DESIGNING CANADA'S ARMY OF TOMORROW

A LAND OPERATIONS 2021 PUBLICATION

ARMY ARMÉE Future

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FOREWORD

The crucible of violent conflict in which Canada's Army has operated over the past decade has seen it surpass all expectations of its ability and capacity to persevere, adapt and thrive. The complex and volatile situations encountered could scarcely have been imagined 10 to 15 years ago, yet our people demonstrated courage, tenacity and adaptability. Unfortunately, if global security trends persist, these current conflicts are indicators of our collective future in an increasingly volatile, uncertain and routinely dangerous global environment.

The world continues to be fraught with risks that directly challenge Canadian values, national interests and security. The Canadian Forces and the Army are needed to defend Canada, Canadians and Canadian interests in this future security environment. To remain an effective instrument of national power the Canadian Army must continue to innovate and adapt. *Land Operations 2021, Adaptive Dispersed Operations: The Force Employment Concept for Canada's Army of Tomorrow* provides the overarching framework for how the Army will successfully operate in the future operating environment. This new publication, *Designing Canada's Army of Tomorrow*, provides the key design philosophies, fundamentals, principles and characteristics upon which our Army of Tomorrow ought to be built.

This publication is my design guidance for building Canada's Army of Tomorrow. It shall guide the Army's capability development processes and activities for the foreseeable future. It is essential that the broad range of structures, equipment, doctrine and training introduced in the coming years remains aligned with this vision for Canada's Army of Tomorrow. Achievement of this goal requires determined leadership at all levels in order to guide the Army to this reality. It demands a disciplined approach to the capability development process, and an ability to develop and sustain an institutional culture of agility.

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We are already well on our way to creating the Army of Tomorrow, and I am confident that Canada's Army will continue to meet all future demands with the professionalism and excellence that the people of Canada have come to expect of their soldiers.

P. J. Devlin
LIEUTENANT-GENERAL
Commander Canadian Army

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INTRODUCTION

PURPOSE

Designing an Army to meet the uncertainties of the future is a challenging endeavour in which many competing considerations must be balanced. This publication aims to inform the design of the Army of Tomorrow by framing the situation, identifying trends and setting out the broad philosophies, fundamentals, principles and characteristics that are essential to build an effective and sustainable force. It provides guidance concerning the consideration of the most important factors in developing the force. Its intent is not to supplant current doctrine, terminology or capability development processes; rather, its purpose is to plainly state the essential considerations for shaping the development of Canada's Army of Tomorrow.

This document is organized into two main parts:

- a background section describes the context in which the Army of Tomorrow will be generated and employed. It includes a summary assessment of the future security and likely operating environments, the impact of expected advances in science and technology on capability development, some pertinent observations on the human dimension, a discussion of enduring and emerging operating concepts, and a brief description of the Army's capability development process; and

- the core section of the book focuses in on the key design philosophies, fundamentals, principles and characteristics of the Army of Tomorrow. Realistic parameters and expectations are set forth in an effort to describe the most important elements of operational capability and the most successful way of going about building the force necessary to meet the demands of the future operating environment. The three main components of the required capability—systems (vehicles, weapons and equipment), operating concepts (by various functions), and structures (force generation and force employment organizations and establishments)—are also spelled out in a broadly prescriptive manner. Some thoughts on how to continue

to extract the best possible results from the Army's capability development process draws the discussion to a close.

Designing Canada's Army of Tomorrow is aimed at a varied readership. Army leaders will find a useful synopsis of the most important aspects of future security environment analysis and the pressing concept and capability development issues facing the Army Foundation. Army capability development staff will receive a stronger appreciation and much clearer picture of the implications stemming from the adoption of *Land Operations 2021—Adaptive Dispersed Operations: The Force Employment Concept for Canada's Army of Tomorrow* as the Canadian Forces concept for land operations. There is an extra level of analysis and detail in the present book. The intent of this is to provide a balance of enough meaningful and enduring guidance to those involved in Army capability development without constraining future adaptability and agility of the process and staff in an inevitably changing strategic context. The Canadian Forces and partner nation capability development communities may find useful models due to the maturity of the Canadian Army capability development process and the rigour of the research involved in the process. For the more general military, government and public audience this publication will provide an accessible entry point into understanding the process that turns ideas into appropriate capabilities. Better decisions in the manner in which the Army manages its valuable resources are the expected results of this process.

DESIGN FOUNDATIONS

This document builds upon a considerable body of previous work. In particular, the background material in Part One draws on research done and publications issued by Directorate of Land Strategic Concepts, Directorate of Land Concepts and Designs, the Canadian Forces and Department of National Defence, and the American, British, Canadian, Australian and New Zealand Armies Program. A capability development glossary and a selection of useful resources is included at the end of Part Two.

An international expeditionary scenario, introduced in Army Experiment 9B, has been used in the analysis supporting this book to represent both the most likely and the most complex and demanding types of operations in which the Army is likely to be employed. The main purpose of the scenario is to present an environment within which concepts and designs can be evaluated, aligned and refined. Other scenarios representing other kinds of operations, including a domestic crisis and prolonged significant combat operations against an adversary with a large modern army, are used to measure risk.

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PART ONE

THE CONTEXT

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THE STRATEGIC CONTEXT

» The Canadian Forces is the military instrument of a sovereign power.
» The Army must conduct domestic and international operations effectively.
» The Army must make a meaningful contribution in a comprehensive approach to operations.

Canada's future security and prosperity requires a stable and predictable international system. "We must be active beyond our borders to protect and promote our values and our interests."[1] The Canadian Forces continues to be an essential means by which Canada contributes to the achievement of this goal.

The Government of Canada relies on the Canadian Forces as an instrument of national power and policy. "The role of the Canadian Forces in protecting Canadians and their interests and values will remain essential in the future."[2] Effective use of the Canadian Forces is an important factor in demonstrating that Canada is a responsible member of the international community and helps the nation to command respect in important international organizations and coalitions.

The mission of the Canadian Forces is derived from Government of Canada defence policy through Department of National Defence guidance. The Canadian Forces' core mandate continues to be the defence and security of Canada, Canadians and Canadian interests, and contributing meaningfully to international peace and security. "Fulfilling this obligation means keeping our citizens safe and secure, defending our sovereignty, and ensuring that Canada can return to the international stage as a credible and influential country, ready to do its part."[3] The manner in which the Canadian Forces and the Army fulfils this obligation is described in the six core missions of the *Canada First Defence Strategy*.

This mandate requires the Army to possess the ability to generate sufficient combat-effective, multi-purpose land forces to meet its responsibility toward Canada's defence and security objectives. The Army shall be prepared to undertake both expeditionary and domestic missions, and be fully capable of conducting

1. *Canada's International Policy Statement: A Role Of Pride And Influence In The World—Overview* (Ottawa: DFAIT, 2005), forward.
2. *Canada's International Policy Statement: A Role Of Pride And Influence In The World—Defence* (Ottawa: DND, 2005), p. 1.
3. *Canada First Defence Strategy* (Ottawa: DND, 2008), p. 1.

combat, stability and enabling tasks. Thus, the Army must be strategically relevant, operationally responsive and tactically decisive. This requires a highly mobile, adaptive, networked and sustainable Army able to operate effectively in a joint, interagency, multinational and public (JIMP) arena.[4]

Whatever challenges the future environment yields, the development of Canadian Forces and Army capabilities will continue to be significantly influenced by the following assumptions:

- virtually all Canadian Forces and Army missions are conducted as joint operations and entail cooperation with other agencies, such as other government departments, international organizations, allies and defence partners, non-governmental organizations, corporate service providers and public representatives, in a comprehensive approach to operations. Neither the Army, nor the Canadian Forces as a whole, is likely to act entirely alone domestically or internationally. They represent one component of a broader array of national resources devoted to the pursuit of Canada's goals;

- the majority of domestic operations involve the Canadian Forces and the Army in a supporting role;

- Canadian Forces and Army participation in expeditionary operations usually occurs as part of a broader international coalition; and

- military capabilities are aligned with Government of Canada commitments and resourcing, and are defined by government priorities and affordability.

4. See *Advancing with Purpose: The Army Strategy* (Ottawa: LFC, 2002) and *The Army: Advancing with Purpose*, 2nd edition (Ottawa: LFC, 2009).

THE FUTURE SECURITY ENVIRONMENT

- The global security environment will continue to be uncertain and volatile.
- Trends in globalization, technological innovation, demographic change, resource scarcity and the physical environment will continue to dramatically shape the future security environment.
- Future threats and challenges will be wide-ranging, complex in character and 'hybrid' in nature.
- Direct conflict between major and rising powers will remain less common than 'small wars,' but significant state-on-state war cannot be ruled out.

GLOBAL SECURITY ENVIRONMENT

The future global environment is expected to be increasingly complex, volatile and uncertain. The current trends in globalization and international monetary system integration, demographic change, burgeoning regionalization and destabilizing actions of state and non-state actors shape the environment. These factors, combined with the anticipated emergence of global energy and resource scarcities, accelerating effects of climate change, rapid scientific and technological innovation, and shifting regional power balances, are expected to generate significant challenges.

The competitive demands of quickly growing populations in the developing world for access to resources and improved living conditions will continue to be frustrated by the disproportionate distribution of wealth globally, regionally and locally. Dwindling levels of resources and the impact of natural and human instigated disasters will inevitably increase the fragility of large portions of the world and create new vulnerabilities for others. Human security issues will be framed in large measure by poverty and poverty-related insecurities—lack of access to reliable food supplies, safe drinking water, adequate health care and modern energy supplies—the lack of good governance, the sense of injustice that results from the imbalance in the distribution of wealth, and artificial polarization along cultural, religious or ethnic lines.

The relative rise of non-western spheres of political power and economic influence (notably Brazil, Russia, India and China) will compel some restructuring of the global economy. This is unlikely to occur without some level of disruption. Future global recessions, currency imbalance, tightening of the international credit market and risk of financial institution insolvency threaten global economic stability, putting more fragile states at risk of failure. As global finances become more integrated, interconnected and vulnerable to an increasing range of influences, the potential for economic crises to spiral out of control is significant.

Ideological differences will add to global instability. When states or other groups of people conclude that they cannot effectively influence their situation

through peaceful means or conventional tactics they will resort to irregular warfare and terrorism. This will give rise to increased humanitarian crises, political instability, civil unrest, and intra- and inter-state violent conflict. These conflicts will be characterized by diverse, simultaneous and complementary physical, cyber, economic, and propaganda or psychological attacks by nation states, proxy-groups, and trans¬national terrorist and criminal groups. Given the continuing proliferation of deadly weapons, the potential emergence of new nuclear weapon states led by unpredictable regimes, and ongoing conventional arms build-ups in regions such as the Asian Pacific, prospects for regional and global instability are rising.

While the relative power of states will fluctuate, the viability, significance and power of the state itself will remain the most important consideration geopolitically and internally. Citizens will continue to look to national governments to provide security and safeguard identity. Internal pressures will continue to encourage states to engage in armed aggression against neighbours and domestic populations. The competition for resources and the drive for greater security and influence will be heightened in the future. A wide variety of non-state actors such as international organizations, non-governmental organizations, corporate business interests and organized crime are having a much more prominent effect in the defence and security domain. The goals of many are likely to be relatively benign or even beneficial to security, but others will pose threats and challenges. All will serve to complicate the emerging security environment.

Many of the broad contours of future conflict will resemble those of today. A key difference will be that adversaries are likely to be even more adaptive and the threats they pose even more varied, multi-dimensional and dangerous. Exponential technological change will offer the ability to achieve influence and access unlike anything seen in the past. Combined with human ingenuity, this increased capability to organize and mount significant challenges on a range of fronts with greater access to a range of enablers—in particular, communications, weapon-related technologies and mobility—reach and lethality will dramatically increase. Indications point to a security environment that will be increasingly complex, uncertain, volatile and deadly.

DOMESTIC SECURITY ENVIRONMENT

The forces at work in the global realm will have domestic consequences as a result of the increasing overlap between international and domestic security interests and influences. While certain fundamental features of the Canadian state and Canada's society—such as geographically expansive territory, low population density and parliamentary democracy—will endure, a range of forces will be at work altering the nation's political, economic and socio-cultural landscape. For instance,

Canada's population will become more multicultural and cosmopolitan in character. Immigration will account for an increasing share of population growth as Canada's natural population growth dwindles.[5] Canadian society will be increasingly urban with cities expanding as centres of creativity and economic dynamism. An educated and skilled workforce will help ensure that Canada continues to be competitive in the future world economy. Canada's strong natural resource base will be a continuing source of prosperity.[6] Moreover, as global climate change raises temperatures in Canada's North, opportunities for exploitation of extractive resources, particularly oil and natural gas, and for further development of northern communities will likely multiply. The abundance of fresh water in Canada will place it in a very enviable position as fresh water becomes a more vital and limited global resource.

There will be negative effects of globalization on Canada and Canadians at home. The ease of global travel will increase threats stemming from infectious disease and the danger of pandemics. The intentional exploitation of societal vulnerabilities and the disruption of Canadian society are the stated goals of some of our most determined adversaries. Terrorist infiltration and armed attack, industrial and state espionage, criminal endeavour such as human, weapons and drug trafficking, and deliberate cyber-attack on financial infrastructure represent some of the many serious possibilities.

Gains resulting from the creativity and economic strength of Canada's technologically advanced, increasingly interconnected and multicultural society are at risk of being curtailed by the effects of an aging population. The potential for growing labour shortages, only partially offset by projected increases based on immigration, could result in declines in gross domestic product. Even now there are increasing pressures on public finances as pension payments and health care costs increase.

Changes in the natural environment will also foster hazards. The frequency and the effects of forest fires, extreme weather and flooding is widely expected to continue to increase. As access to Canada's North increases, so too will chances for environmental accident and degradation, intrusions on Canadian territory and sovereignty, and the conduct of illegal activity by those intent on exploiting the arctic region and its people for personal gain.

The Army, as part of the Canadian Forces, must be able to contribute to the defence of Canada, and alongside our continental partners, the defence of North America. The Army will play a significant role in providing security to the people of

5. Population Projections for Canada, Provinces and Territories 2005–2031, http://www.statcan.gc.ca/pub/91-520-x/00105/4095095-eng.htm.

6. For example, Canada is expected to remain a net exporter of oil until 2030.

Canada and in asserting the nation's sovereignty. It must also be prepared to assist with public safety in the event of a crisis. "Delivering excellence at home requires the [Canadian] Forces to be aware of anything going on in or approaching our territory, deter threats to our security before they reach our shores, and respond to contingencies anywhere in the country."[7]

THE FUTURE OPERATING ENVIRONMENT

- Army of Tomorrow formations and battle groups will operate in both rural and urban environments, often simultaneously, and in virtually all terrain types.
- Urban littoral operations will become more frequent and will continue to pose the greatest challenges due to their human, environmental and geographic complexities.
- The arctic must be considered as an emerging frontier that will require an increased level of commitment from the Army.
- The Army of Tomorrow will continue to be defined by the capabilities required to conduct expeditionary operations.

GLOBAL OPERATING ENVIRONMENT

The future security environment poses a considerable challenge for capability planners. The Army is most likely to be engaged over time in a wide range of complex operations in fragile regions or states in the developing world involving a broad array of actors in multidimensional contexts. More than one-half of the world's population now lives in cities, and 60 percent live within 100 kilometres of the world's oceans.[8] In this context violent conflict will often occur in urban areas with adversaries taking full advantage of the complex physical, moral and informational environments that large, densely populated cities provide.

The possibility of large force-on-force exchanges will not disappear, but irregular warfare conducted by highly adaptive and technologically enabled adversaries, rogue states bent on challenging the status quo, and trans-national criminal organizations will remain the most likely defence and security threats. While designing for a preponderance of mid-intensity operations in complex environments—in which there is a relative balance of effort between combat and stability tasks—the Army must remain capable of rapidly transitioning to effectively conduct high-intensity combat operations.

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7. *Canada First Defence Strategy* (Ottawa: DND, 2008), p. 7.
8. *Joint Operating Environment: Trends & Challenges for the Future Joint Force Through 2030* (Norfolk: USJFCOM, 2007), pp. 15–16.

Army of Tomorrow formations and battle groups will operate in both rural and urban environments, often simultaneously, and in virtually all terrain types including desert, mountain, jungle, wooded, savannah and arctic. Urban operations are expected to become increasingly frequent and will continue to pose the greatest challenges owing to their human, environmental and geographic complexities. These characteristics are likely to increase the number of incidents involving disease, pollution and exposure to industrial waste hazards, and could impair our ability to respond decisively and effectively.

It is anticipated that in some situations adversaries will organize and function in semi-independent, relatively dispersed cells and groups mixed within the population. Based on the premise of the Army operating within a strong alliance or coalition with superiority of forces on the physical plane it is anticipated that shaping operations will reduce opposing conventional forces to manageable levels. Residual elements of infantry fighting vehicles, tanks, mortars, artillery and rockets up to battalion group size could be expected in the close fight in such a scenario once the operating space has been shaped by combined joint assets. There is a reduced likelihood of encountering hostile fast air in the future operating environment;[9] however, helicopters, converted civilian airplanes, remotely piloted vehicles and improvised cruise missiles can be expected. Mines and improvised explosive devices will continue to be extremely dangerous and will range from the most basic (e.g. stacked mines, suicide-bomber) to extremely sophisticated devices. Rocket-propelled grenades will have improved killing power that will challenge our advances in protective and reactive armour and other counter-technologies. There is also considerable potential for the weaponization of commercial materials, including toxic industrial materials, though the capability of adversaries to effectively use these materials is likely to be inconsistent. Technology available to adversaries includes body armour, night vision devices and sophisticated secure communications.

