To Transform An Army

The Canadian Interpretation of The RMA and The Transformation of Armoured Vehicle Design, 1992-2008: The Case of the LAV-III

Transformer une armée de terre

L'interprétation canadienne de la RAM et la transformation de la conception des véhicules blindés, de 1992-2008: le dossier du VBL-III

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Abstract

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To Transform An Army
The Canadian Interpretation of The RMA and The Transformation of Armoured Vehicle Design, 1992-2008: The Case of the LAV-III

Between 2003 and 2006, the Canadian land force pursued a program to create a Direct Fire Unit (DFU) vehicle family based on the Light Armoured Vehicle (LAV)-III as part of military Transformation. This program grew out of 1990s discourse on the concept of a Revolution in Military Affairs (RMA). RMA proponents argued that the emergence of information technology would allow the creation of completely new weapons systems and military capabilities. As opposed to this intention, the criticism that Western military forces pursue procurements which are characterized by "trend innovation" has emerged in some studies. Trend innovation describes a tendency for military forces and industries to make modifications to existing categories of weapons platforms rather than developing fundamentally new systems, usually driving up costs while failing to achieve concomitant gains in military effectiveness.

The LAV was not a new platform, but had originally been developed in the 1970s. In 2006, the Canadian land force cancelled the DFU, which had been intended to replace its Leopard-1 main battle tanks, and instead acquired Leopard-2 tanks. The Leopard 2 had also been developed during the 1970s. Why, then, were these two platforms pursued as part of Transformation, and why did the reversal happen? The overall thesis of this work is that governmental politics refocused what were intended to be far-reaching initiatives into addressing near-term concerns, reinforcing trend innovation. More specifically, the case study of the DFU shows that bargaining for limited funds between subsidiary organizations within the Canadian land force, as well as between it and the Canadian federal government, spawned first the creation of the DFU program, and then its termination.

This bargaining also has specific implications for the history of Canadian defence procurement. A small number of studies of Canadian military procurements have used variants of the governmental politics methodology. However, they generally focus on aspects of organizational bargaining between a given service and other services or government departments. These works have also found that tracking Canadian military procurements through publicly available information is very difficult, with one describing the Canadian acquisition process as "opaque." This dissertation shows that it is possible to examine the details of governmental politics within a Canadian military acquisition program, and that such politics reach deeper than the interactions between federal departments and between those departments and elected officials. In the case of the Direct Fire Unit (DFU), disagreement and organizational bargaining within the land force itself had a greater effect than difficulties in coordination between the land force and other government departments.

RÉSUMÉ

Transformer une armée de terre

L'interprétation canadienne de la RAM et la transformation de la conception des véhicules blindés, de 1992-2008: le dossier du VBL-III

De 2003 à 2006, la Force terrestre canadienne a cherché à mettre en œuvre un programme de création d'une famille de véhicules d'unité de tir direct (UTD) basée sur le véhicule blindé léger (VBL)-III dans le cadre de la Transformation de l'armée. Ce programme a vu le jour dans la foulée du concept de révolution dans les affaires militaires (RAM) des années 1990. Les adeptes de la RAM soutenaient que l'avènement des technologies de l'information ouvrirait la voie à des systèmes d'armes et des capacités militaires complètement différents. Dans le camp opposé, des études jetaient une lumière peu flatteuse sur cette proposition, affirmant que les forces militaires occidentales cherchaient à faire de l'« innovation conjoncturelle », soit une tendance, pour les forces militaires et les industries, de vouloir apporter des modifications aux catégories de plates-formes d'armement existantes plutôt que d'élaborer des systèmes fondamentalement nouveaux, un procédé qui augmente en général les coûts sans pour autant entraîner de gains proportionnels en termes d'efficacité militaire.

De fait, le VBL n'était pas une nouvelle plate-forme : il avait à l'origine été conçu dans les années 1970. En 2006, la Force terrestre canadienne a mis fin au programme d'UTD, qui était censée remplacer ses chars de combat principaux Leopard-1, pour acquérir à la place des chars Leopard-2. Le Leopard 2 avait lui aussi été conçu au cours des années 1970, alors pourquoi ces deux plates-formes avaient-elles été envisagées dans le cadre d'une Transformation, et pourquoi ce renversement de situation? La thèse globale dont il est question dans cet ouvrage est que la politique gouvernementale a redirigé ce qui était censé être des initiatives à long terme pour répondre à des besoins à court terme, donnant ainsi encore plus dans la tendance de l'innovation conjecturelle. Plus particulièrement, l'étude du cas de l'UTD montre que c'est en fait une lutte pour l'obtention de fonds limités entre organisations filiales de la Force terrestre canadienne, et entre elles et le gouvernement fédéral du Canada, qui a été à l'origine du programme d'UTD d'abord, puis de son démantèlement par la suite.

Cette lutte de « marchandage » a également eu des conséquences précises sur l'histoire des acquisitions de la Défense canadienne. Un petit nombre d'études de l'approvisionnement militaire au Canada se sont appuyées sur des variantes de la méthodologie de la politique gouvernementale. Toutefois, elles sont en général axées principalement sur les aspects du marchandage organisationnel entre un service donné et d'autres services ou ministères. Ces études ont également fait ressortir qu'il était très difficile de retrouver les traces des acquisitions militaires au Canada au moyen d'information accessible au public, l'une d'entre elles qualifiant même le processus d'acquisition canadien d'« opaque ». Cette dissertation démontre néanmoins qu'il est possible d'examiner les détails d'une politique gouvernementale dans le cadre d'un programme d'acquisition militaire canadien, et qu'une telle politique va plus loin que les

interactions entre ministères et entre ministères et représentants élus. Dans le cas de l'UTD, les désaccords et le marchandage organisationnel au sein de la Force terrestre elle même ont eu des incidences plus grandes que les problèmes de coordination entre la Force terrestre et les autres ministères.

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List of Acronyms

Due to the number of acronyms used in this dissertation, the full citation for each acronym is provided the first time that it appears on a page.

1 CMBG	1st Canadian Mechanized Brigade Group
2 CMBG	2nd Canadian Mechanized Brigade Group
ABCS	Army Battle Command System
ABCS COE/CA ORD	Army Battle Command System Common Operating Environment/ Common Applications Requirements Document
ACLS	Assistant Chief of the Land Staff
ACV	Armoured Combat Vehicle
AD	Air Defence
ADATS	Air Defence Anti-Tank System
ADM	Assistant Deputy Minister
ADM Pol	Assistant Deputy Minister Defence Policy
ADMP	Army Digitization Master Plan
ADO	Army Digitization Office
AFV	Armoured Fighting Vehicle
APC	Armoured Personnel Carrier
ASCC	Air Space Co-ordination Centres
ASMP	Army Strategic Mobility Plan
AWE	Advanced Warfighting Experiment
BCT	Brigade Combat Team
BITS	Battlefield Transmission System

C2	Command and Control
C3	Command, Control and Communications
C31	Command, Control, Communications and Intelligence
C4	Command, Control, Communications and Computing
C4I	Command, Control, Communications, Computing and Intelligence
C4ISR	Command, Control, Communications, Computing, Intelligence, Surveillance, and Reconnaissance
CCV	Close Combat Vehicle
CDS	Chief of Defence Staff
CEV	Close Effect Vehicle
CF	Canadian Forces
CLS	Chief of Land Staff
CNR	Combat Net Radio
COE	Contemporary Operating Environment
COTS	Cheap Off The Shelf technology
CRAD	Chief of Research And Development
CTC	Canadian Training Centre
D Pol Dev	Director of Policy Development
DAD	Directorate of Army Doctrine
DAT	Directorate of Army Training
DFPPC	Director Force Planning and Program Coordination
DFS	Direct Fire System (variant of Direct Fire Unit)
DFSV	Direct Fire Support Vehicle
DFU	Direct Fire Unit

DG Pol Plan	Director General Policy Planning
DGLCD	Director General Land Combat Development
DGLS	Director General Land Staff
DGSP	Director General Strategic Planning
DLCD	Directorate of Land Concepts and Designs, originally Directorate of Land Strategic Concepts
DLSC	Directorate of Land Strategic Concepts, later becomes Directorate of Land Concepts and Designs
DLSE	Directorate Land Synthetic Environments
DLSP	Director Land Strategic Planning
DND	Department of National Defence
DRDC	Defence Research and Development Canada
DTO	Defense Technology Objective
EFP	Explosively Formed Projectile
EPLRS	Enhanced Position Location Reporting System
EXFOR	Exercise Force
FBCB2	Force XXI Battle Command Brigade-and-Below
FCS	Future Combat System
FIFC	Future Indirect Fire Capability
FLIR	Forward Looking Infrared (camera)
GBAD	Ground Based Air Defence
GDLS	General Dynamics Land Systems
GPS	Global Positioning System
HIBC MNS	Horizontal Integration of Battle Command Mission Needs Assessment

HIC	High Intensity Conflict
IBCT	Interim Brigade Combat Team
IC	Industry Canada
IFOR	Implementation Force (Bosnia peacekeeping operation)
ILS	Integrated Logistics Support
IRB	Industrial Regional Benefits
ISS	In-Service Support
ISTAR	Intelligence, Surveillance, Target Acquisition and Reconnaissance
ITAR	International Traffic in Arms Regulations
LAMTF	Louisiana Maneuvers Task Force
LAV	Light Armoured Vehicle
LAV-TUA	Light Armoured Vehicle – TOW Under Armour
LdSH(RC)	Lord Strathcona's Horse (Royal Canadians)
LFDTS	Land Force Doctrine and Training System
LIC	Low Intensity Conflict
LLAD	Low Level Air Defence
LLTV	Low Light Television
MAIS	Mobile Automated Instrumentation Suite
MGS	Mobile Gun System
MMEV	Multi-Mission Effects Vehicle
MND	Minister of National Defence
MTR	Military Technical Revolution (older variant of Revolution in Military Affairs)

NCM	Non Commissioned Member
NCO	Non Commissioned Officer
NDHQ	National Defence Headquarters
NGO	Non-Governmental Organization
OEF	Operation Enduring Freedom
OIF	Operation Iraqi Freedom
OOTW	Operations Other Than War
OR	Operational Research
PMO	Program Management Office
PRICIE	Personnel, Research & Development, Infrastructure and Organization, Concepts, Doctrine and Collective Training, Information Management, and Equipment, Supplies and Services
PWGSC	Public Works and Government Services Canada
RBA	Revolution in Business Affairs
RFP	Request For Proposals
RLA	Revolution in Logistics Affairs
RMA	Revolution in Military Affairs
SBCT	Stryker Brigade Combat Team
SCIP	Strategic Capability Investment Plan
SHORAD	Short Range Air Defence
SINCGARS	Single Channel Ground and Airborne Radio System
SOF	Special Operations Forces
SOP	Standard Operating Procedure
SOR	Statement of Operational Requirement

SRB	Senior Review Board (Canadian military procurement)
TACOM	Tank-Automotive and Armaments Command (U.S.)
TOW	Tube launched, Optically tracked, Wire-guided missile
TRADOC	Training and Doctrine Command (U.S.)
TTPs	Tactics, Training and Procedures
UAV	Unmanned Aerial Vehicle
UGV	Unmanned Ground Vehicle
VCDS	Vice Chief of Defence Staff

Introduction

To Transform an Army

Between 2003 and 2006, the Canadian land force pursued a program to create a Direct Fire Unit (DFU) vehicle family based on the Light Armoured Vehicle (LAV)-III as part of military Transformation. Within that context, the DFU was intended to replace Canada's Leopard-1 main battle tanks. Subsequently, it cancelled that program and instead acquired Leopard-2 tanks. Why did this reversal take place? The overall thesis of this work is that bureaucratic politics refocused what were intended to be far-reaching initiatives into addressing near-term concerns, reinforcing an effect which has been called "trend innovation." More specifically, the case study of the DFU shows that bargaining for limited funds between subsidiary organizations within the Canadian land force, as well as between it and the Canadian federal government, led to first the creation of the DFU program, and then its cancellation.

The CF's Transformation program of 2003-2006 grew out of 1990s discourse on the concept of a Revolution in Military Affairs (RMA).[1] RMA proponents argued that the emergence of information technology would allow the creation of completely new weapons systems and military capabilities. For such advocates, the RMA and Transformation were to lead to extensive changes in force structure, rather than trend

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[1] That Transformation programs were intended to implement the RMA was a widely held position in the U.S. and Canadian militaries. For example, Michele Flournoy described Transformation in the American experience as "the set of activities by which the DOD attempts to harness the revolution in military affairs to make fundamental changes in technology, operational concepts and doctrine, and organizational structure." Michele Flournoy, Project Director, *Report of the National Defense University Quadrennial Defense Review 2001 Working Group* (Washington, DC: National Defense University, Institute for National Strategic Studies, 2000), 14. The Canadian transition from the RMA to Transformation is described in Chapters Two and Three below.

innovation.[2] Trend innovation describes a tendency for military forces and industries to make modifications to existing categories of weapons platforms rather than developing fundamentally new systems, usually driving up costs while failing to achieve concomitant gains in military effectiveness.[3] However, neither the LAV nor the Leopard-2 were new platforms. Rather, many design elements in both systems dated to the 1970s and 1980s.[4] In addition, LAVs and Leopards fit into the conventional 20th century military category of "armoured forces." Therefore, the broad aim of this dissertation is to address how the RMA and Transformation were reshaped into trend innovation by organizational bargaining processes.

However, the history of the Direct Fire Unit (DFU) program and its ultimate cancellation also has specific implications for the history of Canadian defence procurement. Canadian military historians who have studied the country's procurement system have generally observed that it is extremely complex, often places other political considerations before military effectiveness, and tends to greatly prolong the length of time for acquisitions to be completed.[5] In the case of the DFU, the Canadian land force senior leadership attempted to leverage the concept of Transformation, together with what it perceived as a political opportunity, to avoid such difficulties and procure a new

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[2] This approach was typically described by proponents of RMA using three linked concepts: "information superiority," a "system of systems," and "jointness." These subsidiary concepts are discussed in detail in the section "Defining the RMA" in Chapter One.

