.	Gartner: Information Technology Research and Advisory Company
Space-enabled systems	Space-enabled - Systems, services or capabilities that are provided, derived, supported or enhanced by an on-orbit asset such as a satellite or a satellite constellation. Within a DND context these will enable strategic decision-making, conduct mission planning and execute operations.	DG Space
Stability Operations	A tactical activity conducted by military and security forces, often in conjunction with other agencies, to maintain, restore or establish a climate of order.	Canada
State	A person of international law that possesses a permanent population, defined territory, government and capacity to enter into relations with the other States. Note: Definition derived from Article One of the Convention on the Rights and Duties of States, 26 December 1933 [AKA Montevideo Convention] (not ratified by Canada).	Canada
Trend	The direction and speed of change in important components of the international environment. A trend is a description of the manner in which one of these components is changing, accelerating, or decelerating.	US



TERM	DEFINITION	SOURCE
Weapons of Mass Destruction	A weapon that is capable of a high order of destruction and of being used in such a manner as to destroy people, infrastructure or other resources on a large scale.	Canada & NATO
Western	For the purposes of this document 'Western' powers is used to loosely describe the core NATO allies and a few others such as Australia.	Canada
Whole-of-government approach	An integrated approach to a situation that incorporates diplomatic, military, and economic instruments of national power as required.	Canada
Youth bulge	Fifteen to 29 year-olds who make up close to 40-50 percent of some populations	MIC



LIST OF ACRONYMS

3D	Three dimensional
A2/AD	Anti-access/Area denial
ASEAN	Association of Southeast Asian Nations
BRIC	Brazil, Russia, India, China
C2	Command and Control
C4ISR	Command, Control, Communication, Computers, Intelligence, Surveillance, and Reconnaissance
CAF	Canadian Armed Forces
CBP	Capability Based Planning
CBRN	Chemical, Biological, Radiological, Nuclear
CBRNE	Chemical, Biological, Radiological, Nuclear, and Explosive
CFDS	Canada First Defence Strategy
CMP	Chief of Military Personnel
CORA	Centre for Operational Research and Analysis
CSIS	Canadian Security Intelligence Service
DCDC	Development, Concepts and Doctrine Centre (UK)
DFAIT	Department of Foreign Affairs and International Trade
DIME	Diplomatic, Informational, Military, Economic
DND	Department of National Defence
DoD	Department of Defense (US)
DRDC	Defence Research and Development Canada
EAS	East Asia Summit
EEZ	Exclusive Economic Zones
EU	European Union



FD	Force Development
FOE	Future Operating Environment
FSE	Future Security Environment
G7	Group of Seven (Canada, France, Germany, Italy, Japan, UK, and US)
GDP	Gross Domestic Product
GoC	Government of Canada
GPP	Global Partnership Program
HN	Host Nation
IBSA	India-Brazil-South African
IEA	International Energy Agency
IP	Internet Protocol
IPCC	Intergovernmental Panel on Climate Change
ISAF	International Security and Assistance Force
ISR	Intelligence, Surveillance, and Reconnaissance
LoAC	Laws of Armed Conflict
MANPADS	man-portable air-defence systems
MBD	million barrels per day
MENA	Middle East and North Africa
N11	Next Eleven (Bangladesh, Egypt, Indonesia, Iran, Korea, Mexico, Nigeria, Pakistan, Philippines, Turkey and Vietnam)
NATO	North Atlantic Treaty Organization
NGO	Non-Governmental Organization
NORAD	North American Aerospace Defense Command
OAS	Organization of American States
OECD	Organisation for Economic Co-operation and Development



OGD	Other Government Department
OPEC	Organization of the Petroleum Exporting Countries
PMC	Private Military Contractor
PMESII	Political, Military, Economic, Social, Infrastructure, Information
R&D	Research and Development
REE	Rare earths elements
RF	Radio Frequency
RoE	Rules of Engagement
S&T	Science and Technology
SAR	Search and Rescue
SARS	Severe Acute Respiratory Syndrome
SCO	Shanghai Cooperation Organization
SOF	Special Operations Forces
STANAG	Standardization Agreements (NATO)
UAV	unmanned aerial vehicles
UK	United Kingdom
UN	United Nations
UNASUR	Union of South American Nations
UNCLOS	United Nations Convention on the Law of the Sea
UNESCO	United Nations Educational, Scientific, and Cultural Organization
UNSC	United Nations Security Council
UNSCR	United Nations Security Council Resolutions
US	United States of America
USD	United States Dollar
USN	United States Navy
WMD	Weapons of Mass Destruction



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