Future operations are not easily categorized and they will emerge with clarity only as they unfold. Individual operations will undoubtedly embody some characteristics of one or more of the following themes:

- major combat characterized by frequent, widespread and intense combat against adversaries employing modern versions of conventional tactics;

9. See *Projecting Power: Canada's Air Force 2035* (Trenton: CFAWC, 2009), pp. 29–37.

- counter-insurgency characterized by the political nature of the crisis and the need to address multiple facets of the environment in which the military is in a key supporting role for security;

- peace support operations—including conflict prevention, peacemaking, peace enforcement, peacekeeping and peace building—to promote stability;

- a limited direct intervention with specific objectives and scope; and

- domestic operations where the nature of the crisis will likely render the military in a supporting role to other government agencies.

The nature of violent conflict in the Army of Tomorrow operating environment will demand that the Army is capable of employing adaptive strategies, operations and tactics that focus on:

- understanding the social and cultural environment in which operations are conducted so as to appropriately and effectively influence human behaviour;

- undermining the will and resolve of adversaries; and

- retaining the initiative in the physical realm.[10]

It will also demand that the Army be ready and capable of undertaking offensive, defensive and stability type operations along a continuum from peace-time military engagement through peace support and counter-insurgency to major combat. The Army must, therefore, continue to adjust to the realities of more complex environments, ensuring that it possesses a balance of fire and influence capabilities, supported by appropriate levels of mobility, survivability, sustainability and shared understanding, to create the desired effects while safeguarding people. A good balance between these functions will be essential as the force will be required to engage in formation, unit and sub-unit level operations against adversaries who will likely be even more adaptive and capable than those faced to this point. Any move away from a well-balanced force will increase the risk of exploitation of weaknesses that may be created.

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10. See *Land Operations 2021—Adaptive Dispersed Operations: The Force Employment Concept for Canada's Army of Tomorrow* (Kingston: DLCD, 2007), pp. 5–7.

There are further important implications of the changing character of violent conflict that need to inform the Army's future force posture planning. Depending on the resources available to them, future adversaries will inevitably employ an adaptive and tailored mix of capabilities, strategies and tactics to obtain their objectives.

> *Instead of separate challengers with fundamentally different approaches (conventional, irregular, or terrorist), we can expect to face competitors who will employ all forms of war, including criminal behaviour, perhaps simultaneously. Conflict will involve a range of trans-national, state, group and individual participants who will concentrate and operate both globally and locally… [N]ations are likely to see concurrent inter-communal violence, terrorism, insurgency, pervasive criminality and widespread disorder. Tactics, techniques and technologies will continue to morph as adversaries rapidly adapt to seek advantage and influence, including through economic, financial, legal and diplomatic means.*[11]

This 'hybrid threat' may well feature the cooperation, on at least some levels, of a number of non-traditional adversaries with more conventional-like enemies, and drives a merging of public safety, human security and national security concerns. The Army's engagement in all types of operations must be sustainable with respect to strategic lines of communication and force generation capacity. The capability to conduct operations effectively is provided by forces with a balance of the operational functions—Command, Sense, Act, Shield and Sustain—with the inherent ability to create the desired outcomes. This means having the appropriate levels of tactical, operational and strategic mobility, weaponry, survivability, sustainability and information at hand. Any move away from a balanced, effective and agile force will create unacceptable risk.

DOMESTIC OPERATING ENVIRONMENT

Based on experience, it is expected that the most likely future domestic operations involving land forces will occur as a consequence of natural or human induced disasters. The frequency and severity of these events has shown a steady increase over time and their impact is likely to continue to increase as population density and distribution continues to increase. The stabilizing effect on civilian populations caused by the deployment of Canadian soldiers in times of crisis has generally been

11. "ABCA Future Concept 2020–2030," ABCA Report Number 088 (Washington: ABCA, 2010), p. 10.

positive and out of proportion to the resources applied. There continues to be a public expectation that the Canadian Forces will provide assistance during times of crisis, and governments across Canada continue to rely on the military to assist when the demands of events go beyond the local capacity to respond effectively. The Army will need to be poised to quickly respond to save Canadian lives and help get life back to normal.

Canada's North will be an important government priority for the foreseeable future. The Air Force and Navy will continue to have more routine direct domestic responsibilities to secure Canada's air and sea approaches as part of their mandate, but domestic operations involving the Army in order to protect sovereignty and national security will remain vital tasks. Though the Army has always had capabilities which permitted it to operate in the North, the future will demand new capabilities and an increase in capacity and engagement.

THE STATE OF TECHNOLOGY IN 2021

- The world is in the midst of a continued and increasingly rapid global technology revolution.
- Technology domains such as nano and materials, robotics, biological and genetics, information and communications, and neurological are converging.
- The organization that thrives will be the one that invests in foresight, and prepares for and responds well to change.

Within modern societies and their militaries, technology is ubiquitous. Unfortunately, despite its pervasiveness, many view technology very narrowly, believing that it only pertains to computers, electronics and the internet. In its broadest sense, technology is the process by which humans modify nature to meet their needs and desires. Technology is more than just products and artefacts; it is also the knowledge and processes necessary to create and operate those products. Moreover, technology also includes our entire physical infrastructure.[12]

The world is in the midst of an unprecedented global technology revolution across the converging domains of nanotechnology and materials technology, biotechnology and genetics, information and communications technology, and neuroscience. The result of this convergence will be the emergence of novel

12. Greg Pearson and A. Thomas Young, Editors, *Technically Speaking: Why All Americans Need to Know More About Technology*, Committee on Technological Literacy, National Academy of Engineering, National Research Council (Washington: National Academy Press, 2002).

capabilities that have existed only in the realm of science fiction. It is probable that these converging technologies will be aimed in two principal directions. First, they will be directed inward at understanding and improving the human mind and body. Second, they will be focused on autonomous robotic technologies, or more generically, toward intelligent automation of the environment. These two focus areas will see new capabilities emerge and exponential growth take place in a range of adjacent disciplines that will bring about radical and unpredictable changes in all dimensions of life. Social, economic and military systems will be greatly affected. It is important to consider the trajectories that these converging disciplines may take.

Technological foresight and organizational speed will become increasingly important enablers of institutional resilience. Foresight techniques will be needed to help acquire an understanding of the nature and significance of possible events before they occur in order to mitigate potential risks to Canadian security. This will require active scanning for new technologies and early signals of new usages of existing technologies. Experience tells us that robust and sustained strategic and technological forecasting is worth the effort.

The ambiguity concerning future innovation will prove challenging for current capability development efforts because procurement speed now matters more. But cost also matters. These two factors will need to be carefully balanced. In times of such rapid change the organization that emerges successfully will be the one most able to adapt to the change. Capability development efforts will need to focus on optimizing capabilities in some key emerging strategic technology areas. These may not centre on traditional military weapons, equipment or vehicles, though these, as well, will benefit from new technological advances.

The technological trends towards convergence, miniaturization, integration and digitization all suggest that threats will manifest themselves in smaller and smaller packages with more capability than before. A genetically engineered virus, for example, represents both an instrument of power and a threat that is available in a microscopic package. Sophisticated intelligent software agents roaming cyberspace are also anticipated. The projection of power is possible with the use of information rather than only through the movement of forces. Small, highly networked and collaborative entities will be capable of defeating larger and more powerful organizations.

Significant advances in these shrinking technologies will be driven largely by commercial demand on a global scale rather than military-specific investment. This implies the need for a strong technology warning community focused on understanding and anticipating technology trends. This should be coupled with a force founded upon principles of institutional agility and adaptability that is able

to effect change in its technological foundation in a timely manner. Institutional flexibility, resiliency and relevance ultimately depends on striking the right balance between effectiveness and efficiency in national capability development.

Overcoming the challenges posed by technology will require deliberate efforts including institutional recognition of the importance and critical nature of smart acquisition practices. There should be a move away from the current approach to project management in favour of spiral development or planned technology insertion points where each development block is based on proven technology rather than anticipated technology. Current methods drive up costs, delay project delivery and compromise capability objectives.

THE HUMAN DIMENSION

- People will continue to be the most important resource for the Army.
- Army culture will be inextricably tied to Canadian culture, becoming more diverse and representative of society.
- Trust in fellow soldiers, leadership and the institution is the basis for cohesion in the Army.
- Enhanced decision-making is where the greatest gains will be achieved for military applications.
- The recruiting base within Canadian society will demand greater career flexibility within the Army.

CONTEXT

People will continue to be the primary capital upon which the Army exists, functions, succeeds and endures. The Army draws its soldiers from the very society that it is entrusted to safeguard; therefore, its strength and continued success is directly dependent upon its ability to be relevant and provide value, and to be comprised of a representative cross-section of the vibrant and evolving Canadian population. To continue to achieve its goals there are enduring characteristics that the Army as an institution must recognize, cultivate, nurture and sustain within its human capital.

HUMAN TRAITS

There is little reason to expect that human nature will fundamentally change in the Army of Tomorrow timeframe. The basic human traits and needs that have historically shaped human development remain a central consideration for the development of Army capabilities and structures. Human need to belong to an

organization that provides for his or her physical, psychological and social needs, while at the same time providing a sense of respect and accomplishment, remain paramount. The desire for belonging and respect, the special bond of the group, and confidence in their capabilities and the cause is what will continue to compel soldiers to perform effectively—even valiantly—during operations.

While these core attributes are likely to continue relatively unchanged, societal capacity and preferences will evolve. The Canadian population is aging and the average level of physical fitness continues to decrease. It is anticipated that Canadian society will become increasingly dependant upon technology, supplements and enhancements which will lead to changes in how people work, communicate, relate, behave, and view themselves and their world. While these phenomena tend to raise the standard of living they also elevate the level of complexity within society. Consequently, there is a requirement for superior levels of individual and collective intelligence and education within society at large.

CULTURE

Army culture is inextricably tied to the broader Canadian culture. It continues to become more diverse and representative of the mosaic that is the world's population. As Canadian 'cultures' grow more urban, cosmopolitan and interdependent, they greatly change the shape of Canadian society. While these trends pose challenges to the nation and to the Army, they also offer strengths and opportunities.

The Army's health and ability to understand its role depends on an effective and intimate connection with the Canadian population. It is important for the Army to reach out, understand, embrace and embody the best of Canadian culture and values. The Army must poise and project itself as a vital instrument of national power ready to assist, defend, secure and safeguard Canadians and their interests at home and abroad. This requires connectedness—frequent human contact—contact that is not achievable through virtual means alone and that does not rely solely on news reports and commercials offered by mass media. The Army needs to be a visible and integral part of Canadian society, basing itself where Canadians live, work and learn.

ETHOS

Canadian soldiers continue to be drawn from and be representative of the broad cultural amalgam of Canadian society. Though this diversity strengthens the institution, it is also vital to forge a cohesive Army founded upon a shared ethos and set of ethics. The diverse, complex and increasingly transparent environment that characterizes the Army of Tomorrow period is increasingly more demanding on the ethical and moral foundation and psychological robustness of soldiers. The precept

that 'a good soldier must first be a good person' is even more compelling. A healthy ethical environment is essential to sustaining legitimacy and success in operations.

Since militaries possess the potential to cause great harm or, equally, to enable great good, and given that soldiers are bound by a pledge of unlimited liability to the state, it is essential for all soldiers to be united by duty and allegiance to Canada and to be faithful to the chain of command, to peers within the chain of command and to subordinates. It is necessary for soldiers of all ranks to demonstrate the courage to do the right thing regardless of physical and psychological difficulty, the risk involved, or the potential for a negative impact on personal advancement or popularity.

TRUST

Trust in comrades, leadership and the institution remains the essential bond holding the Army together, underpinning discipline and effectiveness, establishing personal commitment to the organization and operations, and enabling success under the most physically arduous and psychologically horrific conditions. While motivations such as personal recognition, rewards, pay or adventure attract some to military service, they are insufficient to compel soldiers to remain or to unreservedly pursue military objectives. Soldiers' confidence that their institution and leaders, and the people with whom they operate, will respond in anticipated and appropriate ways in any situation, and fulfil promises in accordance with mutual values and expectations, directly affects their willingness to place themselves in harm's way. Soldiers expect that any cause that they are tasked to undertake be just and that they themselves are appropriately recognized and treated for the hardships that they endure and the sacrifices they make.

Building and sustaining the trust of our soldiers' families is also important. Our soldiers' families expect to be appropriately and properly valued, understood, recognized, respected and cared for in light of the sacrifices we demand of them. They will insist that the Canadian Forces properly prepare Canadian soldiers for what they will face in operations, sustain them appropriately while there, and reintegrate members back into Canadian society at the end of operations.

As Canadian society evolves, the ability of the Army to establish and sustain the trust of Canadians will be a factor in its success. It is expected that soldiers' deportment and actions be just and conform to a high moral standard. Canadians demand that their armed representatives are not only doing things right, but that they are also doing the right thing.

INTERFACING WITH TECHNOLOGY

Technological superiority will remain a key enabler for Army success in operations. Adversaries will continue to rely on a variety of means to achieve their objectives and some will possess the ability to employ state-of-the-art technology to create and exploit capability gaps. At the same time, technology will remain an important part of the solution for empowering and protecting our soldiers.

While technological developments are progressing at exponential rates in virtually every domain, it is in the area of enhanced decision-making where the greatest gains are likely to be achieved for military applications. Persistent and pervasive surveillance, data fusion and presentation, courses of action creation and analysis tools, and network-enabled communications will be needed to deliver the capabilities required for Canadian commanders to achieve tactical, operational and strategic advantage over adversaries. An important prerequisite for achieving this goal will be the enhancement of the human-computer interface. Whereas the innate human capacity to synthesize issues in terms of number, depth, breadth and complexity will not be significantly altered, the capability goal is the merger of humans and technology in a manner that can leverage human strengths of synthesis, innovation and creativity while harnessing the speed and responsiveness of automated systems.

As technological innovations become more readily available there is a trend toward greater physical separation between soldiers, allies, neutrals and adversaries. A balance must be struck between the need for protection and the operational need to influence the human landscape through personal interaction. In certain situations separation will be unavoidable, but given that the Army is a human institution and that operations succeed or fail based upon their effect on humans, care must be taken to minimize the potential that technology holds for inhibiting personal contact and the establishment and sustainment of relationships and trust.

ORGANIZATIONAL CHANGE

Current projections regarding the influence of technological developments on future military organizational structures often point to the necessity to fundamentally alter organizations that have many hierarchical levels and inefficiencies. While technological developments, particularly decision support tools and network communications, provide efficiencies and aid in these areas, the innate limitations of human capacity will continue to frame the extent to which fundamental change can be instituted. Human capacity to synthesize, learn and adapt, combined with human preferences and basic emotional and structural needs, necessitate that people are employed in certain roles, and that familiar and empowering organizational

constructs remain. These pragmatic considerations offer a strong case for the benefits realized by perpetuating a hierarchal command system.

Some optimization of existing structures and organizations is necessary in order to increase overall effectiveness and improve institutional efficiency. Change for the sake of economy in one area often creates additional requirements in other areas. Organizations and specialties devoted to areas where new technology has replaced old methods benefit from reduced personnel requirements in one place, but the new technology may require more attention and maintenance, and thus, more personnel in another place. Technology will, in the near-term, increase the need for specialization, training and education requirements. Systems engineering, which seeks benefits by changing processes and tools in a synchronized fashion, may be able to assist in mitigating this problem.

The tension between the requirements of structures and processes optimized for force employment and those optimized for force development, generation and sustainment will continue to exist. The need to have functional experts integrated into units and formations on operations will continue and will demand that diverse entities be forged into a harmonized unity. It will remain necessary to organize as a hierarchy as well as to use functional divisions within career structures and organizations to facilitate order and efficiency. The physical and cognitive demands of employment and of various tasks will demand that labourer and managerial categories are maintained. Ability, potential, and preference will still be the overriding selection criteria in the future, so the structure will need to be multi-dimensional. Knowledge management will continue to rise in importance as will the expertise required to operationalize emerging capabilities.

INSTITUTIONAL NORMS AND PRACTICES

Personal desire to perform effectively within the Army will, in many cases, be the key factor in employment and advancement. Lateral moves within the Army, the Canadian Forces, the public service, academia, and non-governmental organizations or other civilian employment will be less the exception than the rule. The traditional understanding of Regular and Reserve Forces will also be redefined to permit ready movement and viable employment options for all Canadians who wish to serve in changing roles while providing more flexibility to the organization. The Army will need to leverage modern and objective selection tools, including psychometric profiling, for optimizing the selection of personnel for specialties, training, education, teams, promotion and command.

THE ARMY OF TOMORROW: ENDURING DOCTRINAL CONCEPTS

» Enduring doctrine is a key component of the design of the Army of Tomorrow.
» Manoeuvre warfare is realized through shaping understanding, attacking and undermining will and shattering cohesion.
» Military power is based upon and is generated through moral, physical and intellectual components.
» Mission command underpins the manoeuvrist approach to warfare.

Military power[13] is based upon and is generated through its various components: the moral component (on the psychological plane and including morale and cohesion) which describes the ability and will of soldiers to fight; the physical component (power on the physical plane) which is the means to prosecute operations; and the intellectual component (the conceptual elements of doctrine and education) which underpin situational understanding and decision-making. The proper development and combination of these components provides the basis for the generation of military power.

Military power is organized and applied through three frameworks:

- the elements of the physical component of military power—forces, activities and command structure—are organized in spatial and temporal orientation within the environment in an 'operating space framework';

- military power is applied through the synchronized integration and execution of functional capabilities—the five operational functions and the core functions of find, fix, strike and exploit—by the organization of activities in the environment in a 'framework for manoeuvre.' The assignment of tactical activities is done by means of a tactical plan; and

- military power is applied on the physical and psychological planes through assigned activities in order to achieve desired effects (i.e. results). The purpose for, and the operations designed to create, these effects are categorized as shaping, decisive and sustaining. The arrangement of outcomes in relation to one another, the objective and the environment is known as an 'effects framework.'