[3] The concept of trend innovation was mainly developed in: Mary Kaldor, *The Baroque Arsenal* (New York: Hill and Wang, 1981). However, Kaldor does not use the term extensively in the book, but rather in a later article writes that this process is "sometimes called trend innovation." See: Mary Kaldor, "The Military-Industrial Complex and The Baroque Arsenal," in *Search for Sanity: The Politics of Nuclear Weapons and Disarmament*, ed. Paul Joseph and Simon Rosenblum (South End Press, 1984), 67. It is also referred to as such in the following works: Thierry Gongora, Harald Van Riekhoff, *Toward a Revolution in Military Affairs? Defense and Security at the Dawn of the twenty First Century* (Greenwood Publishing Group, 2000), 162; Andrew Laham, *Postfordism in the US Arms Industry: Toward 'Agile Manufacturing.'* (YCISS Occasional Paper 43, December 1996), 6. Kaldor's concept of trend innovation is discussed in more detail in the Literature Review chapter.

[4] See the section "Defining the Armoured Vehicles in this Study" in Chapter 1.

[5] See "The Historiography of Canadian Military Procurement" section in the Literature Review chapter.

family of armoured vehicles rapidly. In doing so, it failed to follow not only established norms for Canadian military procurement, but its own internal capability development processes.[6] Ironically, the land force had put those capability development processes in place, at least in part, because of the perception that they were necessary in order to adapt to the RMA. The lack of clear justification for the Direct Fire Unit (DFU) in the capability development process generated intense resistance to continuing with the acquisition in some branches of the land force. This resistance was a major reason for the cancellation of the DFU.

By treating the DFU program as an example of organizational bargaining, this dissertation applies a bureaucratic politics model to the study of the recent history of military technology, including the history of the RMA and Transformation. Most histories of military technology have taken one of two general approaches, technological determinism or cultural determinism. Technological determinist methodologies focus on technological changes as the key determinants of changes in weapons systems and military organization and doctrine. This focus can provide useful insights into the effects of one or another specific innovation. Cultural determinist models take an alternative perspective, by emphasizing the perceptions of technology within military organizations as determinants of weapons system acquisition choices.

While having much in common with the cultural determinist approaches, the bureaucratic politics methodology used here emphasizes that events are caused by

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[6] Capability development is also known as combat development. The phrase "capability development" came to be used more frequently in the 1990s, while "combat development" was the standard phrase in the 1980s. Capability development organizations study combat experience and conduct operational research and planning. Their primary roles are developing recommendations for future weapons system acquisitions, developing models for organizational change, and developing new military doctrine. They differ from services such as the land force, air force and navy, or arms within the services, such as armour, infantry, and artillery, in being focused on longer term planning rather than day-to-day or near future operations. The change in terminology is discussed in further detail in Chapter Two.

complex sets of interactions between different organizations. Rather than finding one military culture which develops a unitary perception of the possibilities afforded by a given technological innovation, bureaucratic politics identifies numerous subsidiary organizations, each with its own perceptions. The case study of the Direct Fire Unit (DFU) program illustrates the need for this model to address such organizational and cultural complexities in military acquisitions programs.

A small number of studies of Canadian military procurements have used variants of the bureaucratic politics model. However, they generally focus on aspects of organizational bargaining external to a given service.[7] A number of works by Douglas Bland have emphasized the difficulties faced by the Canadian Forces (CF) in interpreting or implementing government white papers on defence. He has also examined problems in coordination between the military command structure and civilian management within Canada's unified National Defence Headquarters (NDHQ).[8] Aaron Plamondon and others have showed that difficulties also arise in the interactions between the Department of National Defence (DND), and other government departments which are involved in distributing industrial regional benefits (IRBs) through military procurement contracts.[9]

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[7] In this instance, a "service" refers to the land force, the navy, or the air force.

[8] See: Douglas Bland, *The Administration of Defence Policy in Canada: 1947 to 1985* (Kingston, Ontario: Ronald P. Frye & Company, 1987); Douglas Bland, "Controlling the Defence Policy Process in Canada: White Papers on Defence and Bureaucratic Politics in the Department of National Defence," in *Canada's Defence: Perspectives on Policy in the Twentieth Century*, ed. Barry Hunt and Ronald Haycock (Mississauga: Copp Clark Pitman Ltd., 1993), 211-225; Douglas Bland, Introduction to *Canada's National Defence* ed. Douglas Bland (Kingston, Ontario: Queen's University School of Policy Studies, 1997) 1:1-7; Douglas Bland, "Issues in Defence Management: An Introduction," in *Issues in Defence Management* ed. Douglas Bland (Kingston, Ontario: Queen's University School of Policy Studies, 1998), 1-12; Douglas Bland, "Transforming Defence Administration," in *Transforming National Defence Administration* ed. Douglas Bland (Kingston, Ontario: Queen's University School of Policy Studies, 2005), 1-9. These works are discussed in more detail in the Literature Review Chapter.

[9] IRBs are described in a number of histories of Canadian military procurement published since the 1980s. Aaron Plamondon's summary is effective: "Canadian defence procurement often includes the need to have Canadian Content Value (CCV). This means that the company awarded a contract must perform part of the work in Canada and use Canadian materials. Although Industrial and Regional Benefits... have been a

Plamondon has also traced problems arising from interference in the military procurement process by elected officials seeking political gain. Nonetheless, he and others have found that tracking Canadian military procurements through publicly available information is difficult, with one paper describing the Canadian acquisition process as "opaque."[10] The study of the DFU shows here that it is possible to examine the details of bureaucratic politics within a Canadian military acquisition program, and that such politics reach deeper than the interactions between federal departments and between those departments and elected officials. In this case, organizational bargaining within the land force itself had a greater effect than difficulties in coordination between the land force and other government departments.

The Main Historical Actors and Periods

From 1992 to 2006, there were seven major historical actors which influenced Canadian armoured vehicle procurement. At the level of bargaining for overall military funding, there were three organizations: the Canadian land force senior leadership and, up to early 2006, the Canadian Liberal government with Jean Chretien and then Paul Martin

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focal part of Canadian procurement throughout its history, particularly in the 1970s, this aspect of defence acquisition was passed by cabinet and became official Canadian policy in 1986. The IRB policy provides the framework for using major government procurements to support prolonged industrial and regional development. IRBs are business compensation activities undertaken by the prime contractor in Canada as a result of successfully bidding on a Canadian defence procurement... The IRB policy is mandatory for major crown projects, and prime contractors must commit to achieving benefits in Canada equal to 100 percent of the contract value... If a procurement is deemed able to give industrial benefits to Canada, an IRB program is created through Industry Canada, in co-operation with the client department, the DND, PWGSC, and the regional agencies." Aaron Plamondon, *The Politics of Procurement: Military Acquisition in Canada and the Sea King Helicopter* (Vancouver: University of British Columbia Press, 2010), 9-10.

[10] See: Plamondon, *The Politics of Procurement*; and David Bercuson, Aaron Plamondon, Ray Szeto, *An Opaque Window: An Overview of Some Commitments Made by the Government of Canada Regarding the Department of National Defence and the Canadian Forces; 1 January 2000 – 31 December 2004* (Calgary: Canadian Defence & Foreign Affairs Institute, 2006). These works are discussed in more detail in the Literature Review chapter.

as Prime Minister, and subsequently a Conservative government under the leadership of Steven Harper. Within the land force, the leadership interacted with four organizations: the land force's capability development system – itself comprised of a number of sub-organizations – the Armoured Corps, the Infantry, and the Artillery.

In addition to these seven actors, there were three indirect influences. The first influence comprised the RMA proponents of the 1990s, both academic and military personnel, whose arguments implicitly, and at times explicitly, influenced the analysis of the land force senior leadership and its capability development organizations. The second and third influences emerged from the United States Army. Within the U.S. Army's own senior leadership and capability development organizations, points of view emerged both for and against shifting away from main battle tanks, such as Abrams or Leopard tanks, towards lighter armoured vehicles. Between 1997 and 2003, the primary emphasis in the U.S. was on moving to a lighter force. However, arguments in favour of retaining heavy armoured forces later became more entrenched. This shift of perspective within the U.S. Army was itself the result of interactions between several organizations, but from a Canadian perspective it is sufficient to summarize the bargaining taking place in the U.S. into the two points of view for and against light armoured vehicles.

Together with the direct actors and indirect influences, the overall period from 1992 to 2008 comprises three subsidiary historical periods during which the various actors had different levels of influence.

From 1992 to 1997, the RMA was a theory which produced a number of books and a great amount of other discourse, primarily in U.S. military studies, conferences, and

military journals.[11] However, the U.S. Army's approach at this time was that, for the foreseeable future, information technology would lead simply to more extensive digitization of existing weapons platforms and combat arms. In 1996-1997 a series of policy documents, in particular *Joint Vision 2010*, produced by the U.S. Joint Chiefs of Staff, endorsed the RMA and changed the approach of the U.S. Army. It was at this point that it began to study extensive force structure changes and a shift to lighter armoured vehicles.

During this same period the Canadian land force was focused on dealing with near term budget limitations and aging equipment. Combined with this, there was also a growing sense among the senior leadership that planning for future procurements had become detached from planning for changes in doctrine. This and related issues described in the following chapters drove the land force leadership to start reorganization of its capability development structure in 1997. The new capability development system was supposed to more closely link planning for future procurements to planning for future doctrinal and organizational change. The intention was that such changes would allow the Canadian land force to study and possibly adopt aspects of the RMA in an affordable manner which could be portrayed as relevant to Canadian interests.

In the second period, 1997 to 2003, the Canadian military adopted the RMA, and study of the concept led to Transformation programs in both the U.S. Army and the Canadian land force. Switching from tanks to lighter armoured vehicles became a central concept of the Transformation plans of both armies. Some in the U.S. Army's planning departments and leadership adopted the view that greater capabilities to detect and

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[11] This discourse continued into the 2000s, but by that time the U.S. Army and Canadian land force had adopted a certain model of RMA for their Transformation programs.

destroy opponents at long distances rendered obsolete the passive protection of heavy armoured plating on military ground vehicles. Key U.S. Army leaders argued that land combat vehicles would no longer "blunder" into the enemy.[12] Together with this belief, they advocated the idea that a more chaotic geopolitical environment, commonly described as the "future security environment," would necessitate more rapidly deployable and operationally mobile ground forces. From this position, it was argued that lighter vehicles could be more quickly deployed using military cargo aircraft and that they would also have far lower logistical requirements once in a combat theatre.[13] Finally, it was argued that they would have higher road speeds and therefore greater tactical mobility in combat theatres, thereby being able to accomplish goals more rapidly.

During these years, the reorganized Canadian capability development system also undertook extensive study of the RMA, including various wargame experiments. However, it was still influenced by the U.S. Army's planning. The Canadian land force simply did not have the financial resources to conduct completely independent work, and its leadership also wanted to retain interoperability with its American ally. In late 1999, the U.S. Army initiated programs to acquire new types of light armoured vehicles and eventually retire all of its heavy vehicles, and in late 2003, the Canadian land force did the same.

The third period comprises the years 2003 to 2008. In 2003, the U.S. Army began combat operations in Iraq while remaining engaged in conflict in Afghanistan.

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[12] U.S. Training and Doctrine Command, *Transcript of the Training and Doctrine Command (TRADOC) Press Briefing, Status of Brigade Combat Team Development at Fort Lewis and Planned Performance Demonstration at Fort Knox* (December 1999). Archived by the Federation of American Scientists: http://www.fas.org/man/dod-101/army/unit/docs/991216-briefing_tradoc_press.htm (accessed March 27, 2008).

[13] Airlift requirements were only studied by the U.S. and Canadian armies after such claims had been made. A brief example of this in the Canadian case is shown on page 260 below.

Experience in these campaigns bolstered the arguments of those who argued that heavy armoured vehicles were still relevant. Lighter vehicles could be more vulnerable to weapons available to insurgents, such as rocket propelled grenades (RPGs) and improvised explosive devices (IEDs). New information technology had not stopped land forces from "blundering" into enemy fire. The U.S. Army also successfully used its heavy tanks and heavy infantry fighting vehicles in urban combat. This combat experience strengthened the position of tank advocates that the passive protection of heavy armour was neither outdated nor unnecessary. While it continued limited acquisition of Stryker light armoured vehicles for some of its brigades, the U.S. Army eventually abandoned plans to develop a Future Combat System (FCS) family of light armoured vehicles intended to replace all of its heavy armoured vehicles.

During the third period, the Canadian land force encountered growing difficulties with, and growing internal resistance to, its Direct Fire Unit (DFU) program. It also deployed into a combat mission in southern Afghanistan, where it began to suffer heavier casualties from insurgent attacks with weapons such as IEDs. Finally, a change in government in 2006 made it appear more politically feasible to buy new tanks. In 2006-2008, the land force cancelled the DFU program and leased a number of Leopard-2 tanks from Holland, and subsequently bought 100 Leopard-2 tanks from Germany.

Sources

This dissertation provides a detailed examination of the DFU program, including disagreement within the Canadian land force, primarily using open source material and

documents secured under access to information requests.[14] In addressing U.S. influence, some primary documents produced by the U.S. Army and its contractors, such as the RAND Corporation, are used. In addition, public U.S. policy documents produced by organizations such as the U.S. Joint Chiefs of Staff during the 1990s are important. In order to establish the background of the RMA and Transformation, analysis of academic prescriptive works produced during the 1990s is included. In a number of cases, press releases and articles in which military leaders, such as U.S. General Eric Shinseki, have commented or been quoted extensively are also used. While a number of interviews and informal discussions with Canadian Forces personnel were conducted, ultimately only three proved useful.[15]

Broad limitations apply to assembling a complete historical narrative. Access to primary documentation is, in some cases, problematic. Access to U.S. documentation is limited to such services as the U.S. military Defense Technical Information Center (DTIC). Primary documentation concerning Canadian land force Transformation and armoured vehicle design has been accessed through the Canadian Freedom of Access to Information Act, but various documents remain classified or partially redacted, meaning that some significant information is bound to be missing.[16] Primary documents can be supplemented by interview, but many persons involved with the events are not available for interview. In addition, extensive records of official correspondence via email are available through the Access to Information Act. With either of these types of primary

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[14] In *Opaque Window*, Bercuson, Plamondon and Szeto state that: "Only information publicly available was used while researching this report... no data was used that might be deemed 'confidential' or 'background only.'" However, the major difference in their research from this dissertation is that they avoided using the Freedom of Access to Information Act. Bercuson, Plamondon and Szeto, *Opaque Window*, ii.

[15] Interviews with Captain Andrew Duncan, Lieutenant Colonel Ian Hope, and Directorate of Land Concepts and Design staff who requested not to be identified are used.

