

SCIENCE & TECHNOLOGY FORESIGHT

A Report of the
Technology Foresight
Directorate
of the
Office of the National
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Preparedness Canada

PROSPECTIVE
PROTECTIVE
FUTURES
SECURITY
WORKSHOP

Executive Summary Report
FINAL

March, 2008
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1 Foreword

The Science and Technology Foresight Directorate (STFD) of the Office of the National Science Advisor (ONSA) produces documents and reports for the benefit of sponsors, participants and professionals interested in how emerging and prospective developments in global science and technology might impact our futures in Canada, North America and the world.

This document was prepared as part of the **2006 Prospective Protective Futures Security Workshop**, sponsored by the Public Security Technical Program, a joint project of Defence R&D Canada and Public Security and Emergency Preparedness Canada.

The STFD operates as a collaboratively structured partnership activity within the Canadian Government. We undertake national and international projects with multiple partners and stakeholders from federal and provincial governments and agencies, universities and the private sector. Partnerships are developed around specific themes or projects. We use foresight tools and methodologies to stimulate longer-term thinking, develop horizontal linkages and build shared R&D awareness and capacity to better prepare Canadian and global S&T and policy communities for new challenges.

This research report is the property of those who participated in the processes described herein, and therefore reflects the combined views of the participants and the best wisdom and creative thinking stimulated by the foresight process.

This work is undertaken under the leadership of the Government of Canada, but does not signify endorsement by its Departments and Agencies unless so indicated. It is useful to recall the definition of S&T Foresight that was used to define the scope and focus for this research:

S&T Foresight involves systematic attempts to look into the longer-term future of science and technology, and their potential impacts on society, with a view to identifying the emerging change factors, and the source areas of scientific research and technological development likely to influence change and yield the greatest economic, environmental and social benefits during the next 5 – 25 years.

S&T Foresight is necessarily speculative, creative and analytical. It relies on both the interpretation of S&T change drivers and on how, if and when these drivers could become significant factors in emerging social, economic and political realities. Since these are highly uncertain, foresight is inherently about attempting to understand and reduce – or at least prepare for – significant risks.

Because of this context of inherent uncertainty, foresight participants and stakeholders should not regard this report as fact or prediction. It represents

collaborative research that was conducted primarily for learning purposes, with the understanding that emerging consensus around some elements might warrant a further, more detailed examination. This is the nature of foresight – creating a range of plausible future scenarios that in their diversity should alert readers to the kinds of issues and perspectives that they may not have considered in initial research planning and contingency thinking.

In foresight, each player, sponsor or participant takes away some collaborative learning and experience that is tacit and more deeply resonant than the descriptive or analytical accounts contained in the reports. These indicate how various foresight approaches and tools can be applied to help readers become better prepared or at least more capable of contingent planning and action in these turbulent times.

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Prospective, Protective Futures Security Workshop (2006) Reports

This report is one of a series of reports produced in conjunction with the March 2006 Prospective, Protective Futures Security Workshop.

The following are all the report titles in the series:

1. Prospective, Protective Futures Security Workshop, Event Proceedings Report
2. Prospective, Protective Futures Security Workshop, Global Scan for Key Drivers for Our Future Report
3. Prospective, Protective Futures Security Workshop, Plausible Scenarios for Canada 2015-2020 Report
4. Prospective, Protective Futures Security Workshop, Key S&T Findings Report & Presentation
5. Prospective, Protective Futures Security Workshop, A story from the Future Report
6. Prospective, Protective Futures Security Workshop, Lessons Learned by The Project Team Report
7. Prospective, Protective Futures Security Workshop, Executive Summary Report
8. Prospective, Protective Futures Security Workshop, Executive Summary Presentation
9. Prospective, Protective Futures Security Workshop, Feedback From Participants Report

2 Introduction

The Prospective Protective Futures Workshop was held on 26-28 March 2006 at Defence R&D Canada (DRDC) Ottawa. The workshop was organized by the Office of the National Science Advisor in PCO on behalf of PSEPC and Defence R&D Canada (DRDC) to generate "foresight" that would feed into "Vision 2015" for the Systems Integration, Standards and Analysis (SISA) mission area of the Public Security Technical Program (PSTP) - a joint initiative of PSEPC and DRDC.

"Vision 2015" is to provide a perspective, for the federal public safety and security community, on possible future challenges to public safety and national security in the 2015 timeframe, target national capabilities for meeting those projected challenges, and opportunities presented by science and technology for obtaining the identified capabilities. In short, it is to contribute to the establishment of a forward-looking strategy for research and innovation for national security.

"Vision 2015" is to provide a projection of capabilities for 'all-hazards preparedness' for the *future security of Canada's borders, of the flow of people and goods across them, and of trans-border critical infrastructure* as called for by the "Smart Border Declaration" and "Security and Prosperity Partnership of North America". Vision 2015 is part of the Canada-US Public Security Technical Program (PSTP) to harness science and technology (S&T) for emergency management and national security (EMNS). It should contribute to PSTP's call for the anticipation of *future* needs. This will require identifying potential persistent and emerging threats and vulnerabilities in 2015 and beyond, factors driving the risks and opportunities to manage them.

Thus, development of the Vision should address four core questions:

- Q1.** What sort of world we could expect to see in terms of both major global and North American societal and technological *trends* and potential *discontinuities*;
- Q2.** What are the likely *risks* (human-made and natural threats/hazards and vulnerabilities) related to borders, infrastructure, and public security and safety more generally that will characterize 2015;
- Q3.** What *new or enhanced capabilities in emergency management and national security* will be needed for mitigation, preparedness, response and recovery to reduce risks; and
- Q4.** How can *current and foreseeable advances in science and technology* help?

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For several years, the Directorate for Science and Technology Foresight in the Office of the National Science Advisor in PCO) has been organizing intersectoral and interdepartmental "foresight" exercises designed to generate forward-looking perspectives for strategic policy on long-term issues. Familiar with this work, PSEPC and DRDC jointly engaged the Directorate to organize this foresight activity to 'kick-start' inter-departmental interest in "Vision 2015".

The sixty-some participants in the Prospective Protective Futures Workshop included experts from academia and industry as well as from municipal, provincial and federal government.

3 Agenda and Process

The Workshop's Agenda included several formal presentations to provide context, but the proceedings primarily involved the hallmark approach to PCO's foresight exercises: brain-storming, scenario-building and backcasting through the alternating use of plenaries and multiple, concurrent break-out groups.

Presentations were made by Dr. Anthony Ashley, Director General, (on behalf of DRDC as the hosting agency) on the new Centre for Security Science and DRDC's Alain Goudreau on the Consolidated Risk Assessment (which, like Vision 2015, is a seminal project under the Public Security Technical Program).

Presentations pointedly addressing topics and methodology in foresight and related approaches to futures studies were made on: scanning for surprise, emerging issues, counter-intuitives, assumption reversals; technological and societal trends and drivers.

4 Key Findings

This section on findings is organized under the 4 main questions that were posed as the start of the foresight project. It must be noted that this summary cannot be exhaustive, but will highlight the key findings of the 3-day workshop. For further details, please consult the detailed reports that are available on this workshop.

Q1. What sort of world we could expect to see in terms of both major global and North American societal and technological *trends* and potential *discontinuities*?

Workshop participants were provided with a strategic environmental scan based upon a wealth of expert information from national and international S&T specialists, security and intelligence focused professionals, and futures-technology and foreign-affairs generalists.