13. 'Military power' is referred to as 'fighting power' in B-GL-300-001/FP-001 *Land Operations* (Kingston: DAD, 2008), p. 4–1.

Military power has traditionally been thought of in terms of destructive force. It is equally applicable to campaign problems that demand other solutions, such as the stability of a region in conflict, the secure delivery of humanitarian aid or the reconstruction of essential services in the effort to secure a population and its support. There is a requirement to be able to affect the perceptions, will and actions of a broad range of actors in the operating space. Military power is therefore used to create desired outcomes on both the physical and psychological planes.

The concept of manoeuvre warfare is defined as "an approach to operations in which shattering the enemy's overall cohesion and will to fight is paramount."[14] It is accomplished by shaping understanding, attacking and undermining will, and shattering cohesion. It is conducted simultaneously on the physical and psychological planes in a complementary fashion.

Mission command supports a manoeuvrist approach to operations as applied to activities on both the physical and psychological planes. An objective may be reached through either fires or influence activities, or through a combination of both. While the term objective has commonly been used to refer to a physical object against which action is taken, an objective is often something far more abstract, particularly if it is on the psychological plane or if it relates to a set of circumstances or conditions to be created. Potential second and third order effects are important considerations. Mission command underpins the manoeuvrist approach to warfare through three tenets:

- the importance of understanding a superior commander's intent;
- a clear responsibility on the part of subordinates to fulfil that intent; and
- timely decision making.

14. B-GL-300-001/FP-001 *Land Operations* (Kingston: DAD, 2008), p. 5–64 citing from AJP 3.2 *Allied Joint Doctrine for Land Operations* (ratification draft 2007).

THE ARMY OF TOMORROW OPERATING CONCEPT: ADAPTIVE DISPERSED OPERATIONS

» Adaptive dispersed operations are grounded in manoeuvre warfare theory.
» The fundamentals of adaptive dispersed operations were derived from the core functions of find, fix and strike.
» Adaptive dispersed operations support, and are supported by, a comprehensive approach within a joint, interagency, multinational and public (JIMP) environment.
» The ability to successfully conduct adaptive dispersed operations is founded upon effective leadership at all levels.
» Network-enabled operations will provide the key means of ensuring the Army is sufficiently adaptive, agile and combat effective.

As a response to an analysis of the future security and operating environments the Army published its Army of Tomorrow operating concept, *Land Operations 2021—Adaptive Dispersed Operations: The Force Employment Concept for Canada's Army of Tomorrow*. Adaptive dispersed operations are grounded in manoeuvre warfare theory and a manoeuvrist approach to operations that "seeks to create and sustain operational advantage over adept, adaptive adversaries through the employment of adaptive land forces alternatively dispersing and aggregating throughout a multidimensional [operating] space."[15] The goal is to create and exploit opportunities, control the tempo of operations and overwhelm the adversary's understanding. The essence of adaptive dispersed operations is the ability to conduct coordinated, interdependent, full-spectrum actions by widely dispersed teams across the psychological, physical and informational planes of the operating space, ordered and connected within an operational design created to achieve a desired end-state.

The fundamentals of adaptive dispersed operations derive from the core functions of find, fix and strike. Key principles include:

> developing situations prior to contact, or rapidly regaining the initiative upon contact;

> manoeuvring to positions of advantage;

15. *Land Operations 2021—Adaptive Dispersed Operations: The Force Employment Concept for Canada's Army of Tomorrow* (Kingston: DLCD, 2007), pp. 17–18.

- influencing the adversary beyond his ability to influence the situation with fires and other capabilities;

- destroying the enemy's cohesion, will and support with lethal and non-lethal precision and area fires;

- conducting close combat and close engagement at the time and place of our own choosing; and

- transitioning between operations without loss of focus or momentum.

Dispersion in this context is in relation to time (decentralized decision-making through mission command and network-enabled situational awareness), space (alternatively dispersing and aggregating over extended distances) and purpose (operations along a continuum that encompasses offensive, defensive and stability actions). The complex, multidimensional and continually changing nature of the operational environment requires land forces that are agile, precise, network-enabled, multi-purpose and capable of full-spectrum operations.

The level of complexity associated with the future security environment will drive significant changes in the way the Army addresses future conflict. The nature of a 'hybrid' threat and the multiplicity of social, economic and political interdependencies within fragile states will present unpredictable and seriously challenging situations. Even when successfully moving such a complex problem toward an end-state the force will find it difficult to measure progress. Complex security problems will increasingly require collaboration with subject matter experts outside the military. At the heart of such collaboration will be the need to achieve shared understanding.

The recognition and understanding of the joint, interagency, multinational and public (JIMP) environment not only enhances the prospects for cooperation and the development of unity of purpose among diverse partners toward desired end-states, but it also enables an approach to operations in which diverse resources can be more effectively utilized to create intended outcomes. A comprehensive approach to operations is intended to involve diplomatic, defence, development and commercial resources aligned and coordinated within an integrated campaign plan.

A need for cross-departmental and multinational collaboration to address crises in fragile and failing states demands a commonly understood methodology for solving complex problems. This methodology should incorporate vigorous collaborative discussion and graphical representations to design a common operating

picture or model of the problem. The discourse and its results need to be available to decision-makers at all levels throughout the force to achieve unity of purpose through shared understanding and common intent.

Adaptive dispersed operations require that junior leaders make quick, bold decisions based upon the principles of mission command. Commanders at all levels must be confident that their subordinates are capable of understanding their intent and rapidly taking decisive action to achieve the desired end-state. While commanders' trust in subordinates will be partially enabled by confidence in the training they undertake, it will also require a leadership culture that supports decentralized decision-making and collaborative planning.

Network-enabled operations will provide a key means of ensuring the Army is highly adaptive, agile and combat effective within the JIMP environment. This concept involves the integration of a network of tactical forces and other elements supported by sensor, direct and indirect fire, combat service support, influence activity, and command and control systems linked by voice and data to create a level of situational awareness, mobility and support that will overwhelm adversaries' understanding of the operating space and their ability to react.

CAPABILITY DEVELOPMENT

- » A consistent capability development message is essential for success.
- » Failure to fully embrace the cabability development process is wasteful.

OVERVIEW

The broad system in which Canadian Army capability development exists is fraught with challenges brought on by changes to leadership, changing finances, changing technology, changing needs based upon the ever-changing global and domestic environments, and a complex and protracted procurement system. To be successful in this environment the Army, as a whole, must provide a consistent message based on a pragmatic approach to capability development aspirations. The only way for this to occur is for the Army to fully embrace its existing capability development process. Failure to do so will continue to see unaffordable or ill-conceived projects consume Army resources and staff capital while resulting in little or no gain in useful capability.

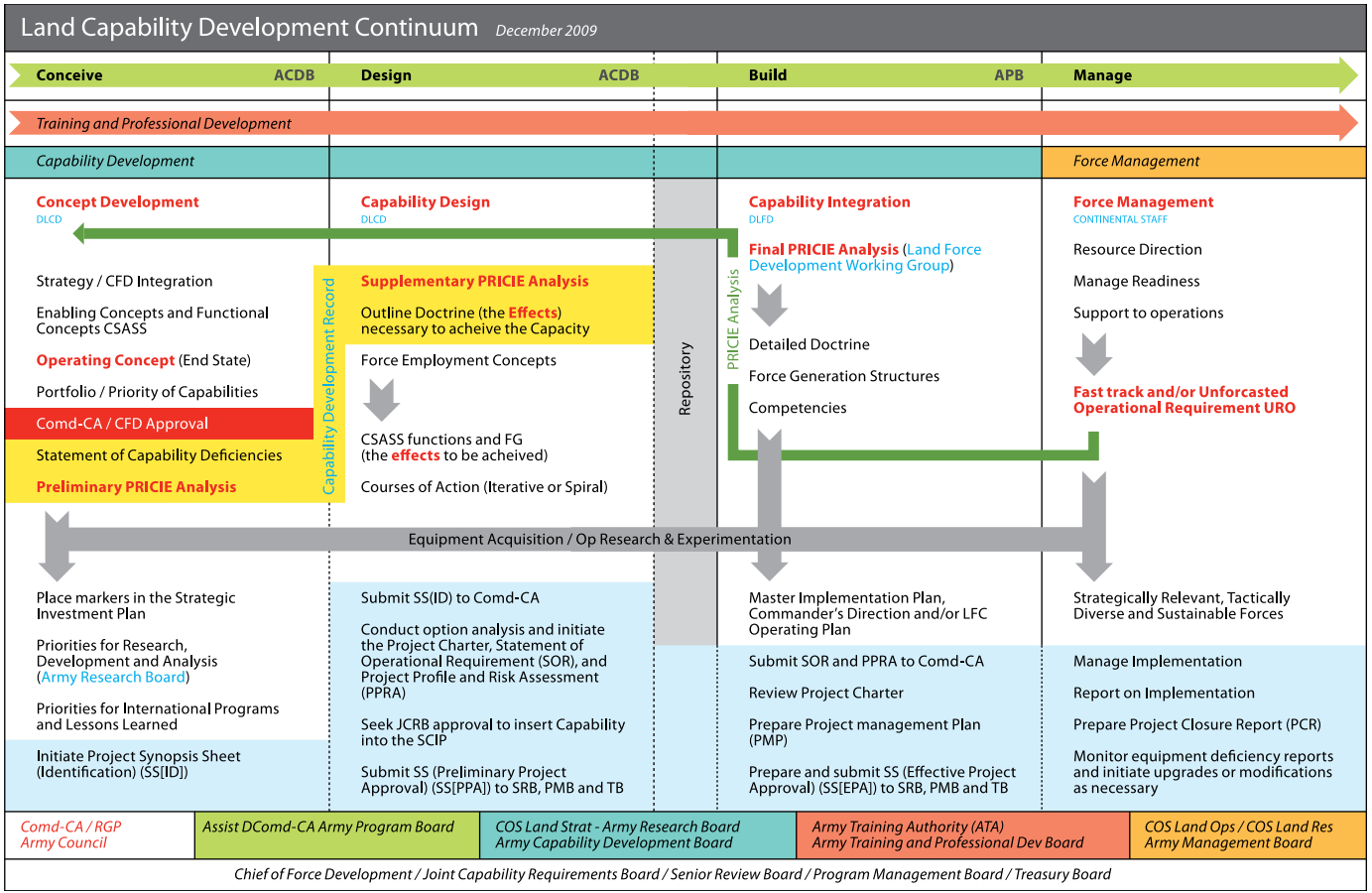

Figure 1: Land Capability Development Continuum, December 2009.

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THE ARMY CAPABILITY DEVELOPMENT PROCESS

Chief of Staff Land Strategy (Director General Land Capability Development) has oversight for capability development on behalf of the Assistant Chief of the Land Staff. Integrated with the force development practices and methodologies governed by the Chief of Force Development, and as detailed in the *Army Strategic Decision Making Handbook*, the Land Staff oversees capability development and force management through its commitment to the Land Capability Development Continuum. The Continuum consists of four pillars, Conceive, Design, Build and Manage, of which the capability development process resides in the first three pillars. Each pillar has a lead agency appointed to govern the process, lead the analysis and draft the documentation necessary to guide the capability through to realization. The work performed within each pillar sets the foundation and conditions for subsequent activity. See Figure 1 on page 34.

CAPABILITY DEVELOPMENT RECORD

The Capability Development Record is a vital component of the Land Force capability development process. Under the auspices of the Army Capability Development Board[16], with support from the Army Research Board and the Land Force Development Working Group, the Capability Development Record is a tool in the process of achieving desired capability goals found in the Army of Tomorrow capability portfolio.[17] The Capability Development Record is the mechanism through which Chief of Staff Land Strategy conducts and records progressive work across the Conceive and Design pillars and prepares for the successive Build work to be conducted through the Land Force Development Working Group, Army capital projects program and respective working groups.

Successful completion of a Capability Development Record is accomplished upon approval by the Army Capability Development Board—or if necessary the Army Program Board—of the outline doctrine (an operating concept for achieving desired outcomes), force employment structure, relevant equipment project, and the master implementation plan needed to fully develop, integrate and generate the pertinent capability. A Capability Development Record serves as a key reference for activities to be undertaken by the Build community (DLFD, DLR, DLCI, etc.),

16. The Army Capability Development Board consists of Chief of Staff Land Strategy Directors, the Directors of Army Doctrine and Training, Arms and Branch Advisors, and representatives from the Science and Technology community, and with direct support and collaboration from other Land Staff and Chief of Force Development Directorates. The Army Research Board membership is similar, less the Arms and Branch Advisors, yet with added Research and Development, and Science and Technology representation from across the five operational functions and the Land Capability Development Operational Research Team.

17. *Toward Land Operations 2021—Studies in Support of the Army of Tomorrow Force Employment Concept* (Kingston: DLCD, 2009), Appendix B.

to include completion of the PRICIE[18] analysis by the Land Force Development Working Group and a clear statement of the operational capability deficiency.

It is important to note that the development of capabilities, particularly those that necessitate major equipment projects, are dependent upon the management phases and processes of the Defence Management System. Moreover, there is often a need to examine fast-tracked projects or unforecasted operational requirements (UOR) to ensure they fit in and complement the overall operating concept.

Pillar 1—Conceive (Concept Development) The objectives of Pillar 1—Conceive are to state an identified capability requirement or deficiency, conduct a preliminary PRICIE analysis to more fully examine the deduced capability goals and explore functional interdependencies. Moreover, priorities for concept development and experimentation are set, as well as confirmation of research and development, operational research, the Land Force International Program, and lessons learned priorities, and if sufficiently evident, the placement of markers for capital projects in the departmental Investment Plan is sought. The deliverable for Pillar 1—Conceive is the statement of capability deficiency and draft requirement, and the preliminary PRICIE analysis.

Pillar 2—Design (Capability Design) The objectives of Pillar 2—Design are to further refine the PRICIE analysis, and in particular, articulate a developmental 'model' that describes the results that are necessary to be achieved by the desired capability. Moreover, it is within this pillar that the developmental force employment and force generation structures are designed. Sub-concepts for the five operational functions and social capital are developed to assist in describing the desired outcomes.

For the equipment requirements approved at Pillar 1—Conceive, the description of the desired outcomes will assist in completing the Concept of Operations and Concept of Support sections of the Statement of Operational Requirements. Likewise, consistent with the management phases and processes of the Defence Management System, the Synopsis Sheet (Identification) should be finalized for Chief of the Land Staff approval, the requirement should be input into the Capability Investment Database and subsequently the Investment Plan, and the Options Analysis Phase, to include the Project Charter, the Project Profile and Risk Assessment, the Statement of Operational Requirements and the Synopsis Sheet (Preliminary Project Approval), should be initiated.

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18. PRICIE is an acronym which describes the Canadian Forces functional components of capability. A complete analysis will examine all aspects of a capability including: personnel, leadership and individual training; research and development, and operational research; infrastructure, environment and organization; concepts, doctrine and collective training; information management and technology; and equipment and support.

Lastly, critical for success across Pillar 1—Conceive and Pillar 2—Design for the realization of the five design elements and any Capability Development Records in progress is the supporting Capability Development Experiment campaign program. This program provides simulation, experimentation and options analysis support for concept and design development. Moreover, it is linked to national and international counterparts and directly supported by the Army Experimentation Centre of the Directorate of Land Synthetic Environments.

Pillar 3—Build (Capability Integration) The objective of Pillar 3—Build is a master implementation plan that realizes the capabilities through effective managed readiness. Consequently, through the Land Force Development Working Group, the PRICIE analysis shall be completed. As well, a training strategy and needs analysis to meet the needs of the force generation course of action shall be developed. The priorities for which deficiencies or redundancies are to be addressed (staff effort and resources) shall be determined by the Army Capability Development Board.

In accordance with the management phases and processes of the Defence Management System, work will be finalized to seek Senior Review Board, Program Management Board and Treasury Board approval of the Synopsis Sheet (Preliminary Project Approval) and the Synopsis Sheet (Effective Project Approval) and, if equipment related, update and submit the pertinent Statement of Operational Requirement to the Chief of the Land Staff for approval. Furthermore, based upon the PRICIE analysis of the operating concept within the force employment concept, force generation courses of action shall be developed that provide various ranges of solutions for the operating concept. Solutions may vary in form, structure, equipment or in time, but they must clearly indicate how well they fill the capability deficiency or redundancy. The deliverable for Pillar 3—Build is the production of a record of decision of the pertinent Land Force Development Working Group, and ultimately, the production of a master implementation plan or similar guidance to realize the capability.

Pillar 4—Manage (Force Management) Master implementation plans will be developed to implement capabilities under Pillar 4—Manage and to confirm equipment entitlement and distribution priorities for procurement and fielding. Force management falls under the purview of governance lines outside that of capability development. It consists generally of all processes and activities that contribute to the management of readiness for the Army to be employed on operations in support of Government of Canada goals and objectives articulated in the *Canada First Defence Strategy*.

PART TWO

DESIGNING THE ARMY OF TOMORROW

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DESIGNING THE ARMY OF TOMORROW

INTRODUCTION

Army of Tomorrow activities will continue to be conducted in land, maritime, air, space and cyber (including the electromagnetic spectrum) environments and these environments each require their own unique set of technological operating capabilities. Activities conducted within these environments occur on the physical plane, and effects are generated across the physical, informational and moral planes. It is on the moral plane where efforts have the highest and most enduring payoff because this is where the human dimension is influenced. It is on this plane that understanding is shaped, reinforced or undermined, and cohesion is solidified or shattered. The moral plane is where domestic opinion and operational legitimacy lies, where trust within the comprehensive approach is built, and where so-called 'hearts and minds' are influenced. Activities conducted within the physical environments are prosecuted with a view to achieving a desired effect in the human dimension.