[16] See the Appendix for examples of the Access To Information Requests that were made.

material, former decision makers may be found to make statements that rely on memory alone which is notoriously fallible, or maintain a biased view in defence of policies which they support or once supported. Even in the case of original primary documents, the authors may have deliberately overstated a case, making allowance for actual and potential media coverage. Press releases and media articles quoting the statements of decision-makers likely have this problem to a greater extent, as an organization or journalist producing articles for publication may quote only those statements that support or reflect their own positions.[17]

Chapters

The first major section in this work is the literature review, which makes three main points. First, it addresses the historiography of military technology, to show that technologically determinist and culturally determinist approaches do not fully address the complexity of events which caused the RMA and Transformation to lead to trend innovation. Second, it reviews the major works which have contributed to the development of the bureaucratic politics methodology and explains that methodology in detail, including its variants. Third, it provides a detailed discussion of the historiography of Canadian military procurement and the gaps in that literature summarized above. These three main points provide the basis for later discussion of the core themes in this dissertation.

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[17] While journalists may often endeavour to show both sides of an issue, this is not always the case, as articles may be written for a specific audience and ideological position.

The following chapters are organized largely chronologically in order to demonstrate the changing interactions between the main historical actors in each period. For thematic reasons explained below, the chapters overlap slightly in the periods they cover.

Chapter One, "The RMA and Mobility: U.S. Army Transformation," illustrates the development of two of the indirect influences during the first period, 1992-1997. These are the academic approaches to the RMA and the U.S. Army position in favour of a shift to lighter armoured vehicles. The chapter begins with a detailed description of the armoured vehicles in this case study, which serves as a reference point for many of the technical details discussed later in the dissertation. It then illustrates how the discourse on RMA during the 1990s grew from initial U.S. Army sponsored studies into a set of wide ranging academic debates. These debates illustrate that throughout the 1990s not all military analysts and academics accepted that there is a RMA, or that it would necessarily develop in a way that would allow information technology to be used to increase the effectiveness of Western military forces. The importance of this distinction is that when elements within the U.S. Army and, later, the Canadian land force, adopted the RMA concept, they are not adhering to a view held unanimously by analysts, but rather taking on a certain bargaining position.

The chapter then examines the U.S. Army's approach to information technology during the 1990s. It shows that, from 1993 to 1996, the U.S. Army took a measured approach to the "information revolution." Its *Army XXI* studies of those years investigated how new technology could allow complete digitization of its forces, and how such increased digitization would increase its military effectiveness. However, it did not

propose replacing its tanks, infantry fighting vehicles, and other weapons system with new platforms. Neither did it propose significantly altering the organizational structure of its battalions, brigades or divisions. Following the *Army XXI* studies, the U.S. military policy changes of 1996-1997, such as *Joint Vision 2010*, are described in detail, along with the U.S. Army's initial response in *Army Vision 2010*. At this point, it is thematically simpler to trace the effects of the shift in approach in the U.S. Army up to 1999, rather than switch to the changes in the Canadian land force which started in 1997.

In 1997 the U.S. Army started a new round of studies, *Army After Next*, which it pursued up to 1999. These studies focused on the two ideas described above that information technology would allow for the creation of lighter, more deployable forces and that there would be a more unstable future security environment. The *Army After Next* studies examined a number of force structure concepts, but eventually came to focus on armoured vehicles in the 20 to 30 ton range as replacements for heavier vehicles weighing up to the 60 to 70 ton range.

In the fall of 1999, the head of the U.S. Army, General Eric Shinseki, announced a U.S. Army Transformation program designed to shift the force to this type of lighter vehicle organization. LAV-III based vehicles, which the U.S. named Strykers by 2002, were to be acquired as interim vehicles for some U.S. brigades. While this took place, an entirely new family of vehicles, described as the Future Combat System (FCS), was to be developed. Eventually, under Shinseki's plan, the intention was to re-equip all U.S. forces with the Future Combat System vehicles. Shinseki's plan encountered opposition from some U.S. analysts and retired officers, who expressed their views in books,

articles, and U.S. Congressional hearings. Nonetheless, in the early 2000s the U.S. Army pursued this approach.

Chapter Two, "Canada Adopts the RMA and Transformation Agenda," returns to 1997 to trace how the Canadian land force's senior leadership and capability development organizations studied, and then accepted, a model similar to that pursued by the U.S. Army in this period. The initial events included a meeting of senior leadership at Canadian 1st Division headquarters, at which a set of problems was discussed. These included concerns about aging, worn out equipment, lack of funds, that "combat development" planning for future procurements had lost relevancy, and a perceived need to examine the RMA. As a result, the leadership initiated extensive reorganization of Canadian combat development, which was renamed "capability development." Some of the documents describing these changes will be reviewed to show how reorganization led to the creation of a clearly defined Canadian capability development process for future acquisitions. The chapter then traces how the capability development organizations proceeded with the mandate to examine the RMA and study various options for future equipment acquisitions.

The senior leadership and capability development staff held a number of conferences to gain input from both academics and the U.S. Army to help define the implications of the RMA. However, capability development also initiated a series of internal studies. Beginning in 1997-98, capability development started to examine light armoured vehicle concepts as replacements for Canada's Leopard-1 main battle tanks.[18] Although these studies were largely independent, the indirect influences of academics

[18] In the late 1990s and early 2000s, the Leopard-1s were upgraded to Leopard 1 C2 configuration, but the Leopard 1 C2 was still a considerably different, and lighter, vehicle than the Leopard 2 purchased after 2006.

and the U.S. Army can be seen. One armoured vehicle concept paper begins with a quotation from a U.S. analyst's article, while in another case, a wargame included U.S. Army and RAND Corporation personnel. The capability development organizations also studied the concept of an unstable future security environment, ultimately endorsing it. Although these studies were separate from future armoured vehicle studies, the idea of an unstable future security environment carried the implication that Canada's land force would have to become more rapidly deployable, consistent with the view reached by the U.S. Army.

Canadian capability development ultimately focused on lightweight wheeled "armoured combat vehicles" (ACVs) with either cannon, missile launchers, or both, as the most promising long term approach. These conceptual designs were not identical to the vehicles that were eventually included as part of the Direct Fire Unit (DFU) family between 2003 and 2006, but closely resembled them in various aspects. They were, however, lighter weight vehicles than tanks. Nonetheless, up to early 2003, the capability development organizations did not conclude that acquisition of Multi-Mission Effects Vehicles (MMEVs) as replacements for main battle tanks was a near-term priority. Work by some capability development organizations suggested that Canada's Leopard 1 tanks could remain useful platforms until beyond 2010. The final point in the chapter is that during 2001-2003 Canadian military spending began to increase by a significant, though still moderate, amount. The possibility of continued gradual increases in funding created conditions in which the senior leadership could contemplate previously unexpected near term acquisitions.

Chapter Three, "The Direct Fire Unit," illustrates how the land force senior leadership decided to quickly seize a perceived opportunity to acquire new armoured vehicles in 2003. From a military capability perspective, the approach of the U.S. Army and the planning documents endorsing Multi-Mission Effects Vehicles (MMEVs) could be used to justify this approach. At a Chief of Land Staff meeting in the spring of 2003 the arguments of RMA proponents featured prominently in a presentation proposing a Direct Fire Unit (DFU) family of vehicles. Included was the then-popular idea that a group of physically separate weapons platforms could function as a military "system of systems" with overlapping capabilities.

The DFU plan is described in detail in that chapter,[19] but in summary, it comprised units of three vehicles based on the LAV-III chassis. One, the Mobile Gun System (MGS), was to be virtually identical to the U.S. Army's Stryker MGS, which was still a developmental vehicle. It was to have a 105mm tank gun mounted in a remotely operated turret atop the machine, and was to engage targets in a direct line of sight at near to medium ranges. The second, the LAV-TOW-Under-Armour (LAV-TUA), was to have a Tube launched, Optically tracked, Wire data link auto-guided missile (TOW) in a turret mount, and was also to engage targets at near to medium ranges. The latest iteration of the Multi-Mission Effects Vehicle (MMEV) was the third vehicle, which was to mount the Air Defence Anti-Tank System (ADATS) missile system to engage both ground and air targets at medium to long distance ranges. The three systems were supposed to have the latest digital communications linking them, aiding each others' observations of enemy targets and fire control, in order to defeat opponents before being attacked themselves.

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[19] See, in particular, pages 188 to 197 of Chapter Three.

From a financial perspective, the land force senior leadership believed that the Direct Fire Unit (DFU) would be affordable. It was optimistic that the U.S. would have few problems with completing the Mobile Gun System (MGS) design. It was also argued that if Canada made the acquisition in the near term, it would acquire the MGS relatively inexpensively because economies of scale would be offered by an expected large U.S. production run. The land force already possessed Tube launched, Optically tracked, Wire data link auto-guided missile (TOW) and Air Defence Anti-Tank System (ADATS) missile launchers in the infantry and artillery respectively. It would simply have to integrate them onto the LAV-III chassis and reassign them to the new "all arms" DFU for aspects of crew training specific to that organization and operational deployments. It was also assumed that integration of these systems onto the LAV-III would be inexpensive. Since LAV-IIIs were built in London Ontario by General Dynamics Land Systems Canada, the land force leadership appears to have paid little attention to possible needs to distribute industrial regional benefits (IRBs) through coordination between the Department of National Defence (DND), Industry Canada (IC), and Public Works and Government Services Canada (PWGSC). Integration of the ADATS onto the LAV-III was to be done by Oerlikon-Contraves Canada in Quebec, again avoiding concerns about IRBs.

From a logistical perspective, cost savings were also anticipated. Canada had operated earlier generations of LAV based vehicles during the 1980s and 1990s, and during the late 1990s and early 2000s had acquired LAV-III armoured personnel carriers. Since the DFU vehicles would use the same basic chassis, it was assumed that common parts could be used, and technical personnel would not need extensive retraining. It also

appeared straightforward to integrate Armoured Corps crews, who had been used to operating the Leopard 1 with its 105mm gun, into the new organization to operate the Mobile Gun System (MGS).

From a political perspective, the land force leadership assumed that the anticipated relatively low cost of the program, and the fact that production of the vehicles could be done in Canada, would make it acceptable to the Liberal government. Some documents also suggest that the Direct Fire Unit (DFU) would be more politically acceptable than a new tank as a platform for peacekeeping missions, since tanks were perceived as too aggressive a platform to deploy into unstable situations.

After the chapter describes in detail the above rationale for the DFU, it traces how some components of the project gained very rapid political approval. The MGS was announced in the fall of 2003. A draft Statement of Operational Requirement (SOR) had not been completed before the political announcement of its acquisition. This is irregular in terms of both the general procedure for Canadian military procurements, and the land force's own capability development process developed after 1997.

The final sections of the chapter deal with initial problems with the DFU. Senior personnel in the Infantry and Artillery branches objected to losing direct control of the Tube launched, Optically tracked, Wire data link auto-guided missile (TOW) and Air Defence Anti-Tank System (ADATS) to the DFU. Also, unexpected developmental problems quickly emerged with both the MGS and the Multi-Mission Effects Vehicle (MMEV). Despite this, the land force leadership pressed for approval of the MMEV, leading the Vice Chief of Defence Staff (VCDS), who is responsible for overall Canadian

military strategic planning, to criticize it for failing to adequately justify its plans. These events took place from late 2003 through 2004.

Chapter Four, "Disassembling the Direct Fire Unit," shows how, after the initial problems seen in the previous chapter, resistance to the project grew in the Armoured Corps and within Capability Development. Some criticism of the draft Statement of Operational Requirements (SOR) for the Mobile Gun System (MGS) in early 2004 was particularly intense, emphasizing difficulties that the land force was having in justifying a program after already announcing it. These concerns were not limited to a small number of analysts in the capability development organizations. Email debates and articles in the Canadian Army Journal at the time show that many junior and middle rank officers became concerned about the Direct Fire Unit (DFU) plan. These email and journal debates, and even the draft SOR itself, also demonstrate a level of confusion about the rationale for the DFU in the land force. The senior leadership's concept was unclear to many personnel, who were uncertain whether the MGS alone, or the DFU as a whole, was to replace the Leopard 1 tanks.[20]

Finally, further capability development studies suggested that the three vehicles in the DFU would not necessarily work well together. Some capability development personnel reiterated that the DFU had proceeded without following proper procedures. The events in these sections of the chapter took place from 2004 to 2006.

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[20] As will be shown in Chapter Three, while the DFU was designed to integrate Infantry, Artillery and Armoured Corps weapons and personnel into a new operational organization, that organization would have primarily drawn its structure and identity from the Armoured Corps. The Lord Strathcona's Horse (Royal Canadians) [LdSH(RC)], an Armoured Crops regiment based in the traditional Armoured Corps training areas in western Canada, was to become the new DFU brigade. DFU personnel would have trained together under its auspices and it would have generated operational deployments of DFU sub-units. Essentially, many Armoured Corps personnel saw tanks as being replaced by the MGS, rather than seeing the Armoured Corps as transforming to provide a MGS capability which would contribute to the all arms DFU organization.

The chapter concludes by describing the piecemeal cancellation of the various components of the Direct Fire Unit (DFU), and how these cancellations are linked to four main factors. The first comprises the problems arising from bureaucratic politics outlined earlier in Chapters Three and Four. The second was the changing influence from the U.S. Army, where the view that heavy armoured vehicles were still a relevant weapons platform had regained ascendance. The third was the impact of increasing casualties in Afghanistan on the land force. The fourth was the change to a Conservative government in early 2006, which created the political opportunity to quickly cancel the problematic DFU and instead acquire Leopard 2 tanks.

In 2003, the decision to pursue the DFU was an attempt to limit political and economic risk and to maintain the basic organizational concept of units based around armoured direct fire ground vehicles, rather than engage in more extensive change. The land force senior leadership took this approach in order to establish a favourable bargaining position for the land force to gain funds for new equipment. However, the approach generated bureaucratic conflict between it and the various organizations comprising the land force, leading to acquisition of Leopard 2 tanks after 2006. In both cases, near term bureaucratic politics limited the original far reaching goals of the concept of RMA to trend innovation within existing categories of weapons system. The conclusion reviews this process in more detail, and discusses the implications of this series of events for the concepts of RMA, Transformation, trend innovation, and variants of bureaucratic politics methodology. It also assesses the implications in terms of the historiography of Canadian defence procurement and the effects on the Canadian military of being influenced by a much larger ally.

Literature Review

At the broad level, this dissertation deals with how the Canadian military's grasp of the RMA led to Transformation programs characterized less by revolution than by trend innovation. However, the case study of the Direct Fire Unit (DFU) also provides insights into Canadian defence procurement and closes a gap in the body of literature dealing with that subject. This chapter therefore reviews three fields.