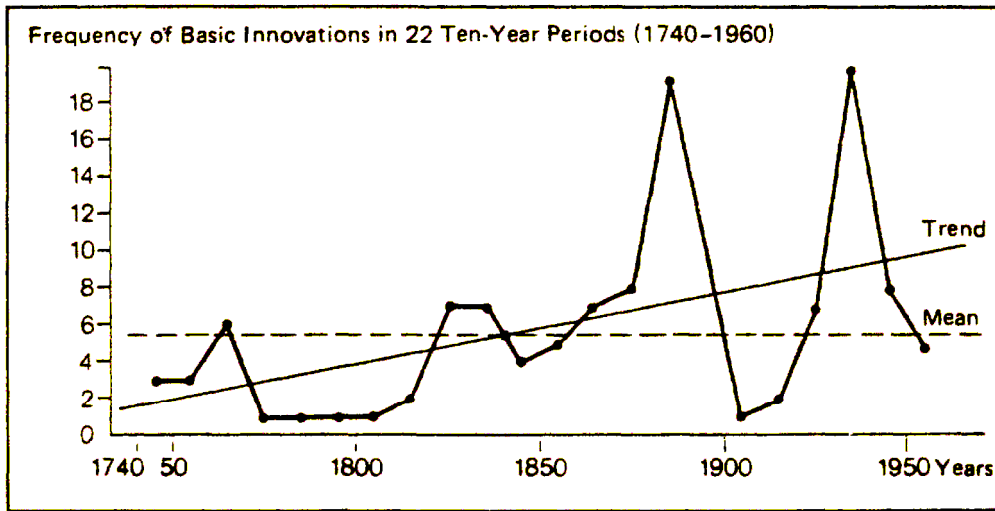
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Having established a broad socio-economic context, the scan material was presented in the form of 'trends' and 'drivers' that were categorized under the following 'lenses':

- Technology;
- Society;
- World Economy;
- Natural Environment.
- Culture;
- Demographics;
- Geopolitics; and

Methodology and Concepts

During recent history, there has been a limited number of innovative surges in which swarms of technical innovations emerged in close formation. In 2006 it appears that we are in the middle of a fifth cycle of innovative activity.



In each cycle the impact is profound, affecting not only technology but also society and culture - 'everything changes'. Each cycle of Innovation typically comes with a 'signature' of factors and a social paradigm that determines how these factors impact society. While the frequency of the cycles appears relatively constant, the scale and scope increases with each cycle.

Factor	Innovation Cycle or Cluster				
	1	2	3	4	5
Primary energy	Water	Hay	Coal	Oil	Natural Gas
Driving low cost factor	Child labour	Steam power	Steel	Oil	Information processing
Motive power	Water wheel	Steam engine	Electric motor	Internal Combustion Engine	Fuel cell engine
Signature technology	Spinning Jenny	Steam Engine	Electric Motor	Internal Combustion Engine	Microchip

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Technological paradigm	Factory	Division of labour	Mass production	Assembly line	Distributed system
Centre of World economy	London	Manchester/ Birmingham	W Europe	US south of Great Lakes	Pacific Rim
Geopolitical centre	London	London	Berlin, London Paris	Washington	Washington ► Beijing, Delhi?

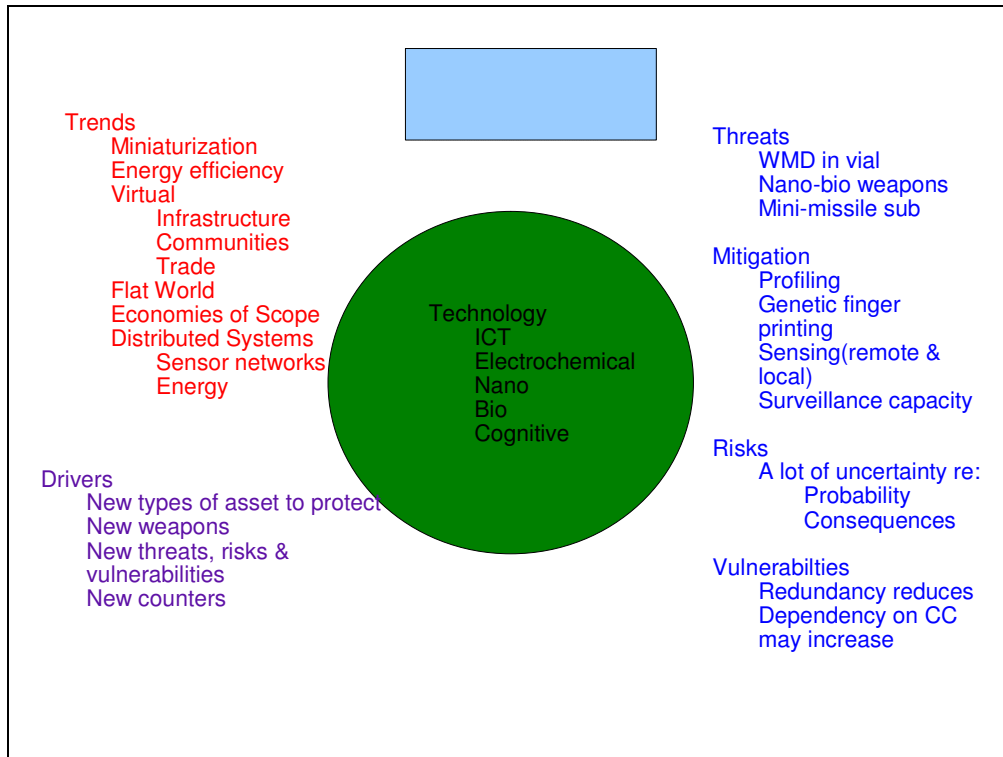
A shift from oil to natural gas as the primary energy sources will have significant geopolitical as well as economic implications. For example, sources of natural gas are found in most parts of the World except in China.

Energy infrastructure can also be much more compact and close to the end user (distributed energy system). Nanotechnology and biotechnology point in the same direction not only for energy infrastructures but all other kinds as well. But the most momentous implication of the sequence is the shift from pyro-technology to electro-chemistry and biology. Future efficiencies in energy and materials use will be phenomenal and could include self-assembly of components using weak electrical currents or magnetic fields or instruction sets contained in DNA.

Lenses

Trends and drivers may be viewed using the following lenses: Technology; Culture; Society; Demographics; World Economy; Geopolitics; and the Natural Environment. For each lens, a schematic encapsulates this approach as a prelude to the creation of Venn diagrams where interactions and interdependencies are considered. A schematic for the Technology lens identifies a number of technology platforms along with key Trends and Drivers as well as potential Threats, Mitigation Strategies, Risks and Vulnerabilities.