The near ubiquitous proliferation of devices capable of capturing and disseminating information and the increasingly sophisticated ability of potential adversaries to manipulate this information will continue to present significant challenges to land forces that require local, national and global perceptions of legitimacy as essential enablers to effect successful operations and sustain them sufficiently in time to facilitate the realization of successful campaigns. Within this increasingly informed climate, an increased emphasis on effectively communicating in all dimensions, including internally, with allies, with the Canadian population, internationally, with populations in theatre and with adversaries will be necessary. While populations in the Army of Tomorrow timeframe will have grown increasingly capable of discerning the credibility of sources of information, their very human proclivity to maintain preconceived notions of trends and legitimacy will necessitate unswerving devotion to a common ethical code and absolute forthrightness at all times. Effective exploitation of the informational plane will be key to achieving the desired effect in the human dimension.

THE OVERARCHING DESIGN

PLANNING CONSTRAINTS

The Army of Tomorrow will be built within a Canadian Forces framework and fully respect its vision.

> *The Canadian Forces, through greater integration of their sea, land, air and special operating forces, will strengthen the defence of Canada and the security of North America and will become more globally relevant, responsive and effective to provide greater influence in shaping the international environment in accordance with Canadian interests and values.*[19]

The Army of Tomorrow embodies the enduring Army mission which is "to generate combat-effective, multi-purpose land forces to meet Canada's defence objectives."[20] The Army shall remain capable of supporting the broader Canadian Forces mandate to conduct the six core missions of the *Canada First Defence Strategy:*

- conduct daily domestic and continental operations, including in the Arctic and through NORAD;
- support a major international event in Canada, such as the 2010 Olympics;
- respond to a major terrorist attack;
- support civilian authorities during a crisis in Canada such as a natural disaster;
- lead and/or conduct a major international operation for an extended period; and
- deploy forces in response to crises elsewhere in the world for shorter periods.[21]

While remaining fully capable of generating force elements for employment on the core missions, the Army of Tomorrow will be designed primarily to execute

19. *Canadian Forces Integrated Operating Concept* (draft version 01, 18 Mar 05).
20. *The Army: Advancing with Purpose*, 2nd edition (Ottawa: LFC, 2009), p. 14.
21. *Canada First Defence Strategy* (Ottawa: DND, 2008), p. 3.

international operations. These operations represent the most demanding mission for the Army and the capabilities required to successfully execute these kinds of operations will support the successful conduct of all other core missions.

THE ARMY OF TOMORROW: OVERVIEW

Canada's commitment to global security and international stability throughout the past century is a basis for its continued respect and influence as a developed nation. Canada routinely responded in times of international instability by contributing appropriate forces to meet the threats and challenges it faced in the global security environment. From today's perspective, multiple destabilizing factors are encouraging volatility and uncertainty. A disturbing number of states inevitably face vulnerability, fragility, fracture and failure. Specific instances of instability have the potential to lead to further destabilizing and violent conflict. The world continues to be affected by varying degrees of persistent violent conflict characterized by highly adaptive, elusive and technologically enabled adversaries. These adversaries will continue to have the ability to quickly generate forces capable of combat in both open and complex terrain, capable of melding back into the populace when and where its suits their purposes. The world is projected to remain in a state of sustained and global low-to-medium level conflict where the threat of modern state-on-state conflict also persists. In this future security environment Canada will not be immune from the effects of global conflict and as a responsible member of the world community—highly dependent upon international commerce and trade—it is certain to be engaged whenever and wherever its security, values and interests are directly threatened.

In order to be successful in this emerging security environment the Army of Tomorrow must possess the following characteristics:

- Army of Tomorrow command processes must cater to complex environments characterized by the need to conduct simultaneous combat and stability tasks within a comprehensive approach framework;

- due to the complex nature of the environment, Army of Tomorrow forces need to develop and sustain the intellectual agility to outmatch highly elusive and adaptive threats. This agility comes from instilling a comprehensive understanding of the operating environment throughout the force. This common operating picture—a mental model—will need to be developed, maintained, shared and kept current to enhance overall force adaptability;

- The Army of Tomorrow must be comprised of modular and interchangeable structures that are based on the smallest effective building blocks of capability in order to provide force generation and force employment flexibility. The Army of Tomorrow's primary focus shall be the battle group within a joint formation context. Formations shall generate those capabilities that are limited and shall also possess the vital assets required to create the conditions for success but which are beyond a battle group's capacity to fully manage;

- The Army of Tomorrow must recognize the human dimension of conflict and cater for the strengths and limitations of the recruitable cohort;

- The Army of Tomorrow must have a pragmatic structure that effectively and efficiently generates the general and specialized skills required to succeed on operations. The structure should be underpinned by the knowledge that close combat and close engagement are the Army's core competencies and the elements that are charged with providing these competencies form the Army's foundation. The principle that all capabilities required to conduct or enable success in close combat and close engagement should be established within battle groups wherever doing so does not inhibit the maintenance of specialist skills, force generation across the Army, or exceed the battle group's capacity to effectively manage, should underpin force generation and force employment structural design;

- The Army of Tomorrow must possess sufficient mass to effectively execute close combat and close engagement tasks, and to permit sustainability. Sufficient quantity of capability, combined with the highest possible quality, is often key to success. The proper mass of soldiers and capability also provides the necessary capacity to react to unforeseen threats;

- The Army of Tomorrow must protect its institutional capacity to adapt if it is to remain effective in the changing global security environment;

- The Army of Tomorrow must be—philosophically—medium-weight. This implies:

  - capable of combat and stability tasks across the continuum of operations;

- » relevant (effective, rapidly deployable, sustainable);
- » highly mobile and agile;
- » technologically enabled to gain maximum effectiveness, but not exclusively reliant upon technology; and
- » networked to allow for increased shared understanding, increased dispersion, more precise creation of effects (in time, space and purpose) and better support the rapid aggregation of forces;

> The Army of Tomorrow must have an effective, efficient and integrated training system;

> The Army of Tomorrow must have a command and control capacity to lead on international operations (i.e. a deployable formation level headquarters); and

> The Army of Tomorrow must have the fewest number of fleets with the greatest practicable commonality between them. It needs the fewest types of platforms that support the required number of functional configurations. The basic equipment platforms should all share the maximum number of common attributes (e.g. layout of driver stations, interchangeable parts), have a high degree of modularity (e.g. fitted-for-but-not-with), and be readily modifiable (e.g. open architecture) to quickly mitigate new weaknesses while increasing flexibility and platform lifespan.

The Army of Tomorrow must be effective, flexible, sustainable and efficient while being capable of the following:

> successfully conducting a range of combat and stability operations under challenging conditions;

> leading and sustaining complex land-based operations for extended periods at home or abroad; and

> responding with appropriate forces in a timely fashion to domestic and international requirements.

The tactical tasks expected of the Army of Tomorrow are those described in land operations doctrine.[22] While the task framework may change over time, the manner in which tasks are conducted and the frequency of various tasks is likely to evolve more quickly. This is an important consideration when designing the Army of Tomorrow as it is a fundamental consideration in the development of the required depth and breadth of capabilities and their corresponding structures. Based upon the future operating environment it is anticipated that the Army of Tomorrow will most often face company or combat team level operations, balanced between combat and stability tasks, and often under relatively isolated conditions. Battle group and formation level operations, while inevitable, will be less frequent. All tasks must be anticipated to be conducted over significantly large geographic areas and will frequently involve local populations. Influence activities will be pervasive.

These attributes define the Army of Tomorrow model. It shall be a sustainable Army that is strategically relevant, operationally responsive and tactically decisive across the continuum of operations. The Army of Tomorrow shall be optimized for a balance of combat and stability tasks while operating with joint, interagency, multinational and public (JIMP) partners in complex environments.

CORE COMPETENCIES AND PRINCIPLES

In order to fulfil its assigned missions as a part of the Canadian Forces' *raison d'être* of defending Canada, Canadians, and Canadian interests, the Army cannot be a specialized or 'niche' force. To fulfil its missions in a sustainable manner it must be a multi-purpose force that is largely homogeneous, but includes the critical enablers that permit it to perform successfully at the more extreme limits of combat and stability operations. The Army of Tomorrow design focus is at that point on the continuum of operations that is the most complex and difficult—that point where combat and stability tasks are found in about equal measure. Land forces must be equally capable of conducting combat and stability tasks, and be able to transition the weight of effort according to the shifting situation.

At the upper end of the scale the Army will be capable of joining coalition partners in major combat operations against a significant conventional foe. The Army may not necessarily be capable of conducting all tasks independently. At the lower end of the spectrum, while the Army will be proficient at stability tasks, it will be relatively limited by its mass in terms of the scale of operations that it can undertake.

Within the anticipated resource limitations on the size of the Army of Tomorrow, and the continuous demands that will be placed upon it, the Army will not be able

22. B-GL-300-001/FP-001 *Land Operations* (Kingston: DAD, 2008).

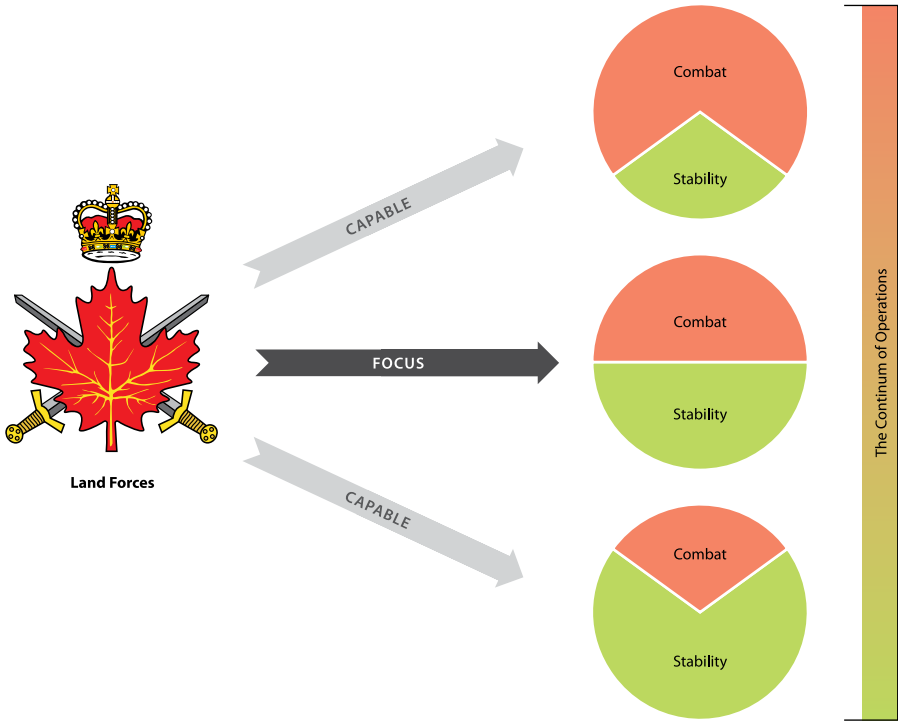

Figure 2: The Army of Tomorrow—A sustainable land force that is strategically relevant, operationally adaptive, and effective across the Continuum of Operations.

to afford to possess niche capabilities that are specialized for specific points on the continuum. That is, the Army will not be large enough to afford to be heterogeneous. Rather, to give it the depth to sustain itself in operations, the Army of Tomorrow will require a homogenous core structure with appropriate combat and stability enablers sufficient to create the essential conditions for success across the continuum of operations.

Specific operations or conflicts may unfold that demand a focus other than that selected as the aiming point of the design for Canada's Army of Tomorrow. The key to the design focus is that it is at this point of the continuum that operations are most complex and demand that the Army possess the capability to respond to adversarial initiatives both above and below the area of primary focus. For example, should an adversary launch a significant combat operation the force will already possess the capability to prevail, though coalition partners may have to be relied upon to provide specific operational or strategic combat enablers. The Army of Tomorrow will have the ability to employ state-of-the-art technological capabilities of magnitudes more capability than traditional weapon systems that usually relied upon weight and mass.

The Army of Tomorrow will have at its foundation the ability to deliver its core competencies. All capabilities will be designed to deliver functions that provide or support the core competencies. The core competencies are as follows:

- the capability to win close combat;
- the capability to conduct close engagement (stability tasks); and
- the capability to set the essential conditions to enable success in close combat and in close engagement.

The Army must be able to conduct these operations within a comprehensive approach in a JIMP environment.

The Army of Tomorrow effort, therefore, shall be concentrated to conceive, design, build and manage a core of close combat and close engagement capable forces along with the essential organic land combat and stability enablers, and the essential capabilities required to sustain the force in operations. The Army of Tomorrow must actively pursue the development of non-organic (i.e. joint) enablers that remain important to the overall delivery of success on missions.

In an uncertain future, Army of Tomorrow success will be contingent upon following these design principles:

- *Size.* The Army of Tomorrow must contain sufficient breadth and depth to permit the successful conduct of operations in support of the *Canada First Defence Strategy* while simultaneously conducting force generation activities;
- *Adaptability.* The Army of Tomorrow must contain sufficient breadth, depth and modularity within its force generation and force employment structures to provide the ability to organize or reconfigure to meet operational requirements. This degree of modularity will be important to attaining the agility required to succeed in adaptive dispersed operations;
- *Sustainability.* The Army of Tomorrow structure (which contains sufficient depth and flexibility) must be affordable over time in all categories of resources (e.g. personnel, materiel, financial, time and training);

- *Agility*. The Army of Tomorrow must have the inherent intellectual robustness, resilient culture, training and doctrine to readily adapt to meet new operational demands; and

- *Institutional Flexibility*. The Army of Tomorrow must maintain sufficient staff power and access to sufficient capital resources to enable it to readily change to meet the exigencies of the increasingly rapidly changing security environment.

PERPETUAL CHANGE AND THE SPEED OF CHANGE

The decision-making ability of our institution will be a critical aspect of the Army of Tomorrow's ability to prevail over elusive and adaptable adversaries. The philosophy of the Army of Tomorrow design must deliberately and holistically facilitate rapid and efficient change in order for it to remain relevant. Homogeneous forces, modular forces, upgradable equipment designs, and a culture of intellect and versatility are all examples of critical components of this ability. The temptation to over-specialize must be tempered by the requirement to protect the ability of the whole to rapidly change.

This is not to imply that change should occur without rigorous analysis. It does, however, imply that a process that identifies, verifies and facilitates perpetual coherent change needs to be institutionalized within the culture and processes. The key will be to balance the necessity to adapt to perpetual and more rapid change with the requirement to ensure the efficient use of resources.

To remain a legitimate instrument of national power in the 21st century the Canadian Army must institutionally commit to developing a robust and sustained culture of perpetual innovation. This means investing more in the Army's intellectual and corporate organizations so that Army concepts, designs, testing and implementation fully embrace systems management and systems engineering practices. That the Army of Tomorrow will continue to manifest itself incrementally over the next decade and beyond, a culture of perpetual innovation based on a disciplined approach to systems management and systems engineering will allow its designers to keep pace with the rate of change in other fields as it occurs. In this way the Army can continue to ensure the rapid production of new and dependable processes and technologies within a predictable budget.

Timeliness continues to be a key factor in the government's capability procurement process so the Army must deal with the constraints that result from this consideration. Disciplined and sustained investment at the earliest stages of the capability development process pays great dividends later on.

Adherence to design principles not only reduces the total time required to prosecute a project from concept through to deployment, it also allows the Army to act on procurement opportunities more quickly when this is required.

KEY ELEMENTS OF DESIGNING THE ARMY OF TOMORROW

SOLDIERS—THE HEART OF THE ARMY

Attempts to understand and, if possible, anticipate future challenges within the human dimension are essential for effective planning. Today, anthropological study of the Army's traditional recruiting base has identified a significant trend of changing attitudes toward work ethics, hierarchical institutions and career stability. This increasingly educated and technologically gifted cohort is also, unfortunately, decreasing in size, which will by 2021 result in a fiercely competitive recruiting environment across all economic sectors. This situation is contrasted by advances in technology that will allow Canadians to live longer and healthier lives thereby increasing their productive life span. The Army will need to explore new recruitment mechanisms, career flexibility, and approaches to retention to remain effective in the Army of Tomorrow environment. Indeed, there is a requirement for a review of legislation, policies and compensation in order to attract and retain sufficient numbers of Canadians in the profession of arms.

A critical aspect of this burgeoning force generation problem involves a reassessment of the traditional Regular Force–Primary Reserve Force model, where reservists are viewed primarily as an augmentation mechanism for the Regular Force. This model must change if we are to mitigate the negative effects of current recruitment trends and maintain credible defence capability within Canada.

Since the seventeenth century Canada's defence has depended largely upon citizen soldiers committed to military service on either a part-time or full-time basis. This system has proven tremendously valuable, especially in times of total war when the country could augment its smaller regular forces by drawing upon the massive resources and capacity of its much larger militia. Since the end of the Cold War Canada's Army has continued to rely heavily upon its Reserve Force, typically drawing upwards of twenty percent of its expeditionary strength from this community. This trend is reflective of the changing life and career expectations of all citizen soldiers in this country, highlighting yet again the requirement to revisit and improve upon the existing Regular Force–Primary Reserve Force service model.