First is the historiography of military technology. Many of the early 1990s arguments made by RMA advocates were based on technologically determinist views of history, while trend innovation derives from a number of culturally determinist interpretations. Both approaches are useful, but as is described in the analysis of the literature at the end of this chapter, neither provides an entirely satisfactory explanation for what took place.

The second field, primarily made up of political science works, is the bureaucratic politics approach. While it provides more complete answers to the gaps in the technologically determinist and culturally determinist literature, there are two different ways that bureaucratic politics is typically used. One is an organizational behaviour model dealing with the internal logic of organizations, while the other is a governmental politics model focused on the leaders of organizations. In the case study of the DFU, both subsidiary models are relevant, and it is suggested here that they can be conjoined.

Third is the history of Canadian defence procurement. While some of these works use variants of the bureaucratic politics methodology, they generally focus on aspects of organizational bargaining external to a given service. A number also suggest that tracking Canadian military procurements through publicly available information is

difficult, because the Canadian procurement system is "opaque." In contrast, it is argued here that it is possible to examine the details of bureaucratic politics within a Canadian military acquisition program. It is also shown that such politics reach deeper than the interactions between federal departments and between those departments and elected officials.

The first three sections of this chapter summarize relevant major works in each of these three fields. All three are analyzed in the fourth section, which further develops the arguments made above. Themes which arise from this analysis are carried through the entire work, and their implications are discussed in the Conclusion chapter.

Historiography of Military Technology

Technologically determinist methodologies have long been used in the analysis of military-technological change. A number of these emphasize the importance of certain categories of technology, rather than specific innovations. Writing in the early 1940s, Tom Wintringham emphasized military operational history as dominated by three functions: mobility, protection, and striking power.[1] For Wintringham, every few centuries new technologies emerged which changed the balance between these three functions.[2] He describes the emergence of related sets of new technologies as "technological wave-fronts."[3] The concepts of mobility, protection, and striking power

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[1] Tom Wintringham, *The Story of Weapons and Tactics – from Troy to Stalingrad* (Boston: Houghton Mifflin Company, 1943).
[2] One example cited by Wintringham is that the stirrup enhanced the mobility of heavily armoued mounted combatants, thereby providing an advantage for a number of centuries to striking power. Ibid.
[3] Ibid.

were reused by other analysts in subsequent decades, such as 1980s British military analyst Richard Simpkin, who described them as mobility, protection and firepower.[4]

Another work of this type is Archer Jones' 1980s study *The Art of War in the Western World.* In it, Jones argues that throughout history technological changes have had military applications which alternately favour the attack or the defence. For Jones, technology does this by alternately improving the capabilities of one of four basic types of military organization: light infantry, heavy infantry, light cavalry and heavy cavalry, with air forces and armoured vehicle forces replacing cavalry in the 20th century.[5]

Other works focus on the emergence of a new technology or on a specific innovation. In the late 1980s and early 1990s, a number of works presented arguments that a new period of rapid military-technological change was emerging as a result of advances in microprocessors and communications, commonly summarized as information technology. Examples of this interpretation include historian Martin Van Creveld's 1989 work *Technology and War from 2000 B.C. to the Present*[6] and futurists Alvin and Heidi Toffler's 1993 work *War and Anti-war: Survival at the Dawn of the 21st Century.*[7] These approaches divide history into three or four overall periods, the last of which would be dominated by information technology.

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[4] See: Richard Simpkin, *Antitank: An Airmechanized Response to Armored Threats in the 90s* (Oxford: Brassey's Publishers Limited, 1982); Richard Simpkin, *Mechanized Infantry* (Oxford: Brassey's Publishers Limited, 1980); Richard Simpkin, *Race to the Swift: Thoughts on Twenty-First Century Warfare* (1985; repr., London: Brassey's, 1986); Richard Simpkin, *Red Armour: An Examination of the Soviet Mobile Force Concept* (Oxford: Brassey's Defence Publishers, 1984); Richard Simpkin, *Tank Warfare: An Analysis of Soviet and NATO Tank Philosophy* (London: Brassey's Publishers Limited, 1979); Richard Simpkin, *Deep Battle: The Brainchild of Marshal Tukhachevski* (London: Brassey's, 1987).

[5] Archer Jones, *The Art of War in the Western World* (Urbana: University of Illinois Press, 1987).

[6] Martin Van Creveld, *Technology and War from 2000 B.C. to the Present* (New York: The Free Press, 1989).

[7] Alvin and Heidi Toffler, *War and Anti-war: Survival at the Dawn of the 21st Century* (Boston: Little, Brown, 1993).

The interpretation of the RMA that became a focal point for debate and discourse in the 1990s was introduced in the early 1990s by analysts such as Andrew Marshall and Andrew Krepinevich of the U.S. Department of Defence's Office of Net Assessment. In a 1992 paper on the "Military-Technical Revolution," Krepinevich draws on Soviet military analysis of the 1970s and 1980s, focusing on the concept of the "reconnaissance-strike complex."[8] The Soviet argument, according to Krepinevich, was that the speed and precision with which computer networks integrated into a military force could gather information about targets and direct munitions against them constituted the next major advance in military effectiveness.[9] Krepinevich emphasizes that organizational and doctrinal change within the military must take place alongside technological change to produce a military technological revolution.[10] However, the key driving factor he identifies, the reconnaissance-strike complex, is technological. In his model, organizational and doctrinal change take place after the emergence of a new technology.

Krepinevich includes a section of historical analysis in his 1992 paper, outlining what he considers to have been examples of military-technical revolutions in preceding historical periods, to illustrate the process by which technological innovations can be harnessed through organizational and doctrinal change. He states that "at least two" revolutions took place earlier in the twentieth century, and "probably two" in the nineteenth.[11] The first of these took place between the Napoleonic Wars and the American Civil War, and was driven by the appearance of railroads, telegraphs, ironclad

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[8] Andrew Krepinevich, *The Military-Technical Revolution: A Preliminary Assessment* (1992; repr. Washington, D.C.: Center for Strategic and Budgetary Assessments, 2002).
[9] Ibid., iii.
[10] Ibid., 18-37.
[11] Ibid., 4.

steamships, rifled muskets and improvements in artillery.[12] The second was caused by the machine gun, aircraft, submarines, and *Dreadnought* class battleships between the mid-nineteenth century and the early twentieth century.[13] Following this, between 1917 and 1939, he finds that: "...internal combustion engines, improved aircraft design, and the exploitation of radio and radar made possible the *blitzkrieg*, carrier aviation, and strategic aerial bombardment."[14] In a 1994 article entitled "Cavalry to Computer," he elaborates on this theme, identifying "up to ten" military-technological revolutions in the preceding few centuries.[15]

As seen in the works discussed above, technological determinist approaches can provide insight either into the effects of a specific technological innovation, such as the internal combustion engine, or into effects of changes in a certain category of technology, such as systems of protective armour. However, the explanatory power of such studies is limited by assuming that military organizational and doctrinal changes follow on from an original technological determinant. In some works, analysts such as Krepinevich discuss examples of military forces failing to undertake sufficient organizational and doctrinal change when confronted with new technology. However, they retain the assumption that one military force will eventually react with the "correct" organizational and doctrinal changes,[16] allowing it to exploit the core technological change more fully than its opponents.

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[12] Ibid., 4.
[13] Ibid., 4.
[14] Ibid., 4.
[15] Andrew Krepinevich, "Cavalry to Computer: The Patterns of Military Revolutions," *The National Interest* (fall 1994).
[16] Krepinevich reiterates the German Army's *blitzkrieg* as a case of making a "correct" choice in how to adapt to rapid technological change. See: Krepinevich, *The Military-Technical Revolution*, 4.

By contrast, culturally determinist studies of the history of military technology place more explanatory power in the manner of a military organization's views of technology. In these interpretations, the perception of a technology determines how it is incorporated into weapons systems, rather than the technology itself driving the change.

In the 1970s, American historian I.B. Holley examined some cultural aspects of technological change in his studies of the U.S. Air Force in the first half of the twentieth century. In one example, he observes that between the First and Second World Wars, the officers of the U.S. Air Corps Tactical School developed doctrine and defined technical requirements for future warplanes based on only "a slender base of experience in bombardment aviation in World War I," and had to "rely upon a sustained effort of creative imagination."[17] One product of their work was the basic specifications for the B-17 Flying Fortress, which would ultimately be a successful weapons system in World War II. However, before combat experience changed perceptions, the aircraft was comparatively lightly armed and escort fighters for strategic bombers were not developed.[18] Holley's argument illustrates that technological specifications, organizational arrangements, and new doctrinal approaches were products of the perception of aviation technology within the military culture. This cultural perception included the assumption that "the bomber will always get through" which was later shown to be flawed following combat experience.[19] However, the perception still

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[17] I.B. Holley, *An Enduring Challenge: The Problem of Air Force Doctrine*, The Harmon Memorial Lectures in Military History 16 (Colorado: United States Air Force Academy, 1974).

[18] Ibid. These shortcomings stemmed from a widely held view among early Air Power theorists that "the bomber will always get through," as reflected in the writings of the Italian Giulio Douhet, American Billy Mitchell, and others. They suggested that fighters would normally be unable to locate and intercept high speed strategic bombers in an environment as large as the skies over entire countries.

[19] The origin of the phrase "The Bomber will always get through" has been attributed to the British Prime Minister Stanley Baldwin during a speech in 1932. Baldwin was not Prime Minister at the time of the speech. See: No author, "The Bomber Will Always Get Through," *Air Force Magazine* (July 2008). See

resulted in a successful weapons system, illustrating that there was not a single technologically predetermined outcome.[20]

A number of insightful cultural determinist works dealing with Cold War era military technologies were published during the 1980s. In what he called a "sociological history" of nuclear missile guidance systems, published in 1990, Donald MacKenzie argues that military decision-makers viewed technology as a "black box" which, provided with sufficient investment, could continually provide improvements to missile performance.[21] In his example, the "black box" is the gyroscope which provides the missile with guidance information to reach its target.[22] A great deal of effort and money, he points out, was expended during the Cold War to develop ever more sophisticated gyroscopes to improve missile accuracy. He asks: "What is that accuracy for? Missing the center of Moscow by a hundred yards, or half a mile, makes little difference to the death and damage a nuclear warhead would cause."[23] In the case of nuclear missile guidance systems, he argues, there was a "continuing process" in how the need for

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also: Frederick Taylor, *Dresden* (New York: Harper Collins, 2004), 92. Taylor writes: "The official view remained colored by former Prime Minister Baldwin's 1932 dictum that 'the bomber will always get through.'" During World War II, bomber formations frequently caused extensive damage to targets, however, they often suffered heavy attrition rates. It became questionable whether the bomber could "get through" with acceptable losses.

[20] In addition, in some of his work Holley develops a model that has elements in common with a governmental politics methodology. He identifies a triangular set of interactions between the U.S. government, the U.S. air force, and U.S. industry as determining acquisition choices, rather than focusing purely on the air force.

[21] Nathan Rosenberg has discussed the view of technology as a "black box" from the perspective of economics, but it can be argued that military decision-makers, historians and the general public often take a similar approach: "Economists have long treated technological phenomena as events transpiring inside a black box. They have of course recognized that these events have significant economic consequences, and they have in fact devoted considerable effort and ingenuity in tracing, and even measuring, some of these consequences. Nevertheless, the economics profession has adhered rather strictly to a self-imposed ordinance not to inquire too seriously into what transpires inside that box." Nathan Rosenberg, *Inside The Black Box: Technology and Economics* (Cambridge: Cambridge University Press, 1982), vii. Essentially, items like gyroscopes or computers are treated as a technical mystery.

[22] Donald A. Mackenzie, *Inventing Accuracy: An Historical Sociology of Nuclear Missile Guidance* (Cambridge, Massachusetts: MIT Press, 1990), 27-94.

[23] Ibid., 1-2.

increasing missile accuracy was perceived amongst military leaders, scientists, and politicians.[24] For MacKenzie, the technology did not drive change, but rather a cultural desire to improve the specifications of an existing type of weapons system led to new developments in gyroscope technology which would likely otherwise not have happened.

While MacKenzie's work focuses on a specific technology, a more general concept of trend innovation was developed by Mary Kaldor in her 1981 work *The Baroque Arsenal*.[25] Writing during the late Cold War arms buildup of the late 1970s and 1980s, Kaldor observed that many Western (primarily American) weapons systems were becoming increasingly complex and expensive with each generation.[26] Despite technical improvements, systems such as the then-new XM-1 main battle tank (later known as the M-1 Abrams), the F-15 and F-16 fighter/strike aircraft, and nuclear-powered vessels were, in her opinion, manifesting various stages of diminishing returns on investment.[27] She argues that this pattern of trend innovation had taken place previously, primarily in Britain's development of ever larger and more complex battleships in the late 19th and early 20th centuries. Her explanation for trend innovation is that during the period in which a given state is highly economically and militarily powerful, it develops and deploys weapons systems which are effective based on its most successful industries. Later, rather than moving away from the approach to acquisitions developed in its prime, the state's industries simply continue to refine, to the point of extremely expensive overengineering, the systems that already exist. Established economic interests and

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[24] Ibid., 8.
[25] Mary Kaldor, *The Baroque Arsenal* (New York: Hill and Wang, 1981). Kaldor's title makes an analogy between the technical complexity of what she considers to be over-engineered weapons systems and the ornate complexity of baroque art.
[26] Kaldor, *The Baroque Arsenal*, 5.
[27] Ibid., 12, 55-97, and 185.

military organizations create industrial inertia.[28] Essentially, Kaldor argues that it is safer to embellish what exists than risk revolutionary ventures which may not work or may not fit well with the receiving military organization, which is geared for trend innovation rather than revolutionary change.