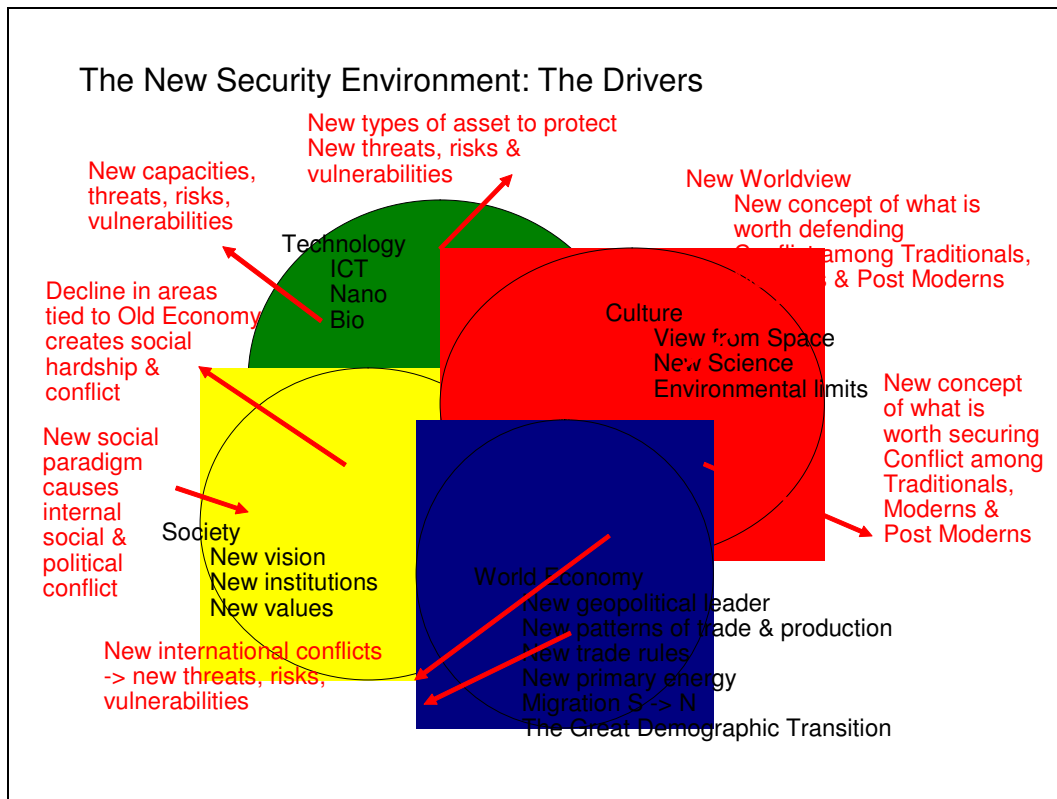
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In the new security environment, it appears that all the lenses overlap and it is typically in the regions of overlap where significant shifts and discontinuities are likely to be identified.

Thus overlapping lenses create additional Drivers. For example, where Technology and Society overlap, the ability of society to adapt to new technology may create 'winners and losers' based on the accompanying shifts in social values. New drivers also lead to new threats and new opportunities.

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Discontinuities involving the Social, Economic and Technology dimension typically occur every 55 years and they occur together because these three lenses are part of a closely-linked system. Discontinuities in the Natural World and in Culture are much rarer. However it has been argued that all five dimensions are currently exhibiting discontinuities.

So how can we plan for the future?

Extrapolation of trends has proven to have limited utility. Taking a 'systems view' also has problems because complex systems are subject to emergent properties and are therefore inherently full of surprises.

The answer is that we have to look for robust patterns and one way of doing this is to employ the process known as Foresight.

Technology Foresight is the *process* involved in systematically attempting to look into the longer-term future of science, technology, the economy, environment and society with the aim of identifying the areas of strategic research and the emerging generic technologies likely to yield the greatest economic and social benefits. Foresight is NOT the same as forecasting; it is a process not a technique. Foresight does not attempt to predict, but rather seeks to shape or create the future by integrating science and technology information within the broader context of government and business knowledge management.

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Drivers and Trends Identified at the Workshop

Workshop participants engaged in an exercise to populate a series of templates allowing them to engage in a discussion of drivers and trends using a variety of lenses. The following is a digest of potential drivers and trends identified by participants as significant for Canada from a public security perspective in the period leading up to 2020. (Note that this is not intended to be definitive, rather it is a reflection of preliminary thinking by the group during a time-limited demonstration exercise).

Lens	Strategic Drivers and Trends
<i>World Economy & Demographics</i>	<ul style="list-style-type: none"> - New primary energy source - New patterns of trade and production - South to north migration - Uneven distribution of wealth
<i>Geopolitics and Environment</i>	<ul style="list-style-type: none"> - Aging population in developed world, shift to India, China - Rise of Asia - Competition over energy and water - Threat to capitalism
<i>Social and Cultural</i>	<ul style="list-style-type: none"> - New institutions: borderless states - New sources of conflict - Pandemics
<i>Technology</i>	<ul style="list-style-type: none"> - Human Rights vs. surveillance - Cluster #5 (ICT) shifts to cluster #6 (nano- & bio-tech) - Cyborgs - Genetic manipulation

Public Security Analysis

Identification of trends and public security issues for Canada was an additional analytical component of the same workshop exercise. A sampling of this analysis from the completed templates identified the potential threats, risks and vulnerabilities listed below.

Sampling of Public Security Analysis Potential Threats, Risks and Vulnerabilities
Canada becomes technologically reliant on another country (e.g. USA)
We have not developed defence capability against the full range of threats
Limited international collaboration
Physical separation/geography does not protect us anymore
Government infrastructure is more vulnerable than that of private sector
Environmental refugees
Common global language could change to Chinese
We are not culturally educated enough for the 'global world'

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Global warming leads to 'inevitable surprise' as diseases spread to newly warmed zones
Lack of 'surge capacity' to respond to threats
Over-harvesting of renewable resources
Need for a Arctic strategy (opening of North-West Passage)
Permafrost melts
Interoperability of command control in an all-hazards environment
Availability of weapons (information) on the internet
Human performance enhancement
Mobilized moral outrage - tipping point reached by disenfranchised youth

Q2. What are the likely *risks* (human-made and natural threats/hazards and vulnerabilities) related to borders, infrastructure, and public security and safety more generally that will characterize 2015?

The workshop identified, explored and populated a number of scenarios, which are highlighted in the following. While some elements of the scenarios overemphasize one driver or another, such scenarios and the combination of them were discussed as plausible.

Super-Asymmetric

In 2020, individuals and small groups have acquired powers that used to be the sole reserve of nations. Satellite surveillance, genetic testing, biometrics and unbreakable codes--all are becoming either free or extremely cheap. Everybody knows how to build an atomic bomb; at the same time, everybody has instant access to live feeds from phone-cams anywhere in the world. The capacity for action of individuals and small groups is hyper-amplified. In the case of natural and other disasters, aid efforts are now organized literally overnight by small bands of widely scattered people working in concert, for free. Tyrannical governments can be toppled by a few judicious pictures appearing on the web. At the same time terrorists have more and better tools than ever before. But the question is, which is bigger: the opportunity, or the danger?

Green World

Recognize reality or die. Climate change has hit with a vengeance and a new category of war, 'ecological war' has been recognized by the U.N. States that pump too much carbon dioxide into the atmosphere are considered to be attacking their neighbours. Across most of the West green tech has become the single biggest economic growth area, and a combination of Wind, Wave and Solar power is overtaking oil as the world's main source of energy. By contrast, the economies, and politics, of the traditional oil-exporting countries have undergone a shock and are trying to adjust. Countries with significant 'green' assets have it good;

those without teeter on the edge of collapse. With huge green assets, Canada is well-placed to prosper--but how do we secure those assets?

Bi-Polarity Reborn

In 2020, it is a time of unexpected events and difficult-to-trace villains. The world in general, and the US in particular, seems set to continue into a third decade of prosperous, information-driven economy. But the world is also continuing along the road to complexity, with additional new structures of influence throughout the globe. The Newtonian diplomatic and military calculus of the past 400 years, since nation states emerged at the end of the Middle Ages, seems to be giving way to a new age.