In order to stave off the worst effects of continuing trends, Canada's Army must commit itself to the creation of a new and true one-Army concept where all members

enrol under the same terms of service, conditions, legislation and legal obligations, and move seamlessly from part-time to full-time service throughout their careers. This change will require some modifications to legislation, primarily in the areas of the soldier's covenant, career administration, pay, benefits and pension. The desired outcome includes a spectrum of career options available to service members ranging from full-time to part-time and even supplementary service. New non-linear career paths, possibly self-managed to some degree, shall become the new standard where professionals flow seamlessly from part-time to full-time and back again depending upon the needs of the Canadian Forces as well as the individual's desire to serve.

TRAINING THE ARMY OF TOMORROW—PREPARING SOLDIERS

The Army's capacity to effectively conduct operations is a function of its ability to recruit, train and sustain its people. Training serves to develop the moral, intellectual and physical strength of individual men and women and, in turn, forges them into a competent, cohesive, confident and collectively disciplined force of soldiers. Training is informed by doctrine, focused on operations, and made better by lessons that are identified and applied. The progressive nature of training demands that the Army must continue to train units and formations successively through periods of higher and lower readiness. Training effectiveness and efficiency is largely based upon a reasonable level of personnel stability and viable levels of collective training.

Training is classified as individual—to produce soldiers able to execute specific functions within a collective entity—and collective—to forge complete capabilities. Education, both academic and professional, serves as a foundation upon which training is conducted. Experience and guided self-development serve to enhance and revitalize the knowledge, skills and attitude developed through education and training. Broad education in social and cultural studies assists in the general preparation of soldiers for full-spectrum operations in a JIMP environment, while a great deal of training focuses on the Army's core capability to effectively conduct close combat.

Human limiting factors—physical and cognitive—are likely to remain largely unchanged. This will continue to frame how much training can be imparted and retained by an individual over a specified period of time. With trends showing decreasing levels of physical fitness within the general Canadian population, the development and maintenance of physical robustness will remain an important element of training because of its direct benefit to overall health and mental resilience.

It is in the intellectual and cognitive domain that the Army may face significant challenges due, primarily, to two requirements:

- operating across—with focus on the most complex and demanding point on—the continuum of operations within a JIMP context will present commanders, from the very junior to the most senior, with a volume and diversity of information that will require robust skills and high levels of aptitude in order to comprehend, associate holistically and manage it; and

- individual and crew training is intrinsically linked to technology through equipment. Collective training is largely founded upon employing multiple and complementary capabilities, largely enabled by technology, coherently. While promotion of technological advances often project decreasing requirements for training, this has proven to be an elusive goal. Whereas young Canadians are now living in a highly technological environment, and are developing in unison with changing technologies, in the future the exponential rate of technological change is poised to challenge even the most gifted and immersed cohort to keep pace.

To execute the planning, control the content and ensure the proper conduct of training, a cohesive training system is required. It is most likely to continue to be composed of headquarters, training establishments, simulations, and ranges and training areas all directly or indirectly linked. The headquarters shall exercise command and control over assigned training establishments and provide training direction in three functional areas: qualitative control, quantitative control and resource management.[23] In addition to a dedicated training system, field units and formations will most likely continue to conduct a large amount of the individual and collective training.

The following key areas demand immediate and ongoing attention:

- *Selection*. Training is a valuable resource and must be used wisely. The social sciences must be exploited to measure suitability for occupations and roles, including suitability for command;

- *Skill Fade*. The knowledge, skills and aptitudes developed through training tend to diminish over time. The requirement for continuation and refresher training should be measured empirically to ensure skills are not lost;

23. Qualitative control refers to the cyclical process by which training objectives are analyzed, designed, developed, conducted, evaluated and validated, with the results of the latter phases fed back into the first. Quantitative control is the process by which training is programmed through formal individual training (course) vacancies allocated and collective battle tasks assigned. Resource allocation matches training resources (time, instructional cadres, ammunition, simulation resources, ranges and training areas, etc.) to units and formations in accordance with their assigned training tasks.

- *Specialization versus Generalization.* Tension will continue to exist between the requirement for specialists and generalists. Complicated equipment and high skill fade tasks will drive a need for specialization, but with rapidly evolving operations and the requirement to maintain core soldier skills there must be a balance between these two imperatives;

- *Human / Equipment Interface.* Operating equipment should be intuitive, convenient, adaptable to individual preferences and as common as possible, minimizing conversion training between equipment fleets as they are acquired, converted or upgraded;

- *Maximizing Experience in Training.* Decision-making in a complex, time-constrained environment against an intelligent adaptive enemy is best practiced intuitively and informed by experience. The experience must be based on multiple iterations of the same, or similar, tasks in varying circumstances. One of the most efficient tools that can be exploited to create virtual experiences, and that is adaptable to a variety of operational tasks and training scenarios, is modelling and simulation;

- *Risk Management.* Risk is an inherent part of military operations. Leaders and soldiers must be taught to assess a wide number of risk factors, their relative probability and their impacts, and take appropriate mitigation measures;

- *Adaption.* Operations will be conducted in an environment of unprecedented complexity and the increasing pace of change will simultaneously make it difficult to directly apply lessons learned from previous operations in subsequent operations. Training for this environment must emphasize decision-making agility based upon general principles rather than detailed and prescriptive procedures;

- *Increased Autonomy.* Following the historic trend towards increased geographic dispersion, smaller elements and their commanders will more often find themselves separated in time and space from superiors. Leaders and soldiers will require the skills to understand their operating environment better by integrating a wide variety of military and non-military capabilities; and

- *Ethical Considerations.* With operations focusing more often on people rather than geographic terrain, interactions between soldiers, local nationals and foreign civilians, adversaries, and host-nation security forces or authorities will be increasingly common. Judicious application of force, including policing responsibilities, will require education and training to guide soldiers' conduct.

Training delivery must specifically conform to the broad types of operations most likely to be conducted for the sake of effectiveness. It must also remain general enough to permit agility and efficiency. This is accomplished by sustaining enough resources dedicated to training and by minimizing the loss of training competencies through timely or continuous training, and by moving systematically and progressively to levels of increasing complexity. The introduction or improvement of technology ought to make training easier rather than harder.

THE ARMY OF TOMORROW: EQUIPMENT—ENABLING SOLDIERS

The Family of Land Combat Systems (FLCS) framework is not all-encompassing; rather, it was developed to assist with articulating the complexity of land systems. Each particular study area is complicated in its own right, but it becomes a complex system of systems when the interrelationships are explored. Considerable staff effort was devoted to a number of FLCS studies to provide advice on Army of Tomorrow equipment requirements. That specific advice is not contained in this book, but the themes and trends identified are presented. See Figure 3, page 55.

Prior to investing resources to acquire equipment it first of all remains necessary to determine if the performance of existing equipment warrants the investment needed to replace it. With relatively fixed resources, and where a plethora of potential acquisitions are available, the process of selecting capabilities in which to invest is exceedingly important. In this constant balancing of requirements, the incremental improvements made available in weapons systems technology is unlikely to provide nearly the same benefit to the Army of Tomorrow as a pragmatic and sustained investment in developing the network, sensor suites, and other capabilities that facilitate situational awareness and information dominance. Effective weapon systems will remain a vital component of the force, and precision is an increasingly important technological development, but for the most part the weapons that the Army currently possesses will likely remain very capable against the adversaries most likely to be confronted in the foreseeable future. The greater challenge will continue to be finding and fixing our foes in order to employ our weapons at the time and place of our choosing. The Army that sees, knows and understands better

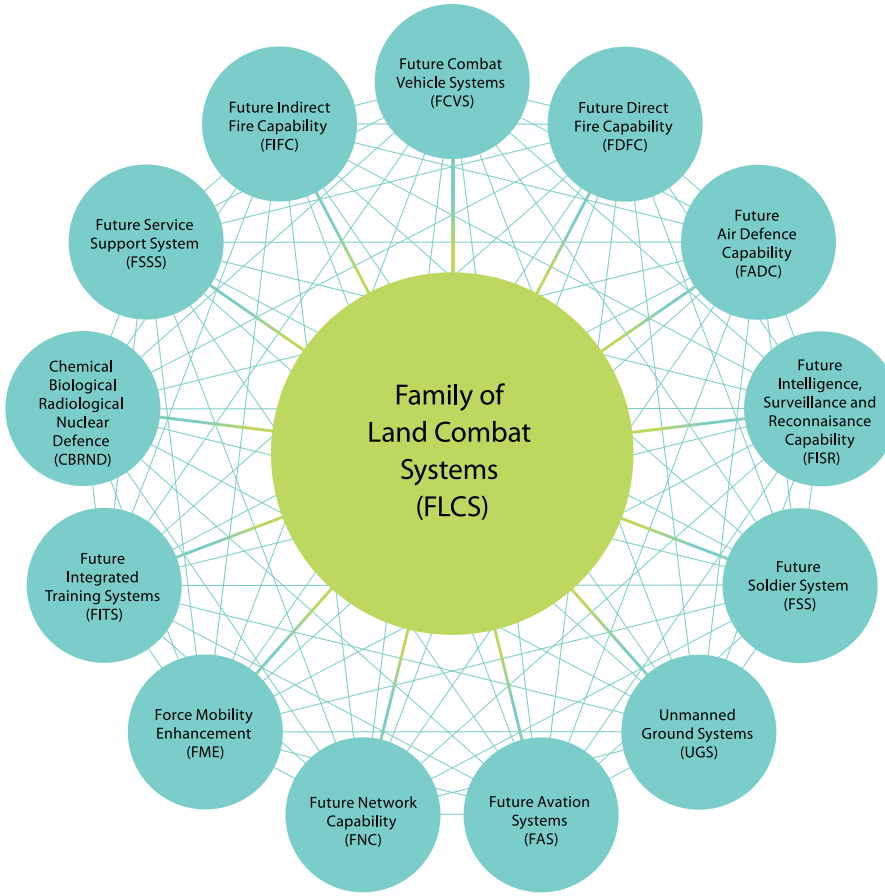

Figure 3: Family of Land Combat Systems (FLCS).

will be able to do much more with its resources. The Army, with better networks and information, will be more capable on the physical and moral planes.

Each platform is a balance of firepower or payload (so-called 'effects'), survivability, mobility, information and human factors. Within an affordability envelope, an overemphasis in any one area generally results in a decrease in another. Too much emphasis on the physical protection of a platform against a particular threat is likely to result in overly expensive systems that are vulnerable in other areas or less capable of carrying out the mission for which they were acquired. Further, and more specifically, overemphasis on defeating improvised explosive devices through building in physical mass has the potential to detract from the development of more holistic and effective means of mitigating the threat. A fascination with fewer, much more expensive and heavier platforms will inevitably reduce the flexibility, agility

and adaptability of the force over the longer-term. If this were to be the case, other elements of the force would necessarily be equipped with less capable platforms which would increase the overall vulnerability of the force. Realistically, and with Army of Tomorrow horizon equipment in view, a primarily LAV III-based Army would provide the desired flexibility, effectiveness and efficiency.

It is highly likely that newly acquired vehicles, weapons and equipment will remain in the Army's inventory for a considerable period of time. It is, therefore, essential that selection criteria emphasize open architectures that promote continual technological evolution. They must consider technology transferability in order to maximize the likelihood of enduring relevance. Acquisitions not offering these kinds of upgrades should only be considered to fill immediate pressing needs for which no other solution is possible.

Intimate support capabilities required to set the essential conditions and shape the operating space to enable success in close combat and in close engagement—in the form of supporting force elements—must receive platforms with similar mobility and protection to those of the supported force. The vulnerability of general support capabilities is often the Achilles' heel of modern forces and are just as subject to aggressive targeting. Intimate, close and general support capabilities must not receive less attention than the equipping of the F echelon.

In support of the principles of simplicity and economy the minimum number of fleets should be employed to the greatest extent possible. Commonality between fleets should be a strong consideration. The ultimate goal is a common operator station throughout the fleets. While this goal may be difficult to achieve, the benefit in reduced training alone will be immense. Where possible, 'fitted-for-but-not-with,' modular capability packs, and preconfigured or palletized 'functional' packages should be the standard.

To facilitate maintaining the force and leveraging available resources, every effort to reduce the non-essential wear on operational fleets must be pursued. The use of simulation, surrogate platforms, add-on armour and a managed training program will continue to be a vital aspect of Army of Tomorrow equipment management.

For the Army of Tomorrow to be strategically relevant, operationally responsive and tactically decisive, the vast majority of its vehicle, weapons and equipment suites shall be medium-weight. This means it shall have proper levels of protection, network connectivity, human dimension considerations, firepower and payload, and excellent strategic, operational and tactical mobility. The bulk of its mainstay fleet—both armoured fighting vehicles and logistics support vehicles—shall aspire to be air transportable by means of strategic and tactical lift.

Notwithstanding the nature of the capability procurement system, the principles outlined here shall be followed to the greatest extent possible in order to sustain the overall effectiveness of the Army of Tomorrow through building the most appropriate capability. The increasing complexity of FLCS demands that simplicity be injected wherever possible. The capability development process ought to cater to the sharply increasing demand for the force to be more flexible, adaptive and agile in its force generation and employment.

A COMPREHENSIVE APPROACH TO OPERATIONS—THE MINDSET

In the future operating environment successful intervention is unlikely to be achieved through the use of military power alone. In a world where security challenges are multidimensional in nature, an ability to bring to bear all instruments of national and multinational power and influence on a problem in a comprehensive, timely and coordinated fashion will be essential to achieving effective results. An ability to address and constructively engage the views and reactions of the public, both domestic and international, as well as the media, will continue to be crucial as operations unfold.

The Canadian Army has a long history of employing a comprehensive approach to operations. While definitions of the term have varied, recent work by the Comprehensive Approach Interdepartmental Working Group, suggests that the comprehensive approach may be defined as:

> *… the interaction of a diverse range of actors in a cooperative, collaborative and constructive manner in order to bring coherence to the planning, implementation and evaluation of efforts to resolve complex problems.*[24]

A comprehensive approach will involve closer collaboration between agencies in achieving strategic policy objectives. It will involve developing a capability to interact with a range of players in a cooperative, constructive manner. By doing so, the chances of achieving greater interoperability and collaboration among key parties in the operational arena increase, and so does the ability to develop the requisite networking capabilities and skills essential to achieving national objectives in the future security environment.

For the Army, the reinvigoration of the comprehensive approach will require the development of a force that is JIMP-capable. A JIMP-capable Army is able to effectively interact with players in four domains:

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24. See Comprehensive Approach Interdepartmental Working Group, "Strategic Level Concept—The Comprehensive Approach (Expeditionary) Discussion Paper," 17 December 2009, especially p. 7.

- joint, involving other national military elements and support organizations;

- interagency, involving other government departments and agencies, domestic and foreign (these agencies will include host-nation government departments including security forces, government departments and agencies from support nations, and international government bodies such as United Nations agencies);

- multinational, involving one or more allies or international coalition partners; and

- public, involving domestic and international publics, host-nation populations, media agencies, non-governmental organizations, public volunteer organizations, international organizations, commercial interests involved in reconstruction or development programs and private security firms hired to support.

Creation of a relevant JIMP-capable Army of Tomorrow will entail the adoption of an up-to-date approach to operations, both domestically and internationally, by allowing contributors to more effectively interact at all levels. It will involve adoption of an inclusive and systemic approach to problem-solving that involves the holistic consideration and coordination of all relevant contributors. It will require a capacity to interact with a wide range of organizations and groups in pursuit of overall shared objectives.

An effective and JIMP-capable Army will allow for interaction with the organizations and agencies of governments, private groups, publics, and non-governmental organizations and agencies. In an operating environment in which hybrid threats are likely to continue unabated, and in which global media will increasingly ensure that operations unfold before a wide audience, attention to civilians inhabiting the operating space, and the informational and moral aspects of operations will continue to remain very important to success. An essential capability will continue to be an ability to enhance awareness, communication, and if possible, coordination and cooperation with JIMP partners.

Creation of an effective JIMP-capable force will require:

- the adoption of a all-agency, potentially civilian-led, team approach to develop an integrated campaign plan to realize objectives in full-spectrum operations;

- the use of planning processes more accessible to non-military personnel;
- more interagency training;
- the necessity to better consider second and third order effects—particularly in the human dimension—in its planning process;
- the ability for all partners to plug into joint battlespace operating systems to interoperate effectively;
- the ability to facilitate the building of interagency and multinational interoperability through common education, interaction opportunities, secondments and exchanges, and collaborative planning mechanisms and protocols;
- an ability to connect non-governmental agencies with Canadian Forces operational architecture and provide liaison to support and accept support from these agencies in the execution of the mission;
- the ability to implement effective communication with joint and multinational agencies, including special forces;
- the capacity to access, collect, collate, assess, analyse and manage key information in an efficient and timely manner to assist in identifying targets for influence or physical attack and determine partner resources required in operations;
- the ability to clearly and effectively communicate the Army's role in mission goals, objectives and actions to the wider public; and
- a JIMP-enabled deployable division level headquarters.

Achieving these goals will take time and effort. With the diversity of organizations and agencies likely to characterize the future operating environment, each with its own culture, mindset, biases and capabilities, there are likely to be numerous constraints and restraints on planning and activities. The sharing of information between organizations will inevitably pose obstacles, particularly in view of concerns over operational security and personal privacy versus prevailing

concepts of the public good. Achieving effective coordination and cooperation among diverse groups, some with divergent and conflicting agendas and objectives, will also require considerable skill and diplomacy.

The potential results of an institutionalized comprehensive approach to operations are essential. Carefully crafted and practiced, a comprehensive approach will better socialize both the military and other organizations to the varied demands and important contributions which each can make in addressing the challenges of the future operating environment. The result will be a clearer understanding, respect and appreciation of the assets that varied players bring to the table, and an increased willingness to cooperate with others when possible and warranted. It will encourage broader support to future operations from a wide variety of sources. The creation of a comprehensive approach to operations is essential to achieving more effective solutions to the increasingly varied and multidimensional threats and challenges that the security environment will inevitably present in the Army of Tomorrow timeframe.