The Bureaucratic Politics Methodology

The bureaucratic politics methodology used here draws from American political scientist Graham Allison's treatment in his work *Essence of Decision: Explaining the Cuban Missile Crisis*, in particular the extensive 1999 revision Allison co-authored with Philip Zelikow. Allison's work is an exercise in contrasting three methodologies, rather than using one. The first of these is the rational actor model, which he considers common in the study of international relations from a realist perspective.[29] The second is an organizational behaviour model, which he draws largely from the field of organizational theory, although he includes a variety of works, including Donald MacKenzie's study of nuclear missile guidance systems, in his review.[30] The third model is that of governmental politics. Allison draws on diverse sources, such as the work of U.S. Presidential advisor Richard E. Neustadt[31] and economist Kenneth Arrow,[32] to develop

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[28] Ibid., these arguments are made throughout Kaldor's work.
[29] Graham Allison and Philip Zelikov, *Essence of Decision: Explaining the Cuban Missile Crisis* (New York: Longman, an imprint of Addison Wesley Longman Educational Publishers, 1999), 13 and 13-54.
[30] Ibid., 148-185. Allison finds MacKenzie's work, along with a number of other studies on weapons acquisitions and military doctrine, to be good examples of organizational behaviour studies.
[31] Ibid., 259. Neustadt was an advisor to U.S. President Truman. Allison considers the most important contribution in his book, *Presidential Power*, to be the observation that the U.S. government is a group of "separated institutions sharing powers."
[32] Allison quotes Kenneth Shepsle in his summary of Arrow's contribution: "Arrow's theorem... 'cautions against assigning individual properties to groups. Individuals are rational, but a group is not..." Shepsle, quoted in ibid., 271.

this model. He provides extensive literature reviews and methodological discussions for each of these three areas.[33] Allison's reasons for including a governmental politics model are significant for this dissertation.

Allison finds that viewing a government or a state as a single rational actor to be frequently insufficient to explain its behaviour.[34] He first contrasts the rational actor model to the organizational behaviour model. With this model he observes that a government is a conglomerate of many distinct organizations.[35] Each of these, he argues, follows its own logic. This is not the logic of a rational individual, who expects certain consequences to follow from his or her actions.[36] Rather, it is a logic of appropriateness.[37] Government organizations are created with certain mandates, to fulfill specific tasks, and each have their own set of regulations or standard operating procedures which guide their activities. Therefore, when placed under pressure, an organization does not necessarily ask what the long-term results of its actions will be, but rather how it can best fulfill its mandate in the near term.[38] It will also be likely to stop

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[33] The reader is referred to Allison's literature reviews for further background on those methodologies.
[34] In one of his examples from the Cuban missile crisis, he demonstrates that the Soviets' highly successful camouflage of the transport of nuclear weapons to Cuba contrasts with a failure to camouflage the missiles against observation by American spy planes. He points out that this contrast has confused many analysts, who have difficulty deciding whether the Soviet Union intended to disguise its missile deployment, or whether it wished the Americans to observe it, in order for the missiles to have a deterrent effect. Ibid., 108-109.
[35] Ibid., 143.
[36] Ibid., 143-185.
[37] Ibid., 146.
[38] Continuing with the example from the Cuban missile crisis, Allison analyzes the contrast in Soviet use of camouflage in terms of organizational behaviour. The Soviets made specific arrangements for the clandestine transport of missiles to Cuba, however, once the missiles were there, they were turned over to Soviet missile forces personnel. The Soviet missile forces organization did not generally camouflage its launch sites in the Soviet Union. Furthermore, it was unfamiliar with, and had difficulties in, the Cuban natural environment. Geography, heat and humidity, and poisonous plants in forests limited its options for where missile launch sites could be constructed. Finally, it was put under pressure by the Soviet political leadership to finish the missile installations quickly. Under these conditions, and with no specific orders to use camouflage, it simply followed its standard operating procedures and built easily identifiable, standardized Soviet missile installations in the open. It did not consider what the consequences of failure to

with the first alternative that is good enough, a process summarized using Herbert Simon's term "satisficing," which is a combination of the words satisfy and suffice.[39]

While Allison finds that conflicts between the internal logic of different government organizations explain some apparently irrational government actions, he still finds a requirement for a more "refined" level of analysis.[40] To address this, he introduces the governmental politics model last. In it, he argues that organizations do not necessarily receive coherent orders from a government which is a unified decision maker.[41] Rather, he points out, the government is composed of the leaders of each organization. Each of these leaders has his or her own perceptions, and is influenced by the recommendations of his or her own organization.[42] As a result, government behaviour can also be understood as a series of results from bargaining games. Intentionally or unintentionally, leaders may be informed or misled, persuaded or ignored by the officials who advise them.[43] In his conclusion, Allison suggests that no effective synthesis between the three methodologies he discusses has yet emerged. Rather, he

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camouflage would be. Rather, it followed its own organizational logic of what was appropriate. Ibid., 210-217.

[39] See: ibid., 143-185. Allison develops his discussion of the logic of organizational appropriateness from: James G. March and Herbert Simon, *Organizations* (Cambridge: Blackwell Publishers, 1993). The original version of Allison's work, dating to the 1960s, likewise references an earlier version of March and Simon's work. Various articles attribute the term "satisfice" to Simon alone; see,, for example: Reva Brown, "Consideration of the origin of Herbert Simon's theory of 'satisficing' (1933-1947)," *Management Decision*, no. 42 (2004): 1240-1256.

[40] Allison and Zelikov, *Essence of Decision*, 255.

[41] Ibid., 255.

[42] Ibid., 255-313.

[43] Ibid., 255-313 and 383. Allison's primary example of organizational bargaining in terms of the Curban missile crisis is the process by which the U.S. Kennedy administration came to favour a 500 mile blockade of Cuba, instead of air strikes, an invasion, or an 800 mile blockade, all of which had strong advocates. In addition, due to pressures from their organizations and from each other, some key members of the administration repeatedly changed their views.

states that each can be used as an alternative conceptual "lens" to provide complementary analyses.[44]

The bureaucratic politics model lends itself to study of military affairs, since interservice rivalry, characterized by conflict between the logic and perceptions of different military organizations, has been remarked upon repeatedly by military historians. Recent examples of such studies dealing with U.S. Army approaches to the RMA and Transformation include books by Douglas MacGregor and Thomas K. Adams. MacGregor argues that the decision to proceed with Transformation was driven by certain preconceptions of the U.S. Army leadership unsupported by experimentation.[45] Adams suggests that U.S. Army leaders took a position on Transformation emphasizing rapid global deployability and mobility because they wanted to be able to portray the U.S. Army as relevant as compared to the U.S. air force, and thereby create a justification for the Army to retain a large portion of U.S. defence funding.[46] Neither work explicitly uses the bureaucratic politics methodology, but the general approach is inherent.

Historiography of Canadian Military Procurement

In his 1987 book *The Administration of Defence Policy in Canada*, Douglas Bland effectively uses a governmental politics model focused on Ministers of National Defence and on senior military officers. He divides the administration of defence policy

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[44] Ibid., 379-405.
[45] Douglas A Macgregor, *Transformation Under Fire*, (Westport, Connecticut: Praeger, 2003).
[46] Thomas K. Adams, *The Army After Next* (Stanford, California: Stanford University Press, 2008). Interservice rivalry between the Army and the Air Force had been ongoing at least since the creation of the U.S. Air Force in the 1940s (and arguably before, while the air force was part of the Army). Adams studies recent iterations of this, including in the 1990s and early 2000s context of RMA and Transformation.

in Canada into two periods. The first, 1946 to 1964, he describes as the "Command Era," a time when the military concept of command authority predominated and the army, navy and air force existed as fully separate organizations.[47] In the second period, 1964 to the 1980s, which he describes as the departmental "Management Era," the three services were unified into the Canadian Forces (CF) and the military and civilian headquarters were unified into a single National Defence Headquarters (NDHQ).[48] He describes how the Defence Ministers who presided over these changes, and the reports and defence white papers which were produced under their direction, at times came into direct conflict with the military leadership.[49] His view is that misunderstanding between the civilian leadership and civilian consultants on the one side, and military leaders on the other, helped to create a "rigid and unresponsive" Department of National Defence (DND) administrative framework.[50] This framework, he argues, utilizes resources poorly and complicates procurements.[51]

In later works Bland at times emphasizes organizational logic more than political bargaining between leaders. In a chapter written for the 1993 book *Canada's Defence Perspectives in the Twentieth Century*, he emphasizes that bureaucratic politics are often driven by white papers on defence that propose organizational changes that are unworkable according to the organizational logic of the various branches of the

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[47] Douglas Bland, *The Administration of Defence Policy in Canada* (Kingston, Ontario: Ronald P. Frye & Company, 1987), 1.
[48] Ibid., 1.
[49] Ibid., this argument runs throughout the work.
[50] Ibid., 237.
[51] Bland writes: "No political authority, no matter his willingness and courage, can make 'a silk purse out of a sow's ear.' If the fundamental concepts, policy process, or strategic analysis is flawed, then no satisfactory choices can result." Ibid., 237.

military.[52] His analyses of defence developments through the 1990s and 2000s generally focus on the same themes, often including aspects of what Allison calls the organizational behaviour and governmental politics models without distinguishing sharply between the two.[53]

David G. Haglund's work falls into the fields of defence management, political science, and economics, but has some historical implications. Discussing the Canadian defence industrial base, he argues that at the level of procurement, "the contest for power and influence primarily is one between alliance members, if indeed it is not largely between societal forces within any particular country."[54] By taking this approach, he focuses on two sets of historical actors. One is the high level policy of Canada itself and the countries it is allied with, and the other is a culturally determinist interpretation of the attitudes of the overall society towards defence spending. Competition between different regions of Canada and between different companies as they compete for defence contracts are aspects of procurement that also draw his attention.[55] He comments that "the politics of procurement in Canada will continue to be a complex and, at times, messy business."[56]

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[52] Douglas Bland, "Controlling the Defence Policy Process in Canada: White Papers on Defence and Bureaucratic Politics in the Department of National Defence," in *Canada's Defence: Perspectives on Policy in the Twentieth Century*, ed. Barry Hunt and Ronald Haycock (Mississauga: Copp Clark Pitman Ltd., 1993), 211-225.

[53] See: Douglas Bland, Introduction to *Canada's National Defence* ed. Douglas Bland (Kingston, Ontario: Queen's University School of Policy Studies, 1997) 1:1-7; Douglas Bland, "Issues in Defence Management: An Introduction," in *Issues in Defence Management* ed. Douglas Bland (Kingston, Ontario: Queen's University School of Policy Studies, 1998), 1-12; Douglas Bland, "Transforming Defence Administration," in *Transforming National Defence Administration* ed. Douglas Bland (Kingston, Ontario: Queen's University School of Policy Studies, 2005), 1-9.

[54] David Haglund, Introduction to *Canada's Defence Industrial Base* ed. David Haglund (Kingston: Ronald P. Frye & Company, 1988), 1.

[55] See: David Haglund and Joel Sokolsky, Introduction to *The U.S.-Canada Security Relationship* ed. David Haglund and Joel Sokolsky (Boulder, Colorado: Westview Press, 1989), 1-7. See also: Haglund, Introduction to *Canada's Defence Industrial Base*, p. 2.

[56] Haglund, Introduction to *Canada's Defence Industrial Base*, 3.

In his 1997 PhD dissertation, Peter Michael Archambault makes the point that while many studies of Canadian defence administration have focused on overall policy and the actions of political and senior military leaders, the actual history is more complex. In his view, focus on decisions by Ministers of National Defence to shift to standardization with U.S. equipment can disguise the fact that the traditional military alliance between Canada and the United Kingdom remained relevant.[57] He pursues this argument by examining the connections between the Canadian and British militaries, rather than the policy statements of the two governments.[58] Not only did British doctrine continue to influence Canada, but a number of failed attempts to develop or procure common weapons systems took place.[59] Even with these failures, Canada continued to use some British equipment for decades, such as the Centurion tank.[60] Archambault's work is significant because it shows that, despite the complexity of the Canadian defence administration and procurement systems and the tendency of historians to focus on overall policy, this complexity can be examined. While his focus is on the years from 1945 to 1960, a similar point is made in this study of the Direct Fire Unit (DFU) during the 1990s and 2000s.

In the mid 2000s, the complexity of Canadian defence procurements drew the attention of David Bercuson, Aaron Plamondon, and Ray Szeto. The result was the 2006

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[57] Peter Michael Archambault, "The Informal Alliance: Anglo-Canadian Defence Relations, 1945-1960" (PhD diss., University of Calgary, 1997) 1-7, and throughout the whole document.

[58] Archambault writes: "The alliance was informal, usually comfortable and familial, and drew its lifeblood from the historical association of the two militaries. That connection, not between the governments but between the two armies, navies and... the two air forces, was the main reason the alliance survived... historians... [have ignored] post-war Anglo-Canadian defence relations... [because] they have concentrated on the political element of Canada's defence policy, rather than on the daily, routine management of defence by the armed forces. Ibid., 4-6.

[59] For instance, Canada attempted to convince the United Kingdom to adopt the Bobcat armoured personnel carrier. Ibid., 311-318.

[60] Ibid., 109 and 254-264.

report *An Opaque Window: An Overview of Some Commitments Made by the Government of Canada Regarding the Department of National Defence and the Canadian Forces; 1 January 2000 – 31 December 2004.* The report finds that it is extremely difficult to track the progress of defence procurements which have been announced by Canadian governments "promises sometimes mysteriously disappear altogether… swallowed up within some Byzantine bureaucratic process that no one understands."[61] Amongst the difficulties they encountered were that the names of projects would often change with "little or no explanation," and that projects and sub-projects would be bundled and then unbundled with other projects for unclear reasons.[62] Of eighteen cases that they studied, they found that in twelve cases "it was hard to gain a complete picture of the progress of the commitments from publicly available information."[63] The Mobile Gun System (MGS) was one of these twelve.[64]

Plamondon continued along similar lines of research, resulting in his 2010 book *The Politics of Procurement: Military Acquisition in Canada and the Sea King Helicopter*. In it, he describes the programs for a replacement for the Sea King to be the "ultimate case study" of the problems in the Canadian procurement system.[65] He points out that the first discussions for a Sea King replacement took place in the 1970s, but as of 2010, the process was still underway.[66] He blames not only complex bureaucratic rules and difficulties in coordination between different government organizations, but also

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[61] David Bercuson, Aaron Plamondon, Ray Szeto, *An Opaque Window: An Overview of Some Commitments Made by the Government of Canada Regarding the Department of National Defence and the Canadian Forces; 1 January 2000 – 31 December 2004* (Calgary: Canadian Defence & Foreign Affairs Institute, 2006), i.
[62] Ibid., 4.
[63] Ibid., 5.
[64] Ibid., 5.
[65] Aaron Plamondon, *The Politics of Procurement: Military Acquisition in Canada and the Sea King Helicopter* (Vancouver: University of British Columbia Press, 2010), ix.
[66] Ibid., pp. ix-x, and throughout the book.

constant political interference.[67] Amongst other things, this interference caused the Statement of Operational Requirements (SOR) for the Sea King replacement to be rewritten repeatedly to avoid purchase of a vehicle that was politically unacceptable.[68] His study has much in common with the case study of the Direct Fire Unit (DFU) here. For example, both identify an attempt to write a highly biased SOR to avoid buying politically unacceptable vehicles. However, while Plamondon's work shows the dangers of external political interference in drastically prolonging a procurement, the DFU program demonstrates the type of problems that can arise when a service leadership attempts to drastically shorten a procurement, generating bureaucratic conflict within the organization.