The global man-in-the-street endured the last century of 200 million deaths in war, dizzying and difficult technological change, and is listening ever more sympathetically to the Earth groan under the burden of pollution and extinction. Nearly all of the animals of Africa, many of the fish in the sea, and much of the wild areas of the globe are gone. At the global level there is a worrisome development: the Alliance of the Southern Constellation made up of South Africa, India, Indonesia, China and other pariahs to the Western social philosophy of individual liberty and human rights is emerging both legitimately - as a block of aligned nation states, and illegitimately - as a set of criminal cartels. Their grand strategy, or "great game" is to keep the world on the edge of chaos, and from that chaos, reap profit. The Alliance is in space, on the seas, in the media and financial institutions and worming its way into the hearts and minds of individuals, smothering hope for personal liberty. The US, its four English speaking cousins (Canada being one), Japan and a newly unified Korea have united to resist this evil empire.

Cognitive "Human Genome Project" – Neuropsychology (Np)

It only takes one major player to decide to unravel the mysteries of human nature using the new science of neuropsychology, and everyone will be doing it. What if, by 2020, we know *exactly* what makes people tick? The fact that a hard science of human behaviour has never existed before should not blind us to the possibility that it could, and soon. What would be the security implications of a world where governments and organizations know exactly what motivates people and groups, and what influences will be successful?

Global Math: IS=UC

In 2020, Shanghai became the first member of the United Cities (UC) to publicly thumb its nose at the United Nations. The latter's increasingly hollow authority and capacity had long been an unfortunate, and costly, feature of the International System (IS). The signing of the Charter of UC (CoUC) by 50 cities of more than 10 million citizens was in part a response to that feature. More importantly, the CoUC recognized two facts. One was that decades of intensifying urbanization had moved the centre of gravity of social, economic,

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commercial, security and political threats and opportunities from the state to the city. The other fact was that the state – by design or default, either did not meet the needs and wishes of its cities – particularly the largest cities, or met them too late in the eyes of citizens.

The UC, operating from a virtual HQ under a Board of Directors, grew quickly to the 71 it is today. There are 24 applications under consideration. Its first order of UC business is to develop a code of practice for each of security, public safety, human mobility, infrastructure and, most challenging; city-state relations. Not surprisingly, the history of Greek and Roman city-states is being reviewed, as are the experiences of city-states of more recent empires, and ones that exist today; e.g., Singapore.

Canada finds itself in an uncomfortable situation. Long famous in its own eyes for “belonging to more multilateral organizations than any other state”, it finds itself without the means to even apply for what is clearly the key multilateral organization of the day and the future.

Q3. What new or enhanced capabilities in emergency management and national security will be needed for mitigation, preparedness, response and recovery to reduce risks?

Most workshop participants agreed that Canada will face major security issues (threats or events) in the next 15 years. So the question is no longer “if”, but “what” and “when”. Given the emergence of new types of security threats and risks, Canada needs to shift gears to a new “security paradigm”. Many workshop participants agreed that the governments may not be able to effectively protect the citizens and such in the new security paradigm the government must enable its citizens to protect themselves either individually or ad hoc groups (wiki security).

A New Security Paradigm Needed

A new security paradigm is emerging in which there is substantially increasing focus on the security of the individual. Historically safety and security have been principally a concern of the state and almost the sole focus has been the protection of the state and its public. State law enforcement has been more concerned with maintaining law and order than with the security of individuals and only the medical profession has focused on the health

New Security Paradigm
- Focus on the individual

- Description
 - Focus on individual security in addition to state-to-state
 - State to State security view no longer sufficient
 - Individuals have competing loyalties – families, friends, employers, religions,
 - Culture defines framework of personal security need
 - US security priority is political, Canadian is economic
 - Power is moving to individuals, small groups and corporations
 - New view of “intelligence” in context of individual security

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aspects of individual safety and security. In the new paradigm, there is a growing issue of individual security and the governmental role in providing this. State law enforcement is increasingly being called upon to sustain individual rights and freedoms and to intercede when such individual and group rights and freedoms are in conflict with those of the greater community. Furthermore, the medical profession is increasingly involved in global environmental and health issues and their impact on individual safety and security.

The introduction of individual safety and security requires the examination of personal loyalties. These include sometimes conflicting loyalties to the family, to various communities, to religions, to countries. An understanding of cultures that encompass the framework of these intersecting and conflicting loyalties is becoming a critical part of the safety and security needs for the future. The Workshop participants noted that the principal difference between the Canadian and US safety and security

priorities are heavily influenced by the Canadian economic concerns against the US political issues. In the US, their status as the global power is already being seen as under threat from the rapidly emerging strength of China while they simultaneously fear terrorism that is both organized but operates with apparent autonomy. Meanwhile, Canada's primary concern is centered on economic issues, especially

personal economic security and health safety. With such fundamental differences in safety and security priorities, solving transnational safety and security issues will likely continue to be difficult as neither side sees the other taking more than a passing interest in the top priority issues of the other.

In the Canadian modern and post-modern cultural framework, power is moving toward the individual, special interest groups and the economic priorities of corporations that must compete in a global context. Within this cultural framework, S&T policy needs to respond to the inevitably competing loyalties of individuals and the primarily international dimensions of Canadian business rather than the politically driven national security priorities of the USA.

In this new individual security paradigm, individual identity security plays a significant role. The workshop participants perceived that there was an increasing willingness in Canada for data and intelligence abstraction from such data to be relatively openly shared providing the identity and security of the individual is fully protected. As a result individual ID security becomes an enabler in the context of intelligence. This applies equally well to intelligence as

New Security Paradigm
- Focus on the individual

- ◆ Relevance
 - Individual ID security is an enabler to sharing data and intelligence
 - Health security a high individual priority
 - Environmental security a growing public concern
 - Emergency response - individual as the focus
- ◆ Key Changes
 - Environmental v Economic v National citizenship
 - Continental, trading block, national, provincial, local, cyber community powers and relationships
 - Cultural change and adaptation, new change agents
 - Migration with cultural baggage

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seen by Canadian national intelligence, counter-terrorism and law enforcement agencies and to does to health-care, environmental, ecological, cultural and social agencies. Individual access to health-care as well as the health-care system's ability to respond to any form of health emergency is a high individual priority.

Individual and community safety and security priorities are also reflected in the Canadian environmental and ecological debates. There is an equalizing trend between economic safety and security and environmental and ecological safety. As individual safety and security policy assumes dominance, this equalizing trend is expected to continue.

The new individual security paradigm is also highly relevant to the emergency response capacity and capability. Emergency response in the Canadian context needs to be targeted to the individual. The workshop participants identified a requirement within Canada to make individuals more aware and more responsible for their immediate personal safety and security in the instance of a major emergency event. Due to the relative sparsity of population and the limited distribution of emergency response resources, the response time in the Canadian situation will necessarily be longer than in almost all other developed countries. Self-reliance must therefore become the norm for Canadians.

The implications of this new security paradigm are:

- The inclusion of environmental and a strengthening of economic safety and security needs as strategic priorities along with those of national citizenship requirements
- The changing dynamics of community and culture as realignments between powers of continental, trading block, national, provincial, local, and other communities such as those enabled by cyberspace, occur
- Rapid cultural change and adaptation in an increasingly volatile economic, environmental, and political power structure driven by new change agents.
- New Canadians are increasingly retaining substantial cultural "baggage". This will make safety and security planning more complex as community priorities and issues diversify and cultural responses and sensitivities to policies and response solutions have to consider the broader dynamics of retained cultural norms and sensitivities

New Security Paradigm

- Focus on the individual

- ◆ Discontinuities
 - Environmental catastrophe – environmental refugees
 - Global pandemic
 - Terrorist / State use of WMD
 - Religious extremism (all religions)
- ◆ Vulnerabilities
 - Individual security trumps collective security
 - International dependency – economic, military, political
 - Socially too open for China – economic implications
 - Governing framework incoherence
 - Global insignificance
 - Sparse infrastructure

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Discontinuities that occur within an individual focused security paradigm may arise as a result of any significant global environmental catastrophe, which results in an environmental refugee emergency. Few countries are politically prepared for significant environmental refugee challenges and it is clear that the traditional policies that manage political, civil war, and economic refugee situations are generally not suited to environmental disasters.