THE NETWORK—THE GLUE

In considering the design of the future network it must be reiterated that command is a human endeavour that relies upon the attributes of individuals who fulfil key roles in the decision-making process, and the dynamics between commanders and subordinates. As a consequence, the first and foremost requirement of any future network is to facilitate better human performance and interaction—the human factor is critical.

The development of a future network capability is a complex evolution toward emerging information systems technology which shall increasingly empower people, organizations and processes. Due to the high significance of the command function, the development of the future network capability must progress together with people and processes, and within an integrated, multinational and civil-military environment, as follows:

- *Improve Information Transition.* To improve information transition considerable effort must be devoted to understanding the human dimension as it relates to multifaceted information flows and information sharing which results ultimately in a useable and improved human systems interface that addresses cognitive functional integration. High fidelity battlefield visualization tools, ideally incorporating augmented reality[25]

25. http://www.wired.com/gadgetlab/2009/08/augmented-reality/#more-22882

or virtual reality features, aimed at improving information display, performance, system supportability and design integration, will be ideal areas for investment;

- *Improve Reach.* The purpose of improving reach is to expand the audience or recipients of information within the network. The most important and necessary capability to enable reach will be in the form of an all-informed secure digital network. It will need to be characterized by a high degree of availability and redundancy, offering multi-protocol transmission, and allow users to communicate by voice, text or graphically;

- *Networked Sensors.* Linking various sensors to each other will allow the sharing of the sensor product, smart allocation of sensor resources and machine-to-machine collaboration;

- *Improve Range.* The future network must deliver improved network coverage including connectivity on the move. It must improve the range of communications suites by offering range extending capabilities such as aerostat-borne radio rebroadcast capabilities;

- *Improve Collaboration.* The future network must allow the user to find and share information across a variety of repositories, formats and security levels. Improved collaborative planning and support tools will enable faster and more comprehensive situational awareness for the commander and staffs;

- *Information Management.* Effective systemic information management will be an essential enabler for the realization of the value inherent in the system. The accuracy and authority of information is paramount, but it must also be well organized. Coherent information management will be the foundation upon which this capability is built; without it, an overabundance of unrelated and unreliable data will inhibit the use of a system that could empower the force by providing access to the right information at the right time and place; and

- *Adaptive Command Philosophy.* The future network will not be a constant on a battlefield. The components of the network will expand or reduce in number depending upon variances in resources available, topography, atmospheric conditions and operational task. A commander therefore

must learn to adapt his command style to be able to command effectively within a robust network and equally effectively within an austere network. This adoptiveness reinforces the future requirement for mission command.

The Army must be network-enabled, capable of exchanging information laterally and vertically, between sensors, weapons, vehicles and command and control nodes, and enabling information accessibility by the right person at the right time. The nature of command in the Army of Tomorrow will be characterized by consistently high operational tempo over extended areas within complex terrain. The future network capability, while aiming to supply near-real-time situational awareness, must also enable faster decision cycles, encourage decisions to be made at the lowest level, and allow commanders on the spot to capitalize on opportunities. The Army will continue to emphasize the human nature of command whereby a command-centric approach shaped by mission command principles will lead to decisive action and the desired end-state. The success of the Army of Tomorrow in the conduct of adaptive dispersed operations is underpinned by a robust network with backup systems and other mitigating measures to ensure that the network does not equally become its greatest vulnerability.

SUSTAINMENT—THE LIFE BLOOD

The Army of Tomorrow requirement to provide assured support to widely dispersed land forces will demand a highly integrated, adaptive and flexible sustainment system. As a force becomes more dispersed, the sustainment system will likely need to transition from a primarily ground-based system to one that contains more integrated air support, though it is highly likely that there will be both ground and air-based sustainment activity within any given operation. Over-reliance upon only land-based sustainment in a non-permissive security environment could threaten tactical operations.

A focused logistics capability will contribute to the relevance, agility and decisiveness of the force through the provision of combat service support with the highest level of certainty. It will put the right support in the right place and at the right time. It will depend on the global projection of capabilities tailored to all envisioned tasks, and shall include total information management and precision service delivery capabilities that are technologically advanced, well protected, economical and sustainable. It will emphasize velocity within the supply chain rather than stockpiles and warehousing.

Networked sustainment planning tools and specialized delivery methods are the basis for a focused logistics capability. Assurance of support is the essential

characteristic of focused logistics. This assurance will be achieved largely through a system that is not just integrated, adaptive and flexible, but robust as well. Integration refers to the ability of all aspects of the sustainment system to work as part of a unified, well coordinated and reliable system of service delivery. This ability demands a technology enabled sustainment information management system as well as a service oriented mindset among the sustainment system's staff and personnel. Adaptivity has, primarily, to do with the scalability of the echelons to the precise capability directly required by the supported force. It has not just to do with task-tailoring the scale of the organization and its holdings, but also with the physical and mental capacity to adopt the battle rhythms and reliably work in the operating conditions of the mission. The notion of flexibility is based upon the ability to provide options for the means and methods of support to the force through the reliable and effective use of a variety of platforms, total asset visibility, and command and control enabled by good integrated logistics planning tools. Robustness demands that the sustainment system be adequately resourced at all levels, but particularly at the lower tactical levels.

DOMESTIC CONSIDERATIONS—THE HOME FRONT

Domestic Operations

The *Canada First Defence Strategy* sets out a vision for future operations that directs the Canadian Forces to effectively conduct operations at home, to be a solid partner in continental defence, and to fulfil a leadership role abroad. Canada First, in the title, does not equate to exclusive conduct of operations within Canada; rather, it is intended to empower the Canadian Forces to defend Canadian sovereignty, Canadians and Canadian strategic interests wherever it is necessary—at home, or abroad. Whereas Canada is undeniably the focus of this strategy, it will often be more efficient, effective and necessary to execute defence tasks abroad. *Canada First* does, however, very decidedly mean that the Army must be fully prepared to contribute quickly and decisively to the 'no-fail' task of defending Canadians at home.

The Army of Tomorrow's capabilities will be designed, for the most part, around the requirements to prosecute expeditionary operations. This force posture is not based on any relative priority between domestic and expeditionary operations. Rather, as demonstrated time and again throughout Canada's history, it is based on possessing the capability and capacity to successfully execute the tasks assigned by the Government of Canada—so we shall be well prepared for those that will be the most likely, complex and difficult. Future operations will demand that the Army can conduct both combat and complex stabilization tasks, including a wide range of domestic operations. Domestic operations are typically done quite well

using capability designed for international operations and warfighting, but in some discrete areas, such as on arctic operations, some select additional capabilities may be required. Deployment domestically has the potential to be as daunting an endeavour as the most difficult international operation when consideration is given to the geographic expanse, harsh climate and lack of infrastructure in most parts of the country. During significant national crises all available military resources would be employed in assistance operations. However, unlike in the defence of Canada, the Army is neither designed nor equipped as the 'force of last resort' for natural or human induced disasters.

Geographic Distribution of Forces

There is, and will continue to be, a high expectation that the Canadian Forces will provide assistance during times of domestic crisis. When crises occur they may present situations well beyond first responders' capacity to effectively manage it. The Army will be asked, and will need to be poised to quickly respond, to save lives and lessen pain and suffering. Establishing the conditions necessary to position the Army for success in domestic operations will require that appropriate capabilities are positioned for use where and when they are needed.

Success in the domestic deployed theatre of operations will come through consistent application of the adaptive dispersed operations force employment concept. The Army of Tomorrow shall continue to focus on the Canadian people. Consistent with this fundamental, it will be necessary for the Army of Tomorrow to base itself where it can most efficiently and effectively connect with and serve the majority of the Canadian population. Therefore, it must base itself at locations in close proximity to where the majority of Canadians live—near major population centres. To serve those Canadians not residing in or near major population centres or areas of national strategic importance the Army will need to maintain a liaison, planning and situational awareness presence and have the force projection capability readily at hand to move to, and operate where, the people of Canada need assistance.

Ongoing global environmental degradation and impending resource scarcities will generate heightened risks across the country, but particularly in coastal regions. With these significant influences and the increasing interest in harvesting natural resources from fragile arctic coastal regions, the threats to Canada's North will increase. These threats will be predominantly in the public safety and security realms. As the Canadian Forces normally only leads in the defence realm, and as there is the smallest likelihood that there will be a direct, land-based military threat to Canada's territorial sovereignty in the Army of Tomorrow period, the

adaptive dispersed operations principle of basing near the majority of Canadians and deploying as necessary to remote regions remains valid. As it is more probable that the Army will occasionally play a supporting role in operations in Canada's North, it will be important for the Army to acquire the capabilities at appropriate levels of readiness to support other government departments' operations there. The Army shall increase its focus on training, equipping and readiness for employment in the various arctic conditions.

Making best use of a broad recruiting base, improving access to education and training facilities, positioning for better domestic response, and geo-political influences will tend to drive the Army to more decentralization in the interests of effectiveness. Connecting with and serving the people of Canada to an extent that meets their expectation will also be an important consideration. The more recent historic trend has been centralization for the sake of economy, ease of training and efficiency. Efficiencies can be realized by limiting real property assets to those essential for basing, training and sustainment. Achieving an appropriate balance between effectiveness and efficiency in basing the Army throughout Canada is something that deserves a great deal more thought than it has been given in recent years.

Command and Control

When considering basing Army command and control elements, political, cultural, linguistic and geographic influences must be fully appreciated. For this reason it is imperative that the Army's command and control be structured and located to effectively interface with the critical national strategic centres (first and foremost National Defence Headquarters), and also to provide appropriate levels of interface with the Government of Canada's six federal regional constructs. The stand-up of 1st Canadian Division Headquarters will bring new and desirable command and control capability to the Army. It will need to not only reflect the requirements for which it has been designed, but it will need to be accommodated to the broader picture of the Army's command and control structure.

While Army command and control will exist within a larger evolving Canadian Forces structure, it must be able to perform a number of functions regardless of changing higher-level organizational constructs. The following sub-paragraphs briefly describe some of these Army of Tomorrow core command and control functions. The hierarchy is used for ease of reference and is not intended to suggest that these functions need to be nested within traditional organizations. What is important is that any organizational structure account for inherent limitations to the span of intellectual and physical control:

- *Strategic Headquarters.* The Army's strategic staff interfaces with the Government of Canada, Department of National Defence and the Canadian Forces to manage and conduct strategic planning, communications and stewardship, and to command subordinate training and education, force generation and infrastructure formations;

- *Operational Training and Education Headquarters.* The Army's operational training and education headquarters interfaces with the Army's strategic staff and with regional force generation headquarters to manage and conduct Army-wide collective training, individual training and education planning, communications and stewardship, and to command subordinate individual training and education formations and units;

- *Operational Force Generation Headquarters.* The Army's regional force generation headquarters interface with the Army's strategic staff, the Canadian Forces Force Employment Headquarters, Joint Task Force Headquarters, and with Government of Canada Federal Regional entities to manage and conduct operational planning, communications, and stewardship, and to command subordinate force generation formations and units with particular emphasis on managing and overseeing unit force generation, and Reserve Force personnel administration and career management,

- *Operational Infrastructure Headquarters.* The Army's operational infrastructure headquarters interface or are integral to other operational headquarters, and plan and manage infrastructure and logistic support; and

- *Tactical Headquarters.* Tactical headquarters interface with their superior operational headquarters to manage and conduct tactical planning, communications, and stewardship, and to command subordinate units.

It is important to note that regardless of the number of levels of headquarters, similar numbers and quantities of tasks will need to be performed. The variable is the degree of centralization or decentralization and the associated size of the headquarters. What has proven to be effective in controlling unnecessary growth in organizations is routine rationalizations and associated cuts that recognize appropriate areas of core business growth and divest in areas that have become less relevant to core business or that have grown due to the natural human tendency to

build bureaucracies. So, when rationalizing the sizes of headquarters, success will be achieved not by reducing or increasing their number, but by strictly disciplining their responsibilities and the size of their staffs.

The following factors shall be considered when deciding upon basing options for Army elements:

- the population distribution;
- vital national assets (economic and political);
- geographic impediments (including distances);
- the current level of developed infrastructure and its accessibility (e.g. access to training areas);
- the regional political, cultural and linguistic considerations, including forging and maintaining strong regional relationships and expertise; and
- its support to timeliness of domestic response.

OUT-OF-CANADA CONSIDERATIONS

The Canadian Forces fights in out-of-Canada operations in a manner similar to the way it conducts domestic operations; through Force Employment Headquarters, Joint Task Force Headquarters, and within a whole-of-government comprehensive approach. Additionally however, Canadian contingents operating out-of-Canada require inter-operability within alliance or coalition C2 constructs. This necessitates the requirement of the Army of Tomorrow network to "plug into" higher allied/coalition networks.

THE ARMY OF TOMORROW: CAPABILITIES

CONTEXT

Outside of a perceived existential threat to the nation—so called 'total war'—Canada has never been able to afford a standing military force with the capacity to deal with all projected threats. Therefore, appropriately sized standing forces designed to meet the demands of Canada's defence and foreign policy must have the flexibility, agility and adaptability to quickly meet evolving threats. Key to achieving

this level of capability will be possessing information superiority, superior quality soldiers, precision delivery of fires and influence activities, and a robust network. Achieving appropriate size and agility will demand a careful analysis of anticipated requirements, and considerable work to attain the optimum balance of breadth (what types) and depth (how much of each) of capability within our force structure. Sufficient breadth is required to cater for the range of requirements and sufficient depth is required to deliver appropriate and sustainable mass in force generation and force employment. In view of the requirement to maintain, project and sustain affordable capability to meet the most likely and most dangerous range of threats, the Army of Tomorrow shall not be overly specialized, nor shall it overinvest in niche capabilities with little chance of employment.

Each potential new element within the structure, and each new capability selected from the portfolio, must be considered within the context of building the whole Army of Tomorrow, including purchase costs, infrastructure, training, operations and maintenance, cascading effects and capacity for modernization. While the cost of introducing independent new capabilities might at first appear affordable, each introduction of capability must be considered within the overall design of the force. The Army must retain the ability to rapidly adapt to meet changing circumstances in the future security environment. With a disciplined capability development process the Army is able to pursue realistic goals in force design consistent with the trends in the operating environment, and appropriate for the future security environment, and still retain potential for rapid adaptation in reserve. The principle of building a heterogeneous force with relative symmetry in the force generating structures and a preponderance of medium-weight, LAV III type vehicles to equip it, engenders higher levels of readiness, deployability, sustainability, relevance, efficiency, and ultimately, effectiveness. This kind of force will be easier to manage over longer periods of time and its actual costs in money, people and time will be more predictable.

It is acknowledged that the future will unfold in ways that are unanticipated today and that will undoubtedly challenge our force structure. However, to mitigate the risks of an unpredictable future the Army will need to pursue a balanced, sustainable, combat-effective force structure that permits maximum institutional agility and the capacity to rapidly and successfully embrace change. The Army must revisit its analysis on a regularly recurring basis to ensure that shifts in the security environment are appropriately considered and accounted for.

DEFINING ARMY OF TOMORROW CAPABILITY: THE OPERATIONAL FUNCTIONS

The operational functions—Command, Sense, Act, Shield and Sustain—provide a useful framework for capability development purposes. One purpose of the operational function framework is to ensure that all capabilities contribute to the creation of military power in a balanced and clearly articulated manner. The operational functions were never envisioned to be just another means of dividing up capability domains into 'stove-piped' categories for ease of capability development management. The operational functions are designed to promote a holistic view of capability—every capability will contain some measure of all five of the functions:

- *Command.* The Army of Tomorrow requires a command and control system that supports commanders in the application of the tenets of mission command and manoeuvre warfare. This system must have the attributes of range, mobility and survivability, and form the backbone of a digitized and network-enabled force. Headquarters must be sufficiently capable through a balance of core and modular (scalable) capability (supported by adequate staff and leadership training) to be effective in domestic and expeditionary operations up to, and including, lead nation status. This capability must include the analysis, planning and operations management tools necessary to plan and coordinate the fires and creation of integrated outcomes across a large and complex area of operations. This system must be rapidly configurable for integration and collaboration within coalitions and other national command and control structures;

- *Sense.* The Army of Tomorrow requires an integrated intelligence, surveillance, target acquisition and reconnaissance (ISTAR) system that can gather and analyse data in support of the timely delivery of accurate information and understanding of the operating space under conditions that are exceedingly complex. This system requires a diverse suite of sensors, including networked uninhabited aerial vehicles, uninhabited ground systems and other autonomous and semi-autonomous systems linked to responsive intelligence capabilities and other analysis tools. Effective and appropriate sensor-to-shooter linkages must be available, including uninhabited attack assets with the appropriate sensor and command and control networks. The future operating environment will also demand an increased emphasis on specific collection and analysis capabilities such as those offered by an expanded electronic warfare and human intelligence capability, and will also demand a greater ability to extract data from all

available general sources (e.g. soldiers, JIMP partners). The ability to sense in the electromagnetic spectrum will be an essential capability whose value will increase in the future. While the ability to sense in complex environments is critical, the requirement to sense in open terrain and into airspace remains;

- *Act.* The Army will require a breadth of capabilities that delivers the means to create a number of outcomes, in a synchronized manner, against a variety of objectives, and under widely differing circumstances. Increasingly important is the requirement to create these results with precision, affecting only the objective, while minimizing collateral damage:

  - *Direct Fires.* The Army of Tomorrow direct fire weapons suite must provide for a layered, scalable, flexible (multi-purpose) and complementary breadth of systems necessary to support from the individual soldier level up to unit and formation level. This system will necessarily include mounted and dismounted systems capable of effective mutual support against most threats;

  - *Indirect Fires.* The indirect fire capability required includes the attributes of range, high accuracy area suppression, precision, lethal and non-lethal scalability, responsiveness and reliability (guarantee of fire). There is a pressing requirement for greater investment in uninhabited attack assets, linked to the appropriate sensor and command and control networks, both on the ground and in the air. While not all indirect fire assets need be integral to the Army, those that are essential for self-defence shall be. The indirect fire capability will take advantage of multiple targeting guidance systems; and

  - *Influence Activities.* To function effectively within the complexities of the future operating environment, an increased emphasis on effectively communicating in all dimensions—internally, with JIMP partners, with the people of Canada, with the international community, with populations in theatre and with adversaries—will be critical. The means to target adversaries on the moral plane and communicate with populations, in order to effectively influence people in the operating space, will be important tools in the conduct of operations across the spectrum of operations in the future security environment;

- *Shield*. The Army of Tomorrow must provide for protection across the physical (including electromagnetic), informational and moral planes. While the preponderance of direct physical threats that will be faced will not be new, ready access by enemies to inexpensive technology, conventional military weapons (e.g. mines, explosive materials, rocket propelled grenades) and chemical or biological materials, combined with their ingenuity and resolve, will provide them with increasingly effective means to attack any vulnerabilities. Countering these threats will involve an evolving process that will rely upon a nimble and flexible, yet structured and disciplined, approach to capability development. Too much emphasis on the physical protection of a platform against a particular threat is likely to result in overly expensive systems that are vulnerable in other areas or less capable of carrying out the mission for which they are acquired; and

- *Sustain*. The Army of Tomorrow will require a modern and appropriately resourced sustainment system that is able to operate successfully in the non-linear, non-contiguous environment. Accordingly, all combat service support soldiers must be appropriately trained and equipped to survive in the future operating environment from the sub-unit down to the individual platform level. The sustainment system must be robust, integrated, modular and container-based to provide the essential flexibility (provision of support options), adaptability (scalability), and agility. It must provide for real-time asset tracking and visibility, and sustainment management tools. Maintenance capabilities will include increased digitization of equipment to diagnose and correct problems before failures, and a protected recovery platform capable of recovering all vehicle types. The Army of Tomorrow also requires access to a flexible medical system with considerably greater reach than existing systems that will enable widely dispersed casualties to receive appropriately treatment in a timely manner. The future medical system will use digitization to continually monitor the condition and location of casualties in real-time to ensure the best medical response possible.