Former Canadian Department of Defence (DND) Assistant Deputy Minister (Materiel) Alan Williams has written a defence management study entitled *Reinventing Canadian Defence Procurement.*[69] It is primarily a prescriptive work based on his own experience in DND, and identifies similar problems to those described by Bland, Haglund, and Plamondon. Its primary recommendation is to eliminate the involvement of various federal departments in defence procurement and concentrate acquisitions in a new department called Defence Procurement Canada.[70] While such recommendations are not the focus of this dissertation, Williams' work provides some useful historical insights into procurements during the late 1990s and early 2000s, including some aspects of the Direct Fire Unit (DFU).

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[67] Ibid., in particular 3-12 and 189-205.
[68] Ibid. The rewriting of the SOR is summarized well on xvi-xix.
[69] Alan S. Williams, *Reinventing Canadian Defence Procurement* (Montreal and Kingston: Breakout Educational Network in association with McGill-Queen's University Press, 2006).
[70] Ibid., 5, and throughout the book.

The Gaps in the Literature

Considering the historiography of military technology, the Canadian Direct Fire Unit (DFU) program cannot be considered to have been technologically determined. If the RMA necessitated Transformation, and acquisition of the DFU was a central part of Transformation, a reversal to main battle tank acquisition should not have taken place. Yet, a technology that was described as necessary by the land force leadership in 2003 came to be considered unnecessary by 2006.

It would be simple to argue that both the Direct Fire Unit (DFU) and Leopard-II acquisition projects were examples of continuing trend innovation, and that the land force's announcement of Transformation was no more than empty rhetoric. As of 2003, the land force already had LAV-III infantry carriers, and it had operated earlier versions of LAV based vehicles back to the 1970s. Furthermore, General Motors and General Dynamics built LAVs in London, Ontario. It could be suggested that Canada was simply improving what it had, and acquiescing to the desire of domestic industry to continue to produce a favoured product, as in a military-industrial complex model.

However, detailed examination reveals difficulties in viewing the choice of the LAV-III chassis as the basis for the DFU vehicle family as typical trend innovation. The DFU was intended to replace Canada's Leopard 1 main battle tank, which had been acquired in the late 1970s and was expected to reach the end of its lifespan between 2010 and 2020. From the 1940s to 1980s, armoured vehicle designers focused on improving the three main aspects of vehicle firepower, protection[71] and mobility.[72] The Mobile Gun

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[71] In the late 1990s the traditional concept of armoured vehicle protection, the use of heavy armoured plating, would at times be called "passive protection" to distinguish it from other means of force protection.

System (MGS) variant of the Direct Fire Unit (DFU) would have had firepower equivalent to, not greater than, the Leopard 1 or first generation U.S. Abrams tanks.[73] Weapons mounted on other variants had firepower equivalent to, not greater than, weapons which could be mounted on other similar late 20th century vehicles, such as Bradley infantry fighting vehicles or M-113 armoured personnel carriers.[74] The passive armoured protection of LAV-III based vehicles was roughly equivalent to, instead of better than, that of other armoured infantry vehicles. The mobility of wheeled LAV-III based vehicles on hard roads was better than that of tanks and heavy tracked infantry fighting vehicles, but poorer in some off-road conditions. The DFU fits generally as an example of trend innovation within the established 20th century category of armoured vehicles, but does not accord with Kaldor's theory in all respects. In addition, in 2006 and after, Leopard 2s were first leased from Holland and then acquired from Germany. Apart from some maintenance contracts, this had little benefit for the Canadian defence industry.

The details do not fit precisely because, as discussed above, the RMA and Transformation were conceived as far-reaching change, rather than as justification for

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The term "passive protection" is used in this dissertation. Force protection is defined by the U.S. military as "Preventive measures taken to mitigate hostile actions against Department of Defense personnel... resources, facilities, and critical information." U.S. Joint Chiefs of Staff, *Joint Publication 1-02 Department of National Defense Dictionary of Military and Associated Terms* (Washington, D.C.: 2010), 143.

[72] The focus on these three aspects is an illustration of interaction between academic work and military planning, making academics an indirect actor in military activities. As seen above, Wintringham and then Simpkin frequently emphasized protection, mobility and firepower. Simpkin had served in British armoured units in the 1960s and 1970s, and was considered an important proponent of what was called "manoeuvre theory" in the 1980s.

[73] The weapon in question is a 105mm NATO standard tank gun. The firepower would have been less than that of a second generation Abrams or a Leopard-2 tank, which both use a 120mm gun.

[74] As described in Chapters Three and Four, the Air Defence Anti Tank System (ADATS) could be mounted on a Canadian M-113 before it was proposed to place it on the Multi-Mission Effects Vehicle (MMEV) variant within the Direct Fire Unit. Tow-Under-Armour (TUA) systems, which were proposed for a third Direct Fire Unit variant, could also be mounted on other vehicle chassis.

incremental improvement of existing weapons systems.[75] For RMA proponents Transformation was supposed to leverage information technology to make possible new types of weapons systems, military organizations, and military doctrine. In the case of light armoured vehicles, the core assumption of the RMA and Transformation advocates was that improved sensor and precision firepower capabilities, combined with greater mobility under most conditions, would reduce the need for passive protection.

Given the contrast between what was intended and what happened, why did the RMA and Transformation ultimately reinforce a trend innovation pattern? The use of the bureaucratic politics methodology helps to answer this question. As seen in the Introduction, research for this dissertation revealed that bargaining took place between seven major organizational actors within the Canadian Forces and the Canadian federal government. As opposed to a typical interpretation of trend innovation, its explanatory power rests on the interactions between these organizations, rather than attempts to define one general military-industrial perception of armoured vehicle technology.[76]

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[75] While incremental change can have far-reaching consequences in some situations, the contrast here is between the trend innovation criticism of modern Western military forces and the position of RMA advocates. The implications of this dissertation for interpretations of the RMA, including the question of whether incremental changes can amount to a revolution, is discussed in the Conclusion.

[76] From the point of view of a culturally determinist methodology, it might have been anticipated that research would reveal that the Canadian Forces' organizational culture first adopted a view of the RMA and Transformation from the U.S. Army that emphasized a shift away from main battle tanks to lighter armoured vehicles. From such a perspective, it could then have been argued that that this view was then altered by different perceptions arising from Canadian combat experience in Afghanistan and American combat experience in both Afghanistan and Iraq. The collective culture of the Canadian military would have reacted to these influences by constructing a collective interpretation of what types of armoured vehicles acquisitions were required as a result of military-technological change. A social constructivist model could be used to pursue such an argument. An effective summary of constructivism as a social theory can be found in an overview on the study of international affairs by Robert Jackson and Georg Sorensen. They write: "In social theory, constructivists emphasize the social construction of reality. Human relations... consists of thought and ideas and not essentially of material conditions or forces. This... contrasts with the materialist philosophy of much social science positivism... the social world is not a given: it is not something 'out there' that exists independent of the thoughts and ideas of the people involved in it... History is not an evolving external process that is independent of human thought and ideas. That means that sociology or economics or political science or the study of history cannot be objective 'sciences'... The social world is in part constructed of physical entities... But it is the ideas and beliefs

However, as seen above, Allison considers organizational logic and governmental politics to be two separate models. The analysis in this dissertation suggests that, in at least some cases, what Allison describes as the organizational behaviour and governmental politics models can be conjoined. The logic of appropriateness in each of the land force's organizations frequently influenced the leaders of those organizations. However, the bargaining between the organizations in the Canadian land force and between the Canadian Forces and the federal government is of greatest significance. As a result, the methodology this dissertation uses is best described as a variant of the governmental politics model in which the internal logic of each organization under study is an implicit component of the conflicts which arise in the bargaining process.[77] The general term bureaucratic politics is used here to cover both of Allison's models, as it is in Bland's work.

As described in the Introduction, apart from interactions between Canadian government organizations, there were also three indirect influences from academia and the U.S. Army. The governmental politics model developed by Allison also accounts for such external influences. He provides examples of foreign actors, such as the British ambassador,[78] becoming involved in the intragovernmental bargaining processes of the U.S. government during the Cuban missile crisis. In the case under study here, the U.S. Army and academia become actors in Canadian bureaucratic politics by exerting indirect influence on Canadian perceptions of the RMA, Transformation and the role of armoured

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concerning those entities which are most important: what those entities signify in the minds of people." Robert Jackson and Georg Sorensen, *Introduction to International Relations, Theories and Approaches* (Oxford: Oxford University Press, 2010), 160-161.

[77] Allison's approach at times connects the organizational behaviour and governmental politics models, but he nonetheless views them as clearly distinct.

[78] Allison and Zelikov, *Essence of Decision*, 233 and 384.

vehicles, thereby affecting capability development studies and the land force leadership's plans.

As well as describing the interactions between different organizations within the Canadian land force, the bureaucratic politics methodology explains why they reached certain bargaining positions. For example, as will be seen in Chapter Two, the land force senior leadership perceived a threefold crisis in the late 1990s. Reduced military budgets combined with an increased number of peacekeeping and peace enforcement operations were stretching the Canadian Forces' resources to the breaking point. Combined with this was the belief that the Canadian land force had to retain a direct fire ground vehicle capability, even though its Leopard 1 tanks were wearing out. The desire to retain this capability was likely emphasized because some senior leaders, such as Major- and later Lieutenant-General- Rick Hillier, had served in the Armoured Corps earlier in their careers and were therefore to some extent guided by their familiarity with it. Finally, there was the concern about maintaining interoperability with U.S. forces, including that the Canadian land force would have to adopt the RMA through Transformation. The development of the senior leadership's 2003 bargaining position to acquire the Direct Fire Unit (DFU) was a result of the interaction of these three organizational concerns.[79]

Other works on the history of Canadian procurement have taken similar conjoined approaches. As seen above, Douglas Bland has noted aspects of both organizational behaviour and governmental politics in his approach to bureaucratic politics.[80] However, as has been shown, these works have also typically examined organizational conflict at the level of overall policy, and have treated much of the functioning of Canadian military

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[79] This intersecting set of concerns contrasts with the direct conceptual link between RMA and Transformation described by academics such as Michele Flournoy, seen in footnote 1 above.
[80] See pages 30 to 31 above.

procurement systems as "opaque." Plamondon's study of the replacement programs for the Sea King helicopter has penetrated many of the details of Canadian procurement. However, his focus is on a naval/air program which has been lengthened by bureaucratic politics for decades, while the focus in this dissertation is on a land force program which was announced prematurely and halted after only three years by bureaucratic politics.

Most of the works on Canadian defence procurement also identify a historical pattern of the Canadian military experiencing difficulties in adapting foreign weapons systems to Canadian uses. Industrial, alliance and political influences are usually identified as the causes of these troubles. In the early 20th century the United Kingdom pressured Canada to use standard pattern British imperial equipment.[81] In the mid to late 20th century, standardization with NATO allies became a concern. Also, the Canadian government made a policy choice after the Second World War to standardize, for the most part, based on American military equipment designs.[82] Such choices were usually made because Canadian governments either did not want to invest the money to develop new equipment domestically, or took the view that the Canadian defence industry was simply not large enough to produce independent designs.[83] Plamondon discusses aspects

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[81] See, for example: Aaron Plamondon, "Casting Off The Imperial Yoke: The Transition of Canadina Defence Procurement Within The North Atlantic Triangle, 1907-1953" (master's thesis, Royal Military College of Canada, 2001); and Aaron Plamondon, *Equipment Procurement in Canada and the Civil-Military Relationship: Past and Present*, Calgary Papers in Military and Strategic Studies 2 (Calgary: Centre for Military and Strategic Studies, University of Calgary).

[82] See, for example: Plamondon, *The Politics of Procurement*, 23.

[83] Plamondon writes that Canada has been "incapable or unwilling... to design and produce the necessary materiel" to support its military domestically, and so the government has consistently searched for "foreign alternatives." See: Plamondon, *The Poiltics of Procurement,* 15. Haglund has discussed whether any country is capable of supporting a self-sufficient arms industry by the late 20th century. See: David Haglund, Introduction to *The Defence Industrial Base And The West*, ed. David Haglund (London: Routledge, 1989), 1-22. The combination of a small Canadian economy and industrial base and political interference in distorting procurements in the late 19th and early twentieth century has been examined by historians such as Ronald Haycock. See: Ronald Haycock, "Policy, Patronage, and Production: Canada's Public and Private Munitions Industry in Peacetime, 1867-1939," in *Canada's Defence Industrial Base*, ed. David Haglund (Kingston, Ontario: Ronald P. Frye & Company, 1988), 71-94.

of these problems in detail throughout his study on the Sea King replacement program; however, he spends less space on the concept of interoperability.[84] Neither do the other works deal with it at length.

The 1990s concept of interoperability is not entirely distinct from the traditional concept of standardization. Interoperability can be described as a concern with allied forces being similar enough to work together doctrinally, deploy and manoeuvre at similar speeds operationally, share many logistic requirements, and communicate large amounts of data to one another seamlessly. Concerns about maintaining interoperability with the United States emerged in Canada in the late 1990s in the context of the RMA. Such concerns generated internal pressure in Canadian academic and military circles to move rapidly to adopt U.S. concepts. For instance, in 1999 the RMA Operational Working Group stated a need for Canada to pursue the RMA in *Canadian Defence Beyond 2010: The Way Ahead.*[85] In 2002 Canadian defence analyst Elinor Sloan questioned whether the Canadian military would be able to work with its American ally in the near future.[86] The case study of the Direct Fire Unit (DFU) shows that internal

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[84] Regarding the Sea King and interoperability, Plamondon writes: "As for interoperability, DND officials believed that, if Canada was going to continue the policy of collective defence, then its equipment has to be able to synchronize efficiently with that of its allies. The most obvious aspects involved fitting the helicopters with interoperable radios and fuelling systems to allow the allies to work together. The *Sea King* lacked these options." Plamondon, *The Politics of Procurement*, 115. Although the importance of interoperability is implicit elsewhere in Plamondon's book, it is secondary to other political and organizational concerns and not treated separately.