A second discontinuity could be a global pandemic (see the next section).

The third discontinuity that would impact the new individually oriented security paradigm is terrorist or state use of weapons of mass destruction on any western democracy. Any substantial increase in risk to Canada as a nation would likely reverse progress toward an individual security paradigm as individual security can only flourish when the global threat to society is perceived as limited and small.

The growth of religious extremism both external to North America, such as Muslim fundamentalism, as well as internal will likely polarize society and reverse or at least delay the political will to implement further moves to address the issues of individual safety and security.

There are a variety of vulnerabilities that an individual safety and security paradigm change would engender from the inability to sustain an effective collective security focus, leaving the broader community exposed to unforeseen external threats and to the loss of response capacity to such threats. Canada has not invested heavily in its military capacity over several decades and, while it has met its responsibilities in international peacekeeping, it is not equipped to undertake a military conflict that threatens its own borders. Recent voyages by foreign vessels through the Northwest Passage and military exercises in the North have shown a very limited capacity to exercise true sovereignty in the far North.

As focus on individual safety and security take priority, safety and security becomes more amenable to commercial solutions and could lead to an increasing reliance on international commercial sources. Such a response would leave Canada dependent on foreign solutions. This would increase the country's exposure economically, militarily and politically.

The cultural and political differences between Canada as an open individually oriented post-modern society and China as a communist controlled capitalist society, might result in Canada being seen as an untrustworthy partner with what will be come the world's largest economy. Coupled to our close economic and cultural ties to the USA, Canada may find it very hard to chart a course that will permit open economic partnership with both China and the USA simultaneously.

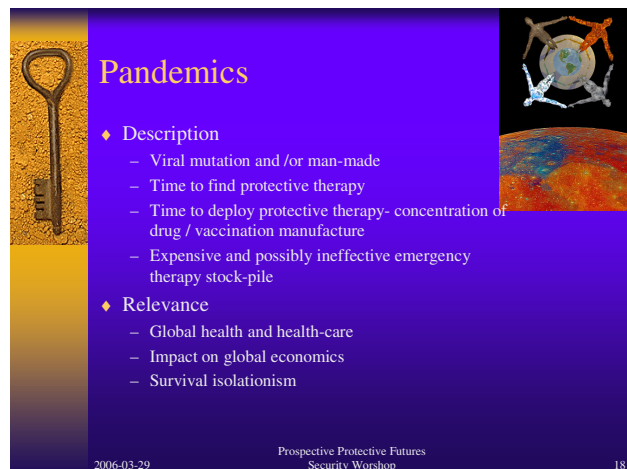
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With substantial cultural priority differences with both our major potential economic partners, Canada might develop an incoherent policy framework, resulting in a lack of direction as the Governments oscillates between two opposing strategies. Both the USA and China may be able to use such a situation to secure control over the very considerable natural resource wealth that Canada possesses, effectively denying Canada sovereignty over these resources.

Canada is already a minor player in global politics and, with the emergence of China and India, this is likely to diminish further. This situation could be exacerbated by Canadian adoption of an individual safety and security model, one, which is perceived by other nations as weakening Canadian ability to support national and international security initiatives.

Pandemics

The characteristic of pandemics are well known and may result from a natural mutation or even from a man-made mutation of a known “killer” virus or from a mutation of a virus that could be originally relatively benign. With the mobility of people around the world, an infection can spread with alarming speed as SARS demonstrated. While the pharma industry has been seeking methods to accelerate the detection of such



Pandemics

- ◆ Description
 - Viral mutation and /or man-made
 - Time to find protective therapy
 - Time to deploy protective therapy- concentration of drug / vaccination manufacture
 - Expensive and possibly ineffective emergency therapy stock-pile
- ◆ Relevance
 - Global health and health-care
 - Impact on global economies
 - Survival isolationism

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viruses and to develop protective therapies, these therapies take time to develop and even longer to place into high volume production and distribution. This situation is exacerbated by the highly concentrated structure of the manufacturing industry. Even if supplies can be ramped up to counter a pandemic outbreak, the transportation, distribution and medical capacity to treat and immunize people may be severely stressed or even undergoing a collapse as a result of the spread of the disease, with an even greater loss of life than would otherwise have been the case. In addition, any private sector developed therapy will become controlled and protected Intellectual Property. As medical jurisdiction lies with the Provinces, both the Federal and Provincial governments must develop the appropriate policies and laws that enable their agencies to respond effectively under such situations.

The consequence of a global pandemic may have an enormous impact on global health and the entire health-care system. With health-care professionals being the front line of the defence against a global pandemic, any systematic failure of established infection control procedures would result in the loss of primary caregivers and of those able to provide the best diagnosis and treatment. At time

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the reactions of Governments and the public would be likely to interfere heavily with the global economy, as the movement of people, goods and services are brought to a standstill. The second phase of economic impact would come from the loss of life and the consequent loss of jobs, skill and management. Africa is facing such discontinuities as a result of the AIDS epidemic, but a viral pandemic would result in a similar or even greater impact occurring within months rather than years. The scale of this impact is hard to estimate, as it is so dependent on the segment of the population most effected, the level of infection and survival, and the speed of infection, and the development and delivery of treatments and vaccines. It may also be further complicated by secondary mutations, which may change the fundamental profiles and treatments of the original outbreak.

One of the more troubling scenarios of the response options is the possibility of communities attempting to isolate themselves firstly to try to prevent the on-set of the pandemic and, if this is unsuccessful, a further isolation in the hope that the outbreak can be contained within the infected community. Not only could such reactions result in food shortages, access to medical treatment but could also result in the breakdown of law and order, and for all Government processes and services.

While the emergency preparedness organizations have established the best available plans to handle pandemics as well as possible, discontinuities in addition to most pandemic scenarios also need to be considered such as:

- The failure of existing drug therapies, particularly antibiotics,
- Fast and unanticipated mutations to even more lethal strains with increase virulence
- Social instability brought on by the loss of authority, services and the necessities of life
- Failure of the global supply chain and the resulting economic collapse
- Age or gender imbalance.

Pandemics

- ◆ Discontinuities
 - Failure of drug therapies – antibiotics
 - Unanticipated /fast mutation – increasing virulence
 - Pandemic induced societal instability
 - Supply chain failure
 - Gender/age imbalance
- ◆ Vulnerabilities
 - Climate change
 - Medical / food supply chain failure
 - Disproportional loss of medical capacity
 - Long incubation period

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All such discontinuities are possible and several may occur in any single pandemic. In the more extreme scenarios, the social and economic consequences are almost unimaginable.

In addition to such discontinuities, there are wide arrays of vulnerabilities. These include:

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- The impact of climate change that may cause a substantial change in the disease profile affecting the populations of countries that have not historically been exposed to such diseases and to the virulence of such diseases.
- The failure of supply chains as a result of other political, social, economic or environmental factors, which weaken the resistance of communities to viral pandemics.
- In the event of late detection or prolonged incubation, the front line medical profession could be disproportionately impacted, substantially reducing the capacity to treat the pandemic in the wider community.