THE ARMY OF TOMORROW: FUNCTIONS

Whereas the operational functions provide a useful framework—in a broad sense—for the Army capability development process, the design process necessitates a closer examination of each of the Army of Tomorrow's functions. Figure 4, page 72, depicts the main Army of Tomorrow functions required. Organic and external capabilities will be required in differing degrees to provide capabilities to deliver on each of

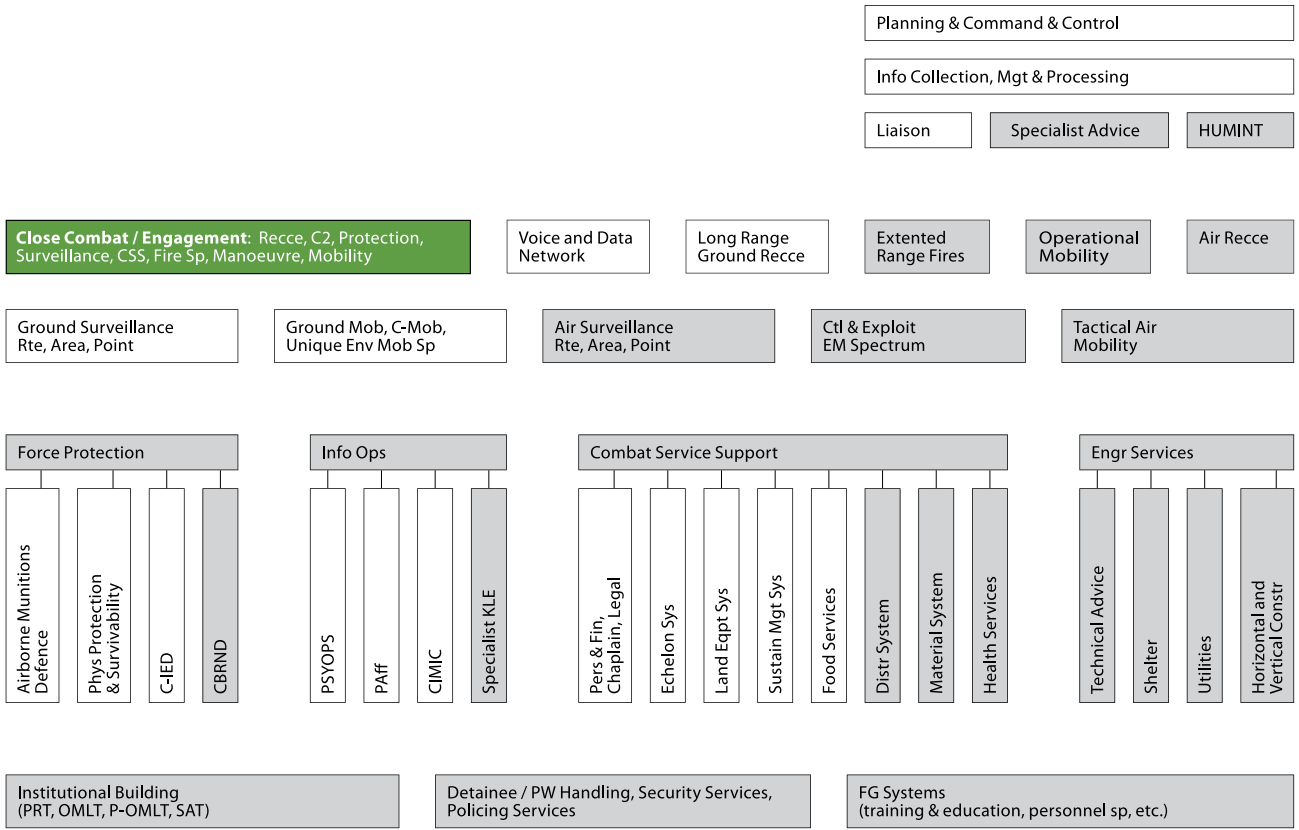

Figure 4: AoT Functions

these functions. This illustration is not intended to be inclusive; rather, it is intended to illustrate the following broad philosophical approach to be employed when designing the overall force and is a point of departure for further development.

FUNCTIONAL PHILOSOPHY

At the core of the combat-effective, multi-purpose Army of Tomorrow are those capabilities that conduct close combat and close engagement (stability tasks). The capabilities that provide these functions must be empowered and sustained by enablers that set the conditions for success in close combat and in close engagement. Accordingly, these critical enablers must constitute a significant portion of the force, but only relative to the size of the capabilities that conduct close combat and close engagement. In other words, the mathematical model for the Army of Tomorrow is based upon the quantity of close combat and close engagement capabilities, and the types and quantities of enablers must be relative to their supporting roles and proportional in their size. By using this proportional approach the Army of Tomorrow structure, and its resultant capacity to sustain missions, will be defined by the resources—principally people—that are applied. Once the resources are known, the relative size of close combat, close engagement, and enabling and sustaining capabilities can be determined, and subsequently, the number, size, types and sustainability of simultaneous and consecutive lines of operation can be established. As a principle, given the closed nature of the holistic Army equation, and given the truism that tactical success is ultimately achieved by close combat and close engagement forces, then the number of resources dedicated to enabling and sustaining capabilities should be minimized to the level essential to provide and sustain the core capability.

While joint, coalition and other partner's capabilities will be leveraged to augment the Army of Tomorrow's effectiveness, particularly in the realms of operational and strategic enablers, as a rule our forces must possess—integral to the force—those capabilities that are essential to their self-defence. Our forces will not deliberately be placed in situations where they lack the capabilities required to guarantee their own security and safety. The potential for critical capability deficiencies must, therefore, be carefully considered for every operation and reduced to the lowest practical level.

FIELDING ARMY OF TOMORROW ORGANIZATIONS

Key areas on which to focus for transitioning to the Army of Tomorrow
» intellectual and social capital
» sensing and sense-making
» achieving shared understanding and common intent
» collaborative and complex problem-solving methodologies
» harmonizing divergent organizational cultures
» precision
» the enhancement of the human—technology interface in the face of the complex environment

CONTEXT

The four dominant social groups in capability development are soldiers, scientists, managers, and administrators, all of whom have competing senses of priority and activity. Characteristically, soldiers like concurrent activity, but project managers prefer phased activity. Scientists prefer collaborative thinking, whereas administrators are more comfortable with hierarchical input. The negative caricature of bureaucracy is the result of the impressions these competing cultures create. Thus, the adoption of disciplined design principles will provide the best opportunity for successfully managing projects and programs with effective cost-control throughout their development. It is, in fact, systems management and systems engineering constructs that bond the various elements together in the larger military problem-solving context.

PERSONNEL AND ORGANIZATIONS

Structures and traditions that contribute significantly to the moral robustness of the Army shall, where practical, be safeguarded. An enduring challenge that will continue to frustrate the Build phase of Army of Tomorrow capability development will be creating adequate personnel flexibility to populate the essential force elements (the field force) and Army Foundation (the institutional piece). To create this flexibility, careful scrutiny must continue to take place in order to reallocate personnel where they are most needed. In an ideal world, tremendous flexibility could be realized by manifesting all skill sets in all soldiers, with no distinct 'trades' required. This ideal model would see generic soldiers—enabled by training and technology—capable of performing all necessary tasks. This goal will clearly never be fully achieved as there will always be some tasks that will require highly specialized skills for which inherent aptitude and special training will be required.

It is, however, important to accept that for maximum efficiency the trend should be to minimize the number of occupation fields, tempered only by the need for competence and effectiveness. It might be anticipated that some of the technical limitations that have precluded the emergence of this pattern will be overcome. Given this evolution, time will see some existing trades merging while others will evolve from their current focus to new ones with greater utility. In this context the trend will likely be that corps and branches will align their *raisons d'être* with one or more of close combat, close engagement, shaping or enabling activities (setting the conditions for successful close combat and close engagement) or sustaining the force. Soldiers in every trade must have sufficient close combat and close engagement skills so as to not be a liability to the overall force.

In addition to enhancing capability and shielding soldiers from particular hazards, technologies that offer the capability to replace soldiers in particular realms must be actively pursued. For instance, modern communications devices can and should be simple and intuitive to the point that little or no training and maintenance will be required, thus reducing personnel and time required on training and maintenance. As technology advances within the Army of Tomorrow timeframe, potential for other technologies—such as replacing drivers with robots in convoys—will be achievable.

Where a sufficient grouping of separate skill sets or functions exists that cannot be pragmatically sustained by close combat and close engagement soldiers or organizations without adversely affecting their ability or capability to remain proficient in their core competencies, a separate corps or branch will be required. Conversely, corps and branches should exist only if they provide sufficient unique functional capabilities that close combat and close engagement organizations cannot sustainably deliver themselves. These corps and branches should aim to provide the required capabilities with as few resources—particularly the human ones—as possible.

Reflecting the hierarchy of core competencies, Army of Tomorrow structures will emphasize close combat and close engagement capabilities and organizations. As a general rule, all personnel resources not essential to supporting, enabling or sustaining these functional capabilities will be used to build more capability in this area. These adjustments will increase depth, flexibility and homogeneity (i.e. simplicity) within the force, ensuring that the focus remains firmly on the generation, projection, employment and sustainment of core competencies.

ORGANIZATIONAL STRUCTURES AND FLEXIBILITY

To reduce disruption and lengthy training cycles, and to facilitate cohesion, the core functions required to conduct close combat and close engagement on deployed

operations should, where practical, be grouped integral to units and formations. Elements that would strain a unit's or tactical formation's ability to focus on its core competencies, that require extensive specialty training, or are too few in number to efficiently force generate from within a unit or formation construct, will be force generated from outside that construct and integrated during mission preparation training. For example, an infantry battle group with integrated sub-specialties such as pioneers and mortars is a more viable force generation organization than one with engineers and artillery permanently grouped with it. This approach frees up lower density, more highly specialized capabilities to concentrate on their fields of expertise and ultimately results in a more effective and efficient employment of forces. On the other hand, having such capabilities as an ISTAR Coordination Centre, an Influence Activities Coordination Centre, and an Intelligence Support Team permanently embedded within a unit provides a substantial capability improvement over task organizing these elements within a brigade context.

In the Army of Tomorrow, the practice of grouping and regrouping—which has been an enduring fundamental of land operations—will remain an important mechanism in both force generation and force employment. To enable this mechanism, capabilities must be developed in such a manner that they can be employed in the smallest element capable of providing the intended function, defined as a building block of capability. Each building block of capability must be designed so that it can be directly combined within a deployable structure such as a battle group, or combined to form larger structures that deliver the same function. Modularity shall provide the Army of Tomorrow with the required flexibility to provide task-tailored capability for employment on deployed operations.

The optimum construct for employment on operations should be based upon a battle group (or groups) deploying with the capabilities required to conduct and tactically sustain close combat and close engagement integral to their organization within a formation construct that provides the capabilities required to create the conditions for success but are beyond a battle group's capacity to manage. To facilitate planning, battle groups should have similarly structured combat service support elements designed to mesh within formation structures. In those situations where a battle group deploys for operations outside of a Canadian formation context, some capabilities normally resident at formation level may have to be shifted to the battle group, and the battle group's integral command and control capability augmented commensurate with the added burden.

DESIGNING STRUCTURE THROUGH THE CAPABILITY DEVELOPMENT PROCESS

Designing military structure is the process of organizing capabilities (groups of people, process, equipment and training) for both force generation and force employment. When discussing structure there is a tendency to focus on the most visible aspects of military capability: structural capital. Structural capital is the physical or tangible aspects of a capability, such as equipment, infrastructure and training. There are also less visible components to this capability model that ultimately have a greater influence in determining the effectiveness of a military capability. These key components are intellectual and social capital. The former is comprised of the concepts, education, doctrine, core skills and experience of a particular capability, while the latter embodies the moral plane of organizational culture, identity, relationships, leadership, cohesiveness and the reputation of a force.[26] The greatest potential for enhancing military capability in the Army of Tomorrow already lies within the structural, intellectual and social capital of today.

Doctrinal structures are based upon sound and proven principles and form the foundation from which the Army adapts to address perceived threats. Capability development structures are created by joining new or emerging concepts with doctrinal principles and organizations. The resultant capability development structures are then validated through experimentation, operational research and analysis, and trial to inform the transformation process from today's capabilities to those of the Army of Tomorrow. In the Build phase, the realities of resource constraints such as personnel, finances, time and existing infrastructure are brought to bear on the selected solutions.

TRENDS AND ARMY OF TOMORROW STRUCTURAL IMPLICATIONS

The work associated with the evolution of new or emerging structures for the Army of Tomorrow is involved in a continuous process of change aimed at addressing future violent conflict in general, as opposed to focusing on any specific theatre of operations. The changes deemed necessary derive from extensive observations, research, experimentation and analysis associated with the future security and operating environments described in Part One of this book. What follows are major factors to be faced and some broad deductions and implications for the Army of Tomorrow.

There are three main trends related to the future security environment that demand changes in how the Army will operate within the future operating environment:

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26. See Nick Jans and David Schmidtchen, *The Real C-Cubed: culture, careers and climate and how they affect capability*, Strategic Defence Studies Centre, Australian National University (Canberra: 2002).

- *An Evolving, Adaptive and Elusive Adversary.* The adversary will form an adaptive web of conventional, irregular, criminal and transnational actors. Many of these actors will not be easily identifiable, and if they are identified they will have the ability to readily blend back into the population. Their identification will require new methods of detection, recognition and marking;

- *An Increasing Appreciation for the Complexities of Conflict.* The Army's increasing appreciation of the complexities of persistent conflict among the people, and its associated hidden web of interdependencies, has demanded a greater level of analysis and understanding of the environment in order to achieve success. No one instrument of national power has the expertise to address all aspects of the conflict. Such conflict demands a collaborative and integrated approach of joint, interagency, multinational and public expertise; and

- *An Increasing Intolerance for the Imprecise Use of Force.* Advances in technology, combined with global media reporting and the need to protect perceptions of legitimacy, have led to increased expectations that collateral damage will be minimized. Increasing global intolerance for unnecessary death and destruction, and attendant strategic repercussions, have demanded the employment of increasingly precise and scalable capabilities.