[85] They write: "The conduct and character of war is changing. Essentially, rapidly integrating technologies (information, sensor, and precision technologies) are effecting massive changes in our global society... the information age is replacing the industrial age. In the military sphere, the application of advanced technologies is viewed by many as a Revolution in Military Affairs. Although the United States is leading the investigation and application of the RMA, Canada's allies, such as the United Kingdom and Australia, are also pursuing these developments to ensure that they maintain modern and interoperable forces for the 2020-2025 time frame... International agreements with Canada's allies must be used to pro-actively promote optimum future interoperability and the establishment of common equipment standards." RMA Operational Working Group, *Canadian Defence Beyond 2010: The Way Ahead* (Ottawa: National Defence Headquarters, 1999) v-vi.

[86] Sloan writes that: "A revolution in military affairs is under way that holds the potential to dramatically change the character of warfare... The information revolution in the civilian world is driving rapid

concerns about interoperability, not only external pressure to standardize and the limited size of the Canadian defence industry, result from Canada's size relative to its neighbour and ally to the south.

These four themes appear in the following chapters. First, bureaucratic politics limited the amount of possible change to trend innovation, despite the claim that there was a RMA. Second, the governmental politics were driven by both organizational logic and individual leaders, and it is necessary to use both these "lenses" together. Third, governmental politics took place within the land force, as well as between the land force and two different federal governments. Fourth, interoperability concerns are an additional pressure on the Canadian military as an ally of the larger United States. The implications of these themes are discussed further in the Conclusion.

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advances in military technologies... European members of NATO are not incorporating advanced technologies into their military systems quickly enough to stem an evident and growing technology gap between the U.S. military and its European counterparts. Canada is in a similar position, ameliorated only by the somewhat closer Canada-U.S. bilateral defence relationship since World War II. The gap, in turn, is calling into question the ability of the European and Canadian militaries to function with their American counterparts in the future." Elinor Sloan, *The Revolution in Military Affairs: Implications for Canada and NATO* (Montreal and Kingston: McGill-Queen's University Press, 2002), 143-144.

Chapter One
The RMA and Mobility: U.S. Army Transformation

This chapter demonstrates the development of two of the indirect influences on the Canadian land force Transformation program, largely within the first historical period of 1992 to 1997. These influences are the academic approaches to the RMA and the U.S. Army position in favour of a shift to lighter armoured vehicles. The last sections of the chapter describe events up to 1999, in order to demonstrate how the U.S. Army's adoption of the RMA led to its Transformation program. There is some evidence that the shift in its position towards the RMA and armoured vehicle design was the result of organizational bargaining and governmental politics. Such an interpretation has been suggested by U.S. defence analysts such as Douglas MacGregor and Thomas Adams. However, from a Canadian perspective what is most important is that the official position of the U.S. Army after 1997 functioned as a single external influence on the Canadian land force.

Discourse on the RMA in the United States became widespread after the publication of Andrew Krepinevich's 1992 Office of Net Assessment study. That study took the core "reconnaissance-strike complex" idea of the RMA, developed it into the concepts of "information superiority" and a "network" or "system of systems," and linked it with the idea of military "jointness." Several other studies endorsed this approach soon after. The idea that heavy armoured vehicles could be replaced with lighter machines was raised as a possibility in these early reports. As discourse widened in the mid 1990s, many other analysts disagreed with the interpretations inspired by

Krepinevich. When the U.S. Army adopted the RMA concept after 1997, it largely followed Krepinevich's model.

In the early 1990s, U.S. Army policy did not endorse revolutionary change. Its *Army XXI* studies from 1993 to 1996 focused on evolutionary improvement by expanding and improving digitization of its forces. While *Army XXI* wargame experiments concluded that more extensive digitization of Army forces could ultimately improve combat capabilities by a significant amount, organizational changes and development of new armoured vehicles were not recommended. In 1996-1997, the U.S. Joint Chiefs of Staff adopted the idea in *Joint Vision 2010* that "information superiority" would drive extensive changes in the U.S. military services. It and other policy documents also incorporated the idea that a more chaotic geopolitical environment would necessitate more rapidly deployable forces. Subsequently, the U.S. Army produced its own interpretation of this policy in *Army Vision 2010.*

In terms of ground forces, the greatest significance of these policy changes was the notion that achieving information superiority and using it to apply precision firepower would greatly increase overall force protection. As a result, the argument emerged that vehicles would not need the passive protection of heavy armour.

The *Army After Next* studies from 1997 to 1999 examined a number of force structure concepts, but eventually came to focus on armoured vehicles in the 20 to 30 ton range as replacements for heavier vehicles weighing up to the 60 to 70 ton range. In the fall of 1999, the head of the U.S. Army, General Eric Shinseki, announced a U.S. Army Transformation program designed to shift the force to this type of lighter vehicle organization. LAV-III based vehicles, which the U.S. named Strykers in 2002, were to

be acquired as interim vehicles for some U.S. brigades. While this took place, an entirely new family of vehicles, described as the Future Combat System (FCS), was to be developed. Eventually, under Shinseki's plan, the intention was to re-equip all U.S. forces with the Future Combat System vehicles.[1]

The first two sections of this chapter establish the context for the remainder of the study. "Defining the RMA," describes the beginning of the RMA discourse in 1992-1993 stemming from Krepinevich's study. The second section, "Defining the Technology in This Study," provides an overview of armoured vehicles in Canadian and U.S. Transformation acquisition programs. Although additional details about the Direct Fire Unit (DFU) vehicles are discussed in later chapters, a clear description of the weapons systems under discussion at the beginning of this work is necessary for conceptual clarity. This section also illustrates the point made in the Introduction that LAV based vehicles and Leopard 2 tanks were not new platforms in the late 1990s and 2000s.

The third section, "Thinking About the Revolution in Military Affairs," shows how discourse widened and debate about the nature of the RMA, including whether there was a RMA, developed after 1993. The fourth section, "1993 to 1997: *Army XXI*," deals with the U.S. Army's approach to information technology during those years. The fifth section, "1996 to 1997: Emphasis on Mobility Increases," illustrates how the policy changes outlined in documents such as *Joint Vision 2010* created the conditions for the U.S. Army to pursue the *Army After Next* studies. The U.S. Army's studies of these

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[1] Aspects of Shinseki's plan to create an ultimate "Objective Force" equipped with the FCS are shown in various primary and secondary sources. An effective summary is in: Thomas K. Adams, *The Army After Next* (Stanford, California: Stanford University Press, 2008), 68-70. Adams also provides a useful account of some of the other events summarized in the paragraphs above. However, the specific interpretation of the events as presented here is demonstrated and referenced in detail below in this chapter.

approaches are summarized in the sixth section, "1997 to 1999: Army After Next." The seventh section, "1999: Transformation," describes the U.S. Army's transition from Army After Next studies to its Transformation program, and how the Army's leadership publicly advocated forces based around lighter armoured vehicles.

Defining The RMA

The concept of military revolutions appeared in historical studies as early as the 1950s, but at that time had no direct bearing on military activities. By the late 1980s, historians such as Martin Van Creveld were suggesting that a period of major military-technological change was underway as a result of the emergence of information technology, facilitated by advances in telecommunications and microelectronics. Also during the 1970s and 1980s, Soviet military officers and analysts, in particular Red Army Marshall Nikolai V. Ogarkov, wrote about what they called a "military-technical revolution," or MTR, being likely to develop as a result of Western advances in those fields.[2]

The Soviets' studies influenced various Western analysts, such as Richard Simpkin in the U.K. and, in America, Andrew Marshall of the U.S. Office of Net

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[2] The reconnaissance-strike complex and MTR theories developed in the writings of the then Chief of the General Staff of the Soviet Army, Marshall Nikolai Ogarkov in the 1970s-80s, and in works by other Soviet officers. For discussions of Ogarkov's role see: Major Norman C. Davis, "An Information-Based Revolution in Military Affairs," in *In Athena's Camp: Preparing for Conflict in the Information Age*, ed. John Arquilla and David Ronfeldt (Santa Monica: RAND, 1997), 84; and Sabine Collmer, *Information as a Key Resource: The Influence of RMA and Network-Centric Operations on the Transformation of the German Armed Forces*, George C. Marshall European Center for Security Studies Occasional Paper Series 8 (February 2007), 6.

Assessment.[3] Marshall decided that further study into the concept was necessary, and in August 1991 he asked Andrew Krepinevich to prepare an in-depth study of the military technical revolution (MTR). Krepinevich's study was published in July 1992, entitled *The Military-Technical Revolution: A Preliminary Assessment.* It argued that a MTR was underway.[4] Earlier still in 1992, the idea that a MTR might be taking place was circulating in the Pentagon, as evidenced by then U.S. Secretary of Defense Richard Cheney's reference to it in the April 1992 *Final Report to Congress of the Conduct of the Persian Gulf War.*[5] Following these events, in March 1993, the report of a six-month study on the MTR, as it was still being called, was published by the Center for Strategic and International Studies (CSIS) in Washington, D.C.[6] By 1994 and 1995 the term Revolution in Military Affairs had replaced Military-Technical Revolution, and was being addressed in increasing numbers of articles and books by military analysts.

The core Soviet concept which Marshall and Krepinevich adopted was that of the "reconnaissance-strike complex". The reconnaissance-strike complex was made possible by the emergence of microprocessors, networked computer systems, and high bandwidth

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[3] Richard Simpkin's 1985 book *Race To The Swift* makes arguments very similar to those made later in 1992 by Krepinevich. Simpkin was widely considered a proponent of what was called "manoeuvre warfare theory." It is likely that there was some blending between 1980s manoeuvre warfare discourse and 1990s RMA discourse. However, a more extensive treatment of the influence of manoeuvre warfare approaches on military analysts in the 1990s is beyond the scope of this work.

[4] Andrew Marshall, Foreword to Andrew Krepinevich, *The Military-Technical Revolution: A Preliminary Assessment* (1992; repr. Washington, D.C.: Center for Strategic and Budgetary Assessments, 2002). Also see: Andrew Krepinevich, Author's Introduction to Krepinevich, *The Military-Technical Revolution.*

[5] Principal Deputy Under Secretary (Strategy and Resources), U.S. Department of Defense, *Final Report to Congress: Conduct of the Persian Gulf War* (Washington, D.C.: U.S. Department of Defense, October 1992), 18-31, 215, 231, and 398. The overview on pages 18-39 is signed by Cheney. Note that the page numbering in the document is inconsistent. Publicly available at: http://oai.dtic.mil/oai/oai?verb=getRecord&metadataPrefix=html&identifier=ADA249390 (accessed August 2009).

[6] Michael J. Mazarr, project director and principal author, Jeffrey Shaffer and Benjamin Ederington, project managers and co-authors, *The Military Technical Revolution: A Structural Framework – Final Report of the CSIS Study Group on the MTR* (Washington, D.C.: Center for Strategic and International Studies, 1993).

communications[7] during the 1970s and 1980s which produced what is usually called information technology. The Soviets argued that the speed and precision with which computer networks integrated into a military force could gather information about targets and direct munitions against them constituted the next major advance in military effectiveness.[8] Krepinevich further develops the reconnaissance-strike complex idea,[9] arguing that it would allow U.S. military forces to achieve information dominance through the creation of a network of systems. He then ties the network of systems and information dominance to a requirement for increasing "jointness." The Center for Strategic and International Studies report makes the same arguments. The definitions of the three concepts of information dominance, a network of systems, and jointness are important to an understanding of the RMA discourse and its effect on U.S. Army and Canadian land force Transformation programs.

In terms of information dominance, both studies argue that the ability to collect information from digital sensor systems and quickly analyze and "fuse"[10] the resulting data into useful intelligence creates an "information gap"[11] favouring the force with more advanced information technology. Information dominance can then be used to strike

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[7] Satellite communications, fibre optics, and compressed digital data rather than analog data were the main technological platforms which developed in the second half of the 20th century facilitating this. Satellite observation was also important for the reconnaissance aspect of the concept.

[8] Krepinevich, *The Military-Technical Revolution*, iii.

[9] Krepinevich states that the reconnaissance-strike complex could alternatively be described as a deep-strike task force, and the Center for Strategic and International Studies study in turn describes it as a surveillance-synthesis-assessment-command-strike loop. See: Krepinevich, *The Military-Technical Revolution*, iii; and Mazarr, Shaffer and Ederington, *The Military Technical Revolution: A Structural Framework*, 30.

[10] Data fusion is essentially the rapid combination of raw information from various sources into a single presentation which can be (relatively) quickly and easily understood, or targeting data which can be redistributed by a network. It is typically taken to include automated, computerized processes, as opposed to lengthier traditional intelligence analysis processes. However, some human intervention in data fusion may take place; some authors speak of "data fusion centres". As with many concepts, there are various definitions. Krepinevich mentions data fusion on pages 28 and 42; Mazarr et al. refer to "intelligence fusion centers" on page 19 and "improved fusion" on page 37; "data" is used many times.

[11] "Information gap" is used in by Krepinevich on pages 11, 14, 17, 23, 24-28, 43, and 45.

enemy forces with great accuracy, destroying the enemy's command, control and communications systems and so further widen the information gap. Taking advantage of the growing information gap, the force with information superiority "gets inside" its enemy's decision cycle by having better data and therefore being able to make decisions more quickly. Similar ideas had been discussed in the U.S. military during previous decades, but the position of these early 1990s studies is that information technology would greatly enhance operational effectiveness.[12]

Such a capability would be achieved by linking together different information processing networks, from battlefield reconnaissance-strike complexes to systems fed by more traditional forms of intelligence.[13] However, these 1992-93 studies also accept that the potential to achieve information dominance may be limited. Krepinevich considers that establishing information dominance may be the critical first phase of conflict amongst peer competitor states,[14] while the Center for Strategic and International Studies group states that "the MTR will partly lift the fog of battle that has bedevilled military operations since the beginning of organized warfare."[15]

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[12] For example, the concept of "getting inside" the enemy's decision cycle was popularized in the 1970s and 1980s by Colonel John Boyd of the United States Air Force in his studies of what he called the Observe-Orient-Decide-Act loop, or OODA loop. See, for instance, Franklin C. Spinney, "Genghis John," *Proceedings of the U.S. Naval Institute* (paper presented July 1997, proceedings published October 9, 1998), 42-47. See also: Jeffrey L. Cowan, "From Air Force Fighter Pilot to Marine Corps Warfighting: Colonel John Boyd, His Theories on War, and their Unexpected Legacy" (master's thesis, United States Marine Corps Command and Staff College, 2000). See also: Grant T. Hammond, "The Essential Boyd," originally published on the website *War, Chaos, and Business* which appears to be in abeyance. These references to the OODA loop were originally assembled by Dr. Scot Robertson for the War Studies 540 Graduate Seminar course on Air Power at the Royal Military College of Canada.