The possibility of more than one vulnerability occurring would have a multiplying impact on the severity of any outbreak. For example, the failure of the supply chain of surgical masks, surgical gloves and disinfectants, would have a massive impact on the ability of the front-line medical professionals to treat both the pandemic itself, and to sustain treatment for other medical problems. Furthermore, it would eliminate many of the protection processes that are used by the front-line medical professionals to prevent their own infection.

Some of the emerging changes that may impact the future abilities to manage a pandemic are: the degree to which the media has been able to capture and raise the level of fear in the wider public: the panic response that will precede the actual spread of the disease; the existence of existing increasingly antibiotic-resistant viral strains; and the cultural differences this will effect the societal responses of the public.

Pandemics

- ◆ Key Emerging Changes
 - Media induced fear precedes reality
 - Panic and panic responses precede disease
 - Antibiotic resistant strains
 - Culturally influenced and other societal response v. planned response protocols

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The media coverage of the SARS outbreak and of the prospects for a human-to-human communicable form of avian flu have set in place a pre-existing fear of such a mutation happening. In the event of such a mutation happening, regardless of the degree of virulence of the resulting virus, the possibility of widespread panic exists. Even without the mutation occurring, governments have been forced to take action to stock-pile potentially ineffective drug therapies and these drugs have had to be removed from circulation except through exacting medical procedures to prevent stock-piling by the public.

These vulnerabilities are generally well recognized but the solutions to mitigate the impacts in the more extreme scenarios are very complex as the levels of uncertainty are high and the range of possible discontinuities and vulnerabilities are enormous.

Cyber Security

Cyber systems have become an essential service for the functioning of the global economy, the provision of healthcare, the general public's access to government and other services, and to education. Service guarantees are required 24 hours a day, 365 days a year. The network will be the backbone of the emerging sensor networks increasing society's reliance on the cyber network even more.

However, network infrastructure is owned and managed by a wide array of organizations. Many are commercial, but governments, armed forces, police, security agencies, NGO's and others are also network and sub-network owners. Not only is the physical network difficult to secure because of its diversity and distributed ownership, but also the traffic passing through it is also pretty open to subversives. This situation is compounded when wireless network infrastructure is used.

Cyber Security

- ◆ Description
 - Network
 - Global reach, ubiquitous 24/365
 - Sensor supporting
 - Economic and social system underpinning
 - Security
 - Generally weak, information easy to intercept transparently
 - Wireless generally very insecure
 - Poorly protected infrastructure
 - Threats from terrorists, criminal, hackers, accidents, natural disasters

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In the globally networked world of today, the cyber network is one of the principal underpinnings of our economic and social structures. While individual elements of the network are quite vulnerable, impacts tend to be limited. On the other hand the ability to acquire commercially, politically, and defensively sensitive information, to defraud individuals and organizations, to acquire and fraudulently use personal and private information, is a continual and growing threat. However from a national security perspective, this intrinsic weakness has and continues to be used very effectively as a means of gathering intelligence for national security purposes.

In general, physical damage tends to have relatively local impact only. Substantial capacity in alternate routes is available to route traffic around faults and damage that may occur and except where facilities concentrate at major network hubs, network damage is more of an inconvenience than a disaster. On the other hand, major attacks on traffic are more difficult to contain. Rapidly spreading viruses, worms and spyware represent major threats to cyberspace but many of the attacks have been by young / rogue technophiles, whose intent appears to have been to demonstrate weaknesses rather than to attempt to wreak havoc. However, network operators, safety and security organizations and those that run mission critical applications cannot assume that this will continue.

Cyber Network discontinuities may result from activities such as the implementation of new Operating Systems with radically superior security capabilities and fewer intrinsic weaknesses.

One of the major opportunities is the introduction of Quantum Cryptography. Currently a few operators are using quantum cryptography to manage the distribution of conventional cryptographic keys. The advantage of quantum cryptography is that anyone intercepting the message that contains the key alters the quantum state and thus the interception can be detected. If a quantum protected key distribution message is intercepted, the key is discarded and so the interception is ineffective. Current cryptographic keys of sufficient length are effectively unbreakable with the deployment of any reasonable level of resource in any practical time.



Cyber Security

- ◆ Discontinuities
 - Replacement of O/S with increased security
 - Quantum Cryptography
 - Quantum Computing
 - Ubiquitous sensors & smart dust
 - Ultra low cost terminal (network embedded applications)
- ◆ Vulnerabilities
 - Minimal government investment in networks and network security
 - Multi-level attack exposure
 - Multi-owners
 - Risk not visible / understood by general users
 - IP address limitations

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The introduction of Quantum Computing (probably in the 2015 to 2020 timeframe) will change the methods available to solve the current cryptographic approaches. A relatively small quantum computer will be able to break cryptographic keys of any reasonable length and thus open all network traffic to clear observability. However, even quantum computers cannot overcome the natural phenomenon on which quantum cryptography is based – detection of interception. Quantum computing will allow the power and speed of computers to continue to progress and “Moore’s Law” will likely continue with atomic and sub-atomic devices being possible.

Protection of Resources

A wide range of natural resources are already subject to a rate of global depletion that is clearly unsustainable. The most obvious of these is oil and natural gas. Many hundreds of thousands of years of natural processes have been exploited in less than one hundred year and are likely to become depleted in less than another human lifetime. While this is the most



Protection of Resources

- ◆ Description
 - Continual consumption growth of developed economies
 - Exponential consumption growth in emerging new hyper-powers
 - Unsustainability environmentally, economically, socially
 - Wealthy / strong win, others lose
- ◆ Discontinuities
 - Reengineer economic theories –quality of life improvement with reducing consumption

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notable example of unsustainable over-consumption, there are many others where consumption is outstripping supply and there is a growing investment by the largest users to acquire as much of the future supply sources as possible.

The projections of the longevity of supply for these strategic resources may well be substantially shortened by the unprecedented growth of China and India. Representing almost 30% of the global population, the successful development of a wealthy and consumption-based economy will further accelerate the consumption of strategic natural resources.

Not only are the resources themselves undergoing excessive rates of depletion but the environmental impact of their consumption, whether through a build up of air, land, fresh water or seawater pollution, is also unsustainable.

In the quest for supply security, nations, global corporations and resource speculators are in a race to secure the largest possible inventories of the most readily exploitable sources of strategic natural resources. This race is likely to continue. As sovereignty and control over resources become critical economic control factors, only those with the strength to ensure their sovereignty and control will have the capability to prevent the decimation of such strategic resources. The wealthy will win at the expense of the poor and eventually the militarily powerful may use such power to secure critical supply sources.

One of the more volatile commodities in any future scenario is the supply of fresh water. As climate change alters rainfall patterns, and economic activity draws ever more heavily on global sources of natural fresh water, the possibility of agricultural failure and desertification and the viability of cities all become part of the safety and security equation.

While the suppliers and users of strategic natural resources, search for solutions to the challenges of over-consumption, there is a social / cultural discontinuity which may significantly ameliorate the challenge – a change to the global economic model in which the quality of life, rather than the global economy, can be increased continuously while the consumption of strategic resources is substantially reduced. While such a new global economic model has not been accepted, the population demographic of many developed countries will encourage such development and acceptance as shrinking populations undermine conventional models of continual growth.