These factors are not new in conflict. However, each represents a recent evolutionary change to the traditional Cold War operating environment. The evolution of all three combined represents a significant challenge for sustaining military effectiveness in the future security environment. The increased appreciation of the myriad of interdependencies associated with violent conflict since the end of the Cold War, combined with heightened global intolerance for unnecessary death and destruction, demands appropriate and precise application of force against an elusive and adaptive adversary. In view of these trends the Army of Tomorrow shall strive to understand and quickly adapt to the environment within which it operates in a number of ways:

- *The Intelligence Function.* The intelligence function is often confused with the Intelligence Branch (a grouping of personnel charged with coordinating and managing the intelligence function on behalf of Canadian Forces decision-makers at all levels). To achieve situational awareness and understanding of the operating environment the intelligence function ought to be done

by a multi-disciplinary group of experts from across the Canadian Forces, academia, government and outside agencies. Intelligence doctrine must embrace the shift in emphasis from a traditional concept of the enemy to an environment-based focus in order to address the complexities of the future operating environment. This shift in focus will be required to provide decision-makers with a more holistic appreciation of the situation and to facilitate the comprehensive approach. Such a change will require a greater breadth and depth of analytical expertise as well as improved information sharing policies across national and multinational departments and agencies. Success will require moving from a 'need-to-know' to a 'need-to-share' outlook. To facilitate this shift a standardized and integrated suite of toolsets will be required to help coordinate and discipline the analytical function, allowing for a virtual network of analysts across the globe. While an All Source Cell, All Source Intelligence Centre or National Intelligence Cell are critical capabilities in support of deployed operations, sufficient connectivity would assist in minimizing in-theatre force size by employing only those intelligence function personnel absolutely necessary to be co-located with in-theatre decision-makers down to subunit level;

> *The Intelligence Function at Tactical Unit Level and Below.* Current challenges pertaining to 'feeding' the intelligence function, timeliness and accessibility to intelligence product, and operator versus analyst organizational culture must be overcome in order to move to a more informed and adaptive force. While tactical units benefit from intelligence capabilities at static unit headquarters levels, deployed subunits are limited by their ability to report and access significant information and intelligence in a timely manner. Providing the technical services and bandwidth down to the individual soldier to empower adaptive dispersed operations will be essential, but will only address part of the challenge. Creating the necessary operator mindset in the analyst, and the corollary analyst mindset in the operator, is required to improve the intelligence function at the tactical unit level and below. Employment of intelligence analysts at the subunit level, and conversely, a greater number of operators within the analyst function at both tactical unit and formation levels, will form the foundation of this mutual understanding and help overcome timeliness and accessibility issues. A complimentary method of enhancing the intelligence function will be to cross-train subunit operators in analyst methodologies, and to educate and re-invigorate every soldier as a sensor through unit professional development and training;

- *Enhancing Leadership and Decision-making.* The complexities of modern operations have outstripped our ability to organize the information necessary to improve decision-making. An integrated toolset from tactical unit to formation level that, as a minimum, integrates intelligence and planning functions will be required. With further development, targeting, joint fires and current operations functions also need to be integrated with the toolset down to the individual soldier system level. Such a toolset should be based on a system-of-systems and manoeuvrist approach in order to support Army of Tomorrow's mission command fundamental. It should also facilitate collaboration with all JIMP partners to achieve the intent of the comprehensive approach. More important than the toolset is the need to educate decision-makers at all levels on how to face the complexities of the future operating environment. The nature of complex problems represents a departure from the tactical problems previously encountered in the context of traditional depictions of a conventional foe. There is a significant body of knowledge in this area, primarily surrounding pattern recognition, graphical modelling and collaborative discourse. As this body of knowledge evolves it will need to inform both the design of the toolset and the best education and training preparation in order to facilitate new approaches to problem-solving. It is likely that leaders with certain particular character and personality traits will be better suited for handling these complexities than others. More objective ways of quantifying leadership traits in the future will need to be embedded into selection mechanisms and professional development regimes. For example, a combination of psychometric profiling and 360 degree assessment could provide a basis for selection and improve performance in selection for command and staff positions. With the growing need for closer relationships with governmental departments and agencies, as part of a comprehensive approach to operations, such a model would enhance the Army of Tomorrow's ability to align leadership for specific missions;

- *Winning Close Combat.* The requirement to win in close combat precedes all other Army requirements, today and in the Army of Tomorrow. To ensure that this requirement is met the Army will design and field capabilities that will ensure that our tactical units will have at their disposal the right equipment, weapons and tactics to defeat any enemy in close combat, regardless of terrain, season, or weather. Those committed to designing the Army of Tomorrow appreciate that the next evolutionary advancement in land warfare is the need for tactical army commanders to dominate the air

space immediately above an identified or suspected enemy. The acquisition of uninhabited aerial vehicles that can transport ISR capabilities, direct fire missiles, and communications enhancers—if properly linked to and responsive to a ground tactical commander—will provide a quantum leap in Army capability to precisely find, fix and finish an enemy. Combined with an enhanced capability for airmobile insertion and helicopter airborne command and control the Army of Tomorrow will have realized true ability to dominate airspace and deny the enemy options to effectively hold ground or disperse before our more conventional close combat capabilities have been able to engage;

- *ISTAR.* ISTAR is the process that synchronizes information collection, processing and dissemination to provide situational awareness to support targeting and decision-making. ISTAR is the sensing and 'making sense' aspect of decision-making. To enable success in the future operating environment the Army of Tomorrow will need education and training to impart an understanding of the importance of the sense function. Reconnaissance and surveillance will not be tied only to specific and specialized organizations. Rather, they will be tasks for which every soldier will have a responsibility to perform. It will take a concerted level of participation and commitment to improve the Army's speed and capacity to understand the problems it will face. The force will need to be equipped, down to the individual soldier system, with Global Positioning System-enabled, handheld, data collection technologies and sensors. To stimulate a broad-based learning culture across the Army, and yet not equip it with the means by which it can leverage its learning and improve performance, is to invite systemic disappointment and failure. To enhance operational effectiveness and maximize force protection in the Army of Tomorrow timeframe, sensor control and feed will need to be embedded within units down to platoon level. Technology will not be a panacea in confronting the problems of the future security environment, but the key to understanding the environment will be a well informed and mentally agile force that espouses a continuous learning culture and is enabled by up-to-date technology;

- *Information Management and the Technical Network.* Whoever has the best, and most current, information, and has the means and mechanisms to make effective use of it, will have a definite advantage in future operations.

Computing power will increasingly have the capability to arrange and display information in a manner that readily supports the human mind to quickly recognize trends, draw conclusions and make better informed decisions. Systemic information management, and ultimately knowledge management, will be a critical key to unlocking this powerful enabler. To realize this potential, the Army of Tomorrow will need to embed new structures, processes and procedures throughout the force. The system will be based upon a properly organized operational database with information constantly being fed in from every level of the organization. The future network capability must ensure reliable access to the electromagnetic spectrum;

- *Force Development of Influence Activity Enablers.* Adaptive dispersed operations have an increased focus on people—the human terrain—within the future operating environment. Activities conducted on the physical plane shall be prosecuted with the view to achieving desired effects on the moral plane (i.e. in the human dimension). Capabilities such as civil-military cooperation (CIMIC), psychological operations, media operations and public affairs, must be institutionalized within the Army of Tomorrow. Soldiers will require training and experience in these functions;

- *Resourcing Combat Service Support Structures.* The ability of the Army of Tomorrow to execute high tempo adaptive dispersed operations will depend upon, and will ultimately be limited by, the capacity of the service support system to sustain it in operations. While elements of the system will be able to be provided by third party service organizations, the manoeuvre units and sub-units will require dedicated integral support elements. Battle groups and companies will require sufficient assurance that resources will be available so their focus is not diverted from conducting tactical operations. Service support shall be projected outside of secure areas through the use of dedicated and task-tailored echelons with mobility, protection and situational awareness equitable to that of the supported forces, and commensurate with the duties they are expected to perform. All lines and levels of support shall be designed with sufficient personnel, equipment and commodity resources, and sufficient modularity to service all units and sub-units simultaneously. Non-traditional service delivery capabilities, such as precision aerial and aviation delivery, will form an important surge capacity within the sustainment system. While it may prove difficult to fully resource the service support capability in force generation structures, to

provide sufficient resiliency in operations it is imperative that it be properly resourced. Modernization programs must include the aggressive pursuit of enabling technologies to facilitate distribution, reduce demand, enhance reliability, reduce maintenance and improve casualty care, evacuation and the continuing health of our soldiers;

- *Echelons.* Supplies, services and coordination authorities shall be organized using an echeloned structure. The depth and breadth of sustainment capabilities at any level will be subject to adjustment through the addition or subtraction of elements—building blocks—of capability. The echelon will be composed of both specialist trade as well as combat arms soldiers, but all personnel employed in echelons shall be competent and capable soldiers. The force will take full advantage of increasing levels of situational awareness and the advantages inherent in a distribution-based, proactive system. Precision in both planning and delivery, combined with flexibility in the means of service delivery and adequate redundancy, will allow for a move away from rigid replenishment systems;

- *The Dismounted Soldier.* Violent conflict is an inherently human endeavour and the dismounted soldier will remain the best close combat and close engagement resource. While soldiers will be empowered and protected by new technology, technology will not be enough to achieve success on operations. To ensure that soldiers are properly prepared for future conflict, they will require rigorous professional education and training. In the context of the future security environment and a comprehensive approach to operations, leaders at all levels shall be better positioned to succeed in their missions through better understanding and consistent application and practice of the enduring principles and fundamentals of good leadership; and

- *Developing and Building Tactical Formation Level Expertise.* It is anticipated that Canada will continue to deploy tactical units and formations to intervene in violent conflict on the international stage. The Army of Tomorrow will need to ensure that its educational and training institutions focus on the production of effective staff officers for battle group, brigade and division headquarters.

CONCEPT DEVELOPMENT AND EXPERIMENTATION

The Land Staff oversees capability development and force management through its commitment to the Land Capability Development Continuum. Concept development for the Canada's Army begins with perpetual research into the future security environment, and as a subset of that, the future operating environment, within which Canada's Army of Tomorrow must be able to effectively operate. These bodies of work, in turn, form the foundation upon which a future force employment concept is developed. *Land Operations 2021, Adaptive Dispersed Operations: The Force Employment Concept for Canada's Army of Tomorrow* was published in 2007 and "serves as the guide for Land Force Development through to the year 2021."[27] It forms a conceptual model that describes in a broad manner how the Army of Tomorrow should be able to operate, but on its own it does not provide the detail required to direct and enable the Build pillar of the Land Capability Development Continuum.

Capability Development Records are the focal point of the Conceive and Design pillars' work and cover a broad range of various capability areas reflected in general by the component parts of the Family of Land Combat Systems and the Developmental Force Employment Structures. The concepts for future capabilities and their envisioned operating concepts constitute the main part of Capability Development Records. The intent of the Design pillar work captured in the Capability Development Record is to record the transfer of sufficiently detailed background, guidance and direction for follow-on Build pillar work, which in part takes place in Land Staff processes such as Land Force Development Working Groups and capital equipment projects. In particular, *a clear statement of operational capability requirements or deficiencies shall be included*. The documentation must be supported by robust engagement both within the Land Staff and with Chief of Force Development and other service staffs in order to close the gap between Design and Build pillars.

In order to provide the necessary guidance with adequate detail to inform the Build team, the Land Staff employs a capability development experimentation program. This program will holistically test and refine the proposals of planned

27. From the Commander Land Force Command preface to *Land Operations 2021, Adaptive Dispersed Operations: The Force Employment Concept for Canada's Army of Tomorrow*, p.2.

and envisioned Army of Tomorrow concepts, capabilities and structures, and enable the further examination of the key PRICIE elements of future capability within a system-of-systems approach. The capability development experimentation program will work within the guidance and direction provided by the Army Capability Development Board and the Army Program Board, and will include and leverage other Canadian Forces and Government of Canada resources as appropriate. This guidance and direction on future concept development and experimentation in support of capability development will be found in the Army Operating Plan.

The capability development experimentation program shall include events of varying size and scope. The central event will be a large-scale integrated experiment with participation from the full membership of the Army Capability Development Board. This integrated event will be set within the joint context and will normally be conducted on an annual or bi-annual basis. Smaller events dealing with specific areas of investigation, often in high degrees of fidelity, will occur between the large integrated events to follow through on specific lines of investigation or in preparation for the next large scale integrated event. Events may be conducted as studies, may make use of synthetic environments or may involve actual units and soldiers.

The capability development experimentation program will address the most pressing high-level issues facing the Army's capability development community. First and foremost, the adaptive dispersed operations concept itself will be continuously scrutinized for applicability and relevance as our understanding of the future operating environment evolves. In addition, the Army of Tomorrow systems, that is the Army equipment program (current, planned and projected), and the future organizational structures will be tested and validated against the ever increasing demands on the Army to train for and successfully conduct operations.

WATCHING THE FUTURE

The security environment described in Part One suggests a future marked by a number of considerable challenges. It does not take much imagination to consider the potential impacts of resource scarcities, particularly in the area of non-renewable energy and fresh water, and the wide array of possible effects associated with climate change, to conclude that any precise description of the nature, location and severity of the threats and challenges that the Army of Tomorrow will face in the future remains difficult. A sure conclusion, drawn from an examination of the future security environment, is that a future of rapid change, high uncertainty and considerable volatility is highly probable.

Defence planners and analysts shall continue to maintain a watchful eye on the unfolding security environment and the various trends that characterize it, paying close attention to the potential impacts of trends, their interaction, and most importantly, the potential implications that they hold for the development of our Army of Tomorrow forces. Only then will it be possible to ensure that we are truly capable of achieving the degree of adaptation necessary to effectively address the challenges that the future security environment and operating environments will undoubtedly raise.

Technological change is, and will continue to be, the most dynamic factor influencing the future security environment. The forces of globalization and commercialization of science and technology are providing current and future adversaries with ready access to advanced technologies as well as the knowledge and expertise needed to exploit those technologies.[28] A multitude of evolving technologies exists for which advances are being driven by the commercial, global, scientific and technical communities. Human societies do not mobilize to fight one another with bare hands; rather, they choose to augment their natural human abilities with technology. Doing so increases their reach, lethality and likelihood for success. Thus, while war remains a distinctly human endeavour, warfare is unquestionably a human-technological undertaking.

RISK

This book is about preparing to meet an uncertain future. As the trends identified and extrapolations anticipated will undoubtedly be imprecise, any specific conclusions and deductions based upon these predictions are equally imprecise. Thus, the key message is that the Army must build adaptable and sustainable forces, but above all, foster a culture of agility while creating and protecting the institutional means to effect change.

28. Ruth A. David, Avoiding Surprise in an Era of Global Technology Advances, Committee on Defense Intelligence Agency Technology Forecasts and Reviews, National Research Council, THE NATIONAL ACADEMIES PRESS, 500 Fifth Street, N.W. Washington, DC 20001.

CONCLUSION

The world is entering a period of intense perpetual change and rising instability, and Canada, the Canadian Forces and the Army will be significantly challenged in this environment to defend Canada, the people of Canada and Canadian interests. To be effective in the future security environment the Army of Tomorrow shall evolve more quickly and more fundamentally than it ever has before, outside of wartime situations. These changes will permeate all aspects of the institution; however, none will be more important or difficult to change than the Army's intellectual and social capital. But change we must. Communicating this compelling need for change and leading the Army through these requisite changes to the Army of Tomorrow will demand an encompassing vision, a coherent and stable plan, and strong leadership.

GLOSSARY

In the writing of this manual the following abridged capability development definitions have been used:

Capability. The ability (power) to accomplish something (composed of people, process, equipment and training).

Function. A description of what (the something) a capability is intended to provide.

Core Competencies. The most important functions or group of functions that define the basic purpose of the Army of Tomorrow.

Organization or Structure. A grouping of capabilities.

Characteristic or Attribute. The nature and qualities of a thing.

Fundamental or Principle. Basis or foundation.

Adaptability. The ability to adjust a capability or an organization to a new purpose.

Flexibility. The degree and rapidity of which capability or organization can adapt (a measure of effectiveness of change).

Agility. The ease of adaptation (a measure of efficiency of change).

The Operational Functions. The Army uses five operational functions as a framework for concept and capability development. The strength of the operational functions stems from the indivisible integration of capabilities and on the incorporation of the moral, physical and informational planes. The functions retain their viability in a continuum going from the strategic to the soldier levels:

- *Command* integrates all the operational functions into a single, comprehensive strategic, operational or tactical level concept. It is the nexus of all activities, integrating all functions towards the attainment of specific

operational goals. The human nature of command will remain paramount, whereby a command-centric approach will be shaped by mission command;

- *Sense* integrates sensor and sensor analysis capabilities into a single concept. This initiative breaks previous sensor and information stovepipes, allowing for comprehensive sensor fusion and all source analysis within a single system. This concept moves beyond the simple collection of data or information to provide commanders with timely and relevant knowledge;

- *Act* integrates manoeuvre, firepower and offensive information operations to create a desired effect and end-state through the synchronized application of the entire array of available capabilities, both lethal and non-lethal. The concept is relevant across the continuum of operations, from domestic and humanitarian missions to combat;

- *Shield* provides for the protection of a force's survivability and freedom of action. Shield is a layered, integrated and comprehensive operational function that seeks to prevent any impact on friendly forces across the physical, moral and informational plane that could affect survivability or freedom of action; and

- *Sustain* integrates strategic, operational and tactical levels of support to generate and maintain force capability. This function addresses issues of sustainment on the physical and moral planes. It integrates the provision of materiel and personnel support to ensure the sustainment of combat power. It fully integrates all levels towards the attainment of this objective, linking combat activities to the national base.

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Designing an Army to meet the uncertainties of the future is a challenging endeavour in which many competing considerations must be balanced. This publication aims to inform the design of the Army of Tomorrow by framing the situation, identifying trends and setting out the broad philosophies, fundamentals, principles and characteristics that are essential to build an effective and sustainable force. It provides guidance on the consideration of the most important factors in developing the force.

Designing Canada's Army of Tomorrow is aimed at a varied readership. Army leaders will find a useful synopsis of the most important aspects of future security environment analysis and the pressing concept and capability development issues facing the Army Foundation. Army capability development staff will receive a stronger appreciation and much clearer picture of the implications stemming from the adoption of *Land Operations 2021—Adaptive Dispersed Operations: The Force Employment Concept for Canada's Army of Tomorrow* as the Canadian Forces concept for land operations. The Canadian Forces and partner nation capability development communities may find useful models due to the maturity of the Canadian Army capability development process and the rigour of the research involved in the process. For the more general military, government and public audience this publication will provide an accessible entry point into understanding the process that turns ideas into appropriate capabilities.

National Defence Défense nationale

Canada

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