Sensor Networks

Nano- and Bio-sensors will likely become viable in the next 10 years. These may be as small as sand or dust and have sufficient intelligence to gather data and feed this into sensor networks. Self-forming and self-healing sensor networks will create new opportunities of information and intelligence gathering. The scope of these opportunities are only just being conceived but our abilities to understand what is happening from within the human body to the management of trans-border trade flows and from the tracking of terrorists and criminals to the surveillance of medical patients during recovery and rehabilitation will be truly transformative.

The potential for the explosive growth of sensor networks is a technology-enabled opportunity. The broad range of sensors is growing rapidly, and the development of self-organizing wireless networks is allowing flexible and fast deployment to become practical. With the introduction of nano-sensors, this capability will continue to grow as commercial, security, surveillance, and other applications are implemented. As with bar-coding and Radio Frequency Identification (RFID), global deployment of identification information networks for asset tracking, warrantee validation, theft detection etc will occur for

Sensor-networks for Surveillance

- ◆ Description
 - Broad measurement / observation capability
 - Embedded, distributed and mobile
 - Deployable, scaleable, networked
- ◆ Relevance
 - Fast alert / awareness
 - Evidence based intelligence
 - Sovereignty over Canada's north
- ◆ Anticipated Key Changes
 - Satellite imaging real-time, multi-spectral, accessible
 - RFID: things → animals → people

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commercial reasons. With the addition of all types of sensors, particularly nano-sensors, which will have exponentially increasing “intelligence” over time, a composite series of sensor networks will become deployable and scaleable and capable of providing extensive information based on the combined data from all the deployed sensors.

The deployment of sensors networks in Canada’s north will give accurate information about on-shore and offshore activity providing proof of sovereignty and the ability to counter attempts to weaken or contest Canadian control, especially over the North-West Passage.

Anticipated technological changes will permit much more effective use of satellite technologies as much wider spectral imaging with much higher resolution becomes possible. It is anticipated that RFID technologies will migrate from objects to animal and eventually to people. The benefits of secure ID which can be read at a distance and will be able to monitor health, stress and exercise as well as providing secure financial authorization, license and health-care validation, bio-metrics and other personal information such as electronic passports will have significant advantages over the multiplicity of low security

solutions in place today. The security of such systems not only in the implantable device but also in the upstream network and information processing will be critical to their acceptance.

One of the more critical discontinuities for sensor networks to be broadly deployed and useful over extensive periods will be the powering solution. Even with low power, secure self-organizing networks, will have limited use if functionality is lost as the sensors fail due to power loss. It should be noted that solar or bio-power solutions might provide the solution to this discontinuity.



Sensor-networks for Surveillance

- ◆ Discontinuities
 - Powering solutions
 - Convergent bio/nano sensors
 - Catastrophic event occurrence
- ◆ Vulnerabilities
 - Foreign control of key network / infrastructure
 - Canadian Charter of Rights and Freedoms
 - Infrastructural attack / intelligence acquisition attack
 - Core skills and training

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The convergence of bio- and nano-technologies has the potential of accelerating the functionality and deployment of sensor networks by expanding their utility and security substantially. There is also the distinct possibility that a catastrophic event could create the political will and the public acceptance to accelerate the implementation of human ID device networks. Safety and security capability would be enhanced substantially providing the necessary protect of personal privacy can be assured.

There are a range of vulnerabilities ranging from concern over foreign control if Canadian sensor networks and the network infrastructure are owned and controlled by foreign governments corporations or individuals, to the guarantees and protections in the Canadian Charter of Rights and Freedoms. Networks that provide so much data and intelligence about all aspects of our world and carry so much personal information will be highly vulnerable unless extensive precautions are taken. Engineering such security will be extremely challenging.

A further vulnerability anticipated by the Workshop participants is the skill and knowledge within Canada to deploy and manage advanced sensor networks. With the Canadian population sustained only with the implementation of immigration strategies, the shortage of trusted indigenous skills may increase deployment risk such that insufficient public and political confidence can be generated. Deployment of any systems that have a capability significantly above that of evolving commercial systems may be inhibited as a result.

Q4. How can current and foreseeable advances in science and technology help?

World Security S&T Cycle

The conventional view of the cycle of influencer of world security takes as its base the status of the World's security environment. As is shown in figure 1, based on the perceived security position in the world at any point of time, the safety and security risk is assessed and prioritized, and current and developing capabilities are set against these risks to identify S&T shortcomings. As such S&T capability is developed both in Canada and around the world, this changes the World security environment and produces a change to the risk and capability.

This is a very simplistic but easily understood model of the interaction. However, the reality is considerably more complex. Not only does each part of the process feedback to the preceding process step but it also cross-feeds to all of the other process steps as seen in Figure 2. As such any new technology advance that we develop, even if it is meant to counter security issues, eventually may create its own new security risks.



Fig 1



Fig 2



Fig 3

Furthermore the value of this understanding of the interactions is not as a static picture at a specific time but the greatest understanding is deduced

from the rates of change - and not only should the rate of change be the true “vector” of the determination of our safety and security, but the model should include a range of discontinuities. These will include the discontinuities of risk, capability and science, but also must consider all other discontinuities that derive from political, social, religious and cultural changes. It is this dynamic feedback model that Foresight attempts to capture and from which it creates a framework for the development of policy and S&T priorities.

The Dynamics of Global S&T Change

One of the greatest change factors in S&T is the rapid emergence of China and the possible emergence of India as the future leaders of S&T globally. Historically almost all safety and security models have been built on a

static view of the global leadership of S&T by the USA, together with their global military, economic and political leadership. With the massive populations of China and India, their high quality of education and their emerging economic power, their global S&T leadership becomes much more than a possibility. Current projections developed from global S&T statistics produced by the National Science Board of the USA, show that a reasonable projection of Chinese S&T investment is of the order of \$1T (US) by 2020, representing a level close that of the rest of the world combined. Whether China can sustain such a rapid rate of growth for such an extended period is a major uncertainty. However, there is a strong indication that China will surpass the US as the leading S&T country in this timeframe.

These projections not only project the relative scale of S&T by the major global players, but they also portray a convincing argument that the rate of S&T discovery and



Fig 4

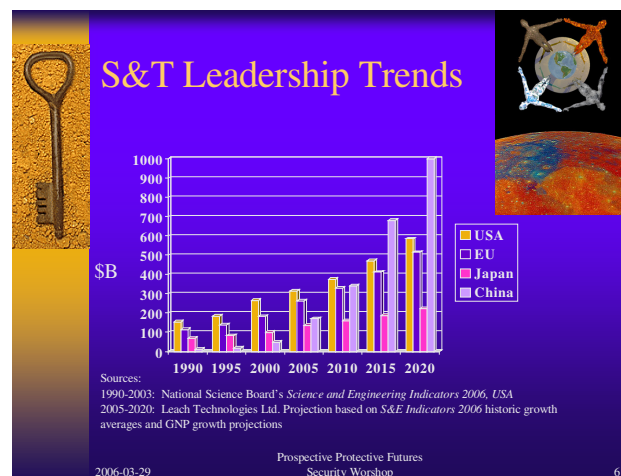


Fig 5

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exploitation will accelerate, not only due to the level of investment anticipated but because of increasing competition within the global research community. With existing economic and political alliances (EU, NAFTA, etc), it would appear that these alliances may rapidly become scientific and technological alliance as well (where they are not already). Transnational S&T collaboration is likely to become prevalent as a means of mounting a competitive response to the surging Chinese threat. One of the key questions for Canada is to determine what alliances may provide the best opportunity in the face of a rising “Hyper-power”.

This change in global power, influence and economic leadership is also being fueled by the largest innovation surge in history. As discussed in the ***Strategic Environmental Scan Report*** of the Prospective Protective Futures Security Workshop, the 5th Innovation cycle is one in which more change drivers are in play than any other Innovation Cycles in recorded history. While such cycles have historically involved Technological, Economic and Social dimensions, the 5th Cycle involves Environmental, Cultural and global Demographic change as well. These additional factors result in more uncertainty, more instability, and greater challenges than those faced by society in any previous cycles. As a result, we need better and more robust tools that have the ability to examine opportunities and threats that lie further from our historic “comfort zone”. Not only does this require new paradigms for strategic planning, but it also requires the policies and priorities to be viewed through multiple “lenses”. Solutions that may appear viable, say from a technological and economic perspective, may be unacceptable when seen through cultural, environmental and social lenses. One of the few tools that have been used effectively to gain such insights is ***Foresight***.

Specific S&T areas that are identified are as follows:

- Information Networks
- Bio-Science
- Quantum Science
- Neuro- Science
- Nano-technologies and structures
- Cognition Systems
- Energy
- Transportation
- The Science of Cultural Change

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Information Networks

Key Emerging Changes:

- Sensors for all forms of surveillance: environmental, ecological, weather, structures, transportation, intelligence, asset management, health, weapons management, etc.
- Sensor networking; high scalability, embedded analysis and maintenance
- Evolution /revolution of ID technologies: biometric, personal, commercial systems, border management, asset and personnel tracking, health management
- Smart network agents: locate and recover data, network embedded processing, J-I-T reporting.
- Evolutionary computational speed and power

Safety and Security Issues:

- Global massive multi-application commercial, health and security networks of constantly improving sensors transform surveillance opportunities.
- Scope of monitoring and analysis capabilities can revolutionize intelligence and other S&S information
- Smart agents with the ability to threaten cyber-networks and other critical infrastructure; deliberate viral and other networks attacks
- Dependency on foreign supply of tools, programs and network infrastructure
- Network security and secure O/S to thwart cyber-attacks.
- EMP susceptibility
- Hacking as a sport and as a security attack
- Uninformed public concern

Biosciences

Key Emerging Changes:

- Genetic crop/plan modification for arid agriculture/silver culture
- Algal, agriculture, aquaculture and silver culture biomass conversion for energy
- Waste management and recovery
- Desktop genetic engineering
- Exploding bio-hazard risks and bio-remediation solutions
- Bio-sensors for personal health
- Human bio-engineering
- Multi-faceted bio-science response to GHG management and environmental change

Safety and Security Issues:

- Perception and real risks of genetically-modified or synthetic organisms (especially from lab or desktop systems) that become uncontrollable
- Bio-extraction of materials that could be used subversively
- Psychological threat of small-scale bio-engineered weapons
- Poorly informed / low knowledge general public and media

Quantum Sciences

Key Emerging Changes:

- Quantum Cryptography
- Quantum Computing (first generation)
- Atomic-level teleportation
- Quantum engineering of materials for totally new performance attributes
- Unimagined modeling of complex systems and interactions

Safety and Security Issues:

- Unbreakable communications in the hands of subversives
- Unanticipated data mining and intelligence extraction capability
- China and India get quantum computing first
- China and India get quantum engineered material first

Neuro Sciences

Key Emerging Changes:

- Human organ reconstruction / synthesis
- Understanding of the operation of the brain (lower animals and subsequently humans) and the ability to influence/control it
- Computational pharmacology – desktop drug creation, simulation and synthesis
- Human attribute enhancement / damage or disability repair

Safety and Security Issues:

- Neural process modification and control
- Genetically engineered neuro-drug therapies/ capabilities on the desktop
- Sentience modification as a population destabilizer
- Public and expert trust / distrust in cogno-neuro R&D
- Emotion and motivation management capability

Nano-Technologies and Structures

Key Emerging Changes:

- Wide array of nano-tech engineered materials with customized / customizable properties
- New synthetic “designed” materials
- Nano- sensors: Driver of many/most future sensor solutions
- Nano-robots
- Next generation integrated ID solutions
- Ecosystem sensing and monitoring

Safety and Security Issues:

- EMP susceptibility of nano-electronics
- Raw material sources and scaling of commercial manufacturing processes
- Asian domination of commercial manufacturing

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- Lab scale manufacturing in the hand of subversives and criminals
- New Nano and/or Bio weapons technologies
- New modeling paradigms and capabilities

Cognition Systems

Key Emerging Changes:

- Behavioral Psychology (and Neuro-Psychology) providing emotion, behaviour and motivation control / management.
- Insect and “drone” control/performance enhancement

Safety and Security Issues:

- Imprecise science
- Very young science
- Seen as contrary to public interest
- Fear of “State / authoritarian” control
- Technology in the hands of subversives and dictators

Energy

Key Emerging Changes:

- Increasing diversity of generation technologies – wind, wave, solar, biomass, hydrogen
- Global energy shortage v surge in demand (2nd world)
- Global concern over climate change and change factors, esp GHG’s
- Mini- and micro-nuclear powerplants
- Commercial hydrogen production and transportation
- Politics of energy and challenges to ownership
- Wild-card: Cold fusion

Safety and Security Issues:

- Internet-enabled electrical grid control network vulnerability
- Intelligent software-agent attack on control network
- Control network hardening
- Safety engineering of mini- and micro-nuclear power generation systems
- Physical safety of distributed mini and micro-nuclear generation systems – nuclear waste management
- Overall energy effectiveness of biomass and hydrogen energy solutions

Transportation

Key Emerging Changes:

- Environmental impact reduction
- Hydrogen powered vehicles
- Increasing use of non-recyclable / hard-to-recycle materials
- RFID tracking of movement of any assets
- Automated highway vehicle guidance and routing systems

Safety and Security Issues:

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- Safety of vehicular hydrogen source and refilling systems
- Waste management of non-recyclable / hard-to-recycle vehicle components esp battery materials
- Subversive / criminal tracking of hazardous materials transportation
- Security of automated highway vehicle guidance and routing systems
- Transportation collapse in global pandemic

Science of Cultural Change

Key Emerging Changes:

- Science in its infancy
- Social and political implications of impact mitigation strategies, e.g. Neuro-psychology for attitudinal manipulation
- Continuing/growing population migration driven by economics – intra-state, international and intercontinental
- Rapidly growing economic disparity

Safety and Security Issues:

- Organizational capacity of networked youth / poor / subversives
- Capacity of dissatisfied groups to disrupt and protest “instantly”
- Asymmetric value of life
- Intelligence / surveillance of cultural, religious, subversive, criminal and other radical sub-communities
- Dynamics of religion and political manipulation of religion
- Stresses within multi-cultural communities
- Communications in an environment of multi-cultural, multi-ethnic, multi-religious frameworks
- Neuro-psychological manipulation / control of humans

5 Next Steps

The Workshop's proceedings themselves are expected to be of immediate interest to PSPEC and a number of PSEPC's partners in the public-safety and national-security community. Their main value for PSTP will largely be as an intermediate product.

The co-leads on Vision 2015, PSEPC's Shane Roberts and DRDC's Dave McKellar, in consultation with colleagues and their respective superiors, will assess how to use the proceedings to drive the next phase of interdepartmental discussions of challenges to PSEPC, the capabilities needed to meet the challenges, and how S&T could help us to acquire those capabilities. The foresight work (the current and any future continuation) is part of a broader development strategy for the PSTP Vision 2015 and its eventual operational delivery.

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