[13] Krepinevich and the Center for Strategic and International Studies also suggest more expansive definitions of information dominance. For example, Krepinevich writes that it could include the requirement for: "A superior understanding of a (potential) adversary's military, political, social, and economic structures, to include their strengths, weaknesses, locations, and degrees of interdependence, while denying an adversary similar information on friendly assets." See: Krepinevich, *The Military-Technical Revolution*, 22. However, such general definitions reflect a timeless military and political need for good intelligence and strategic analysis, rather than the specific effects of information technology.

[14] Krepinevich, *The Military-Technical Revolution*, 26 and 28.

[15] Mazarr, Shaffer and Ederington, *The Military Technical Revolution: A Structural Framework*, 25.

After 1992-93, the term "information superiority" also came to be used frequently in RMA discourse and U.S. and Canadian military documentation. The difference is not significant here, since it is often used interchangeably with the term information dominance. For example, both terms are used as interchangeable on the same page in the U.S. Army policy document *Army Vision 2010*.[16] In some cases, differences in the scope of the definitions occur, with information dominance being described as the "degree" of information superiority a military force possesses, but it is not used consistently this way.[17] Some papers were published in the United States during the 1990s which argued that one or the other term was preferable, and that one definition was superior to others.[18] However, given the manner in which both terms were used loosely and in an interchangeable way, even in official U.S. and Canadian policy documents, the two can be taken as interchangeable for the purposes of this study.

For Krepinevich, information dominance and the second concept, a network of systems, are linked: "Because of the nature of this revolution, the ability to *integrate* military systems into – and across – networks of systems (or system architectures) will be

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[16] U.S. Department of the Army, *Army Vision 2010* (Washington, D.C.), 17. None of the copies publicly available appear to be dated anywhere in the document, however the Defense Technical Information Center version has a number stamp on the cover page which indicates a publication date in 1996 (19961230 017).

[17] The 1998 U.S. Joint Chiefs of Staff publication *Joint Doctrine for Information Operations* defines information superiority as "the capability to collect, process, and disseminate an uninterrupted flow of information while exploiting or denying an adversary's ability to do the same." U.S. Joint Chiefs of Staff, *Joint Doctrine for Information Operations* (Washington, D.C.: Joint Chiefs of Staff, October 1998), I-10 - I-11. The 1996 version of the U.S. Army doctrinal pamphlet *FM 100-6 Information Operations* defines information dominance as: "The degree of information superiority that allows the possessor to use information systems and capabilities to achieve an operational advantage in a conflict or to control the situation in operations short of war, while denying those capabilities to the adversary." U.S. Department of the Army, *FM 100-6 Information Operations* (Washington, D.C.: August 1996).

[18] See, for example: Jim Winters and John Giffin, "Issue Paper: Information Dominance vs. Information Superiority," IWS – The Information Warfare Site, paper posted April 1, 1997, http://www.iwar.org.uk/iwar/resources/info-dominance/issue-paper.htm (accessed December 1, 2010). The paper argues that dominance is a qualitative description, while superiority is a quantitative term, the term "Information Dominance" is superior, as the qualitative aspects of the term "Information Superiority" are too restrictive.

of great importance if they are to achieve a dramatic increase in military effectiveness."[19] While a single reconnaissance-strike complex may consist of a number of sensors, weapons platforms, and precision-guided munitions tied together in a tactical network, a network of systems refers to many networks tied together into a super-system. He goes on to discuss how new weapon platforms must be "designed to increasingly rely for their effectiveness on being integrated into ever more sophisticated networks of systems,"[20] and he suggests that systems that cannot "be integrated quickly and effectively into networks of systems"[21] will quickly become obsolete. As shown in the following chapters, the concept of the network of systems would also be called a "system of systems" later in the 1990s. While this phrase took on broader meaning after the year 2000, during the mid to late 1990s in U.S. Army documentation, and, in the case of the Canadian land force, even later, it referred specifically to this type of linking together of sensor systems, weapons systems, command and control and intelligence sources.

The third concept that emerges in these 1992-93 studies is that of jointness. The concept of jointness did not originate with RMA, but rather gained greater emphasis in U.S. military planning following the 1986 Goldwater-Nichols Act.[22] Krepinevich makes the argument that greater connections between ground, sea, air, and space based systems are needed in order to fully implement a network of systems. He finds that the United States military had already accepted jointness between air and land forces in the "Air-Land Battle" doctrine of the 1970s and 1980s. However he adds that: "it is plausible that for other areas – war at sea, war in space, power projection/forcible entry, and strategic

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[19] Krepinevich, *The Military-Technical Revolution*, 14.
[20] Ibid., 15.
[21] Ibid., 16.
[22] See: U.S. Congress, *Public Law 99-433 Goldwater-Nichols Department of Defense Reorganization Act of 1986*, 99th Cong., 1986.

strike – revolutionary changes are also possible in how these activities are conducted, or even whether they are conducted."[23] The Center for Strategic and International Studies study group states that the military-technical revolution "runs against service parochialism; it recommends an increasingly joint force – and a force whose jointness extends lower in the chain of command than ever before, which can avoid artificially joint operations even as it pursues a useful coordination of service efforts."[24]

An overall definition of the RMA was produced by Andrew Marshall at some point during the early to mid 1990s, drawing on Office of Net Assessment work such as that of Krepinevich. It was frequently used in U.S. and Canadian planning documents during the late 1990s: "A major change in the nature of warfare brought about by the innovative application of new technologies which, combined with dramatic changes in military doctrine and operational and organisational concepts, fundamentally alters the character and conduct of military operations."[25]

The combined implications of information dominance, the network of systems, and jointness lead Krepinevich to question the role of heavily armoured vehicles. The following statements in his report represent an initial view leading to U.S. and Canadian land force Transformation plans to replace tanks with lighter vehicles. He writes that in the case of "tanks and other heavily armoured combatants:"

> One might question whether, as the capability for extended-range engagements grows, it will be desirable to "close with" the enemy and destroy him. It may be more advantageous to create an "information gap" between ourselves and our enemy, and employ extended-range munitions to accomplish the required levels

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[23] Krepinevich, *The Military-Technical Revolution*, 52.
[24] Mazarr, Shaffer and Ederington, *The Military Technical Revolution: A Structural Framework*, 22.
[25] Sources are unclear as to precisely when Marshall made this statement. An example of a document which attributes it to Marshall is: Directorate of Operational Research (Joint & Land), *The Revolution in Military Affairs: Possible Implications for Canada*, by Scot Robertson, (Ottawa: National Defence, 1998), 3.

> of destruction. Direct-fire engagements are thus avoided, since by allowing them to develop, the enemy can reduce partially (and perhaps significantly) the information gap we have spent time and resources to create.[26]

While Krepinevich questions the eventual need for traditional heavy armour, the Center for Strategic and International Studies report focuses on increasing their mobility by reducing size:

> In the longer run... the MTR holds out the tantalizing hope of... lighter weapons capable of being transported in large numbers and of dominating future battlefields. Those closer to production might include armored vehicles a fraction of the size and weight of today's main battle tanks, but with the same antiarmor punch; engines with much greater reliability and fuel economy, and more modular designs for rapid repairs; and lighter and smaller smart weapons.[27]

However, neither Krepinevich nor the Center for Strategic and International Studies call for an immediate replacement of tanks in the 1990s. Krepinevich postulates instead that tanks may retain an important secondary role for some time, because despite having a network or system of systems and information dominance, military forces may still be forced to fight at close ranges due to geographical constraints.[28]

The Center for Strategic and International Studies makes the argument that "even older platforms can join the MTR era when using precision weapons."[29] What eventually

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[26] Krepinevich, *The Military-Technical Revolution*, 17.

[27] Mazarr, Shaffer and Ederington, *The Military Technical Revolution: A Structural Framework*, 40.

[28] Krepinevich writes: "Ground forces may be increasingly centered around formations of highly mobile extended-range non-line-of-sight (LOS) systems, rather than tank-heavy forces. This is not to say that armored forces will become irrelevant; rather, they will assume less of a central and more of a supporting role. For example, even if ground operations come to emphasize ranged fires, direct fire systems will continue to provide an important capability, for several reasons. First, it can be argued that such forces may eventually have to close with the enemy, to take and hold terrain. Having a mechanized vehicle that offers protection against residual enemy capabilities seems to make good sense. Second, it may not always be possible to fight at extended ranges. For example, the Israelis cannot afford to trade space on the Golan Heights in attempting to develop ranged-fire engagements. Nor can United States forces engage in such a practice along the DMZ in Korea. Third, one must expect adversaries to offset their disadvantages in deep-strike capabilities by trying to "hug" these forces as close as possible (perhaps emphasizing infiltration tactics), thereby making direct-fire engagements unavoidable, if not predominant. The end result may be a redefinition of the nature and the role of tanks and other heavily armored combatants." Krepinevich, *The Military-Technical Revolution*, 17.

[29] Mazarr, Shaffer and Ederington, *The Military Technical Revolution: A Structural Framework*, 41.

took place with the Stryker and the Direct Fire Unit reflects these trains of thought: an existing platform would be equipped with improved sensor and intelligence sharing technology, thus effectively giving it new "smart" weapons which would compensate for the lack of heavy armour found on main battle tanks or heavy infantry fighting vehicles such as the Bradley. At the same time, the Light Armoured Vehicle (LAV)-III chassis would be light enough to provide the desired increase in strategic mobility. For the U.S. Army, this was the interim step while the completely new Future Combat System vehicles were being developed, in keeping with the idea that acquisition of smart weapons should precede acquisition of completely new weapons systems. For the Canadian forces from 2003 to 2005, this approach to Light Armoured Vehicle (LAV)-III based vehicles temporarily fitted with other priorities.

Conceptually the idea of replacing tanks with lighter vehicles therefore had early origins in the office of Net Assessment's study of the Soviet concept of the reconnaissance-strike complex. As described in the historiography, Krepinevich's analysis was technologically determinist, indicating that information technology was a new driving force that would necessitate military organizational and doctrinal change. Other early studies, such as the Center for Strategic and International Studies, used the same conceptual approach. As discourse on RMA became widespread during the 1990s, some analysts criticized such views of RMA as too focused on high intensity conflict. High intensity conflict can be defined as combat between the organized, uniformed armed forces of traditional states. It is opposed to low intensity conflict, which includes operations against insurgents, terrorists, international criminal organizations, operations in failed states, and peacekeeping and peace enforcement operations. U.S. Army

Transformation in the late 1990s was based on a view of RMA similar to that of Krepinevich.[30] The armoured vehicles that would be affected by this approach to RMA are described in the section below. To show that the U.S. military followed the pattern of analysis used by Krepinevich, the main lines of the wider 1990s RMA academic discourse are summarized in the section after.

Defining the Technology in This Study

The LAV-III which was a major component of both the U.S. and Canadian Transformation programs was based on the Piranha wheeled armoured vehicle designed by the Swiss company MOWAG in the 1970s.[31] The Piranha was originally developed as a family of four, six, and eight wheeled armoured vehicles.[32] Design features included large, low-pressure wheels, internal space to carry infantry, armour thick enough to stop small arms fire, and capability to mount a turret which could carry various types of light to medium armament. MOWAG signed a license agreement with Diesel Division General Motors (DDGM) Defence Operations, a business unit of General Motors Electro-Motive Division, in August 1976, leading to production of Piranha-derived vehicles in North America under the GM name of LAV.[33] Twenty-two years later MOWAG was

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[30] This is unsurprising, as the U.S. Office of Net Assessment operates within the U.S. Pentagon, and is comprised of both civilian analysts and military officers. Andrew Marshall was a civilian, while Krepinevich was a U.S. Army officer. The U.S. military would be more inclined to draw on the analysis of its own organizations rather than on the work of unaffiliated academics.

[31] General Dynamics European Land Systems/MOWAG "Company History." General Dynamics European Land Systems. http://www.mowag.ch/En/01E_About/012E_History.htm (accessed October 18, 2007).

[32] Ibid.

[33] General Motors, "General Motors, Diesel Division, and MOWAG consolidate international defence vehicle manufacturing interests," General Motors Press Release (London, Ontario: General Motors, press release undated)

formally acquired by Diesel Division General Motors (DDGM) Canada, based in London, Ontario,[34] which, as part of General Motors Defense, became a partner with General Dynamics in producing the Stryker for the U.S. Army.[35] General Motors Defense was, in turn, acquired by General Dynamics in 2002, with the Canadian branch producing the LAV becoming General Dynamics Land Systems-Canada.[36] During the 2000s, General Dynamics also produced the American Abrams main battle tank and was a contractor for the manned ground vehicle portion of the American Future Combat System (FCS).[37] LAV-based vehicles therefore became part of an extensive line of General Dynamics heavy automotive products.

Canada placed an initial order in 1977 for 350 of the Piranha vehicles in a six wheeled configuration, and additional orders were made for variants of the vehicle during the 1980s.[38] By the 1990s, the Canadian Forces had acquired eight wheeled derivatives of the Piranha, including the Bison infantry carrier[39] and the Coyote Reconnaissance vehicle.[40] The Canadian Forces used these vehicles, classified as LAV-IIs,[41] in peacekeeping operations in the Balkans in the 1990s. The United States Marine Corps

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http://email.gmcanada.com/corpdb/cachq/pressrel.nsf/7a15ac9c7647fb7985256790005e5a02/93ac8074e3eee0bc8525696d00711286?OpenDocument (accessed October 27, 2007).

[34] Ibid.

[35] General Dynamics, "General Dynamics Completes Acquisition of GM Defense," General Dynamics Press Release, March 3, 2003. http://www.gdls.com/ (accessed October 27, 2007). The website opens press releases in separate windows, without a more specific URL.

[36] Ibid.

[37] General Dynamics' various MBT and armoured fighting vehicle (AFV) programs were listed at the website above http://www.gdls.com/ (accessed October 27, 2007).

[38] By the end of 1981, orders increased to almost 900 vehicles. General Dynamics European Land Systems/MOWAG "Company History."

[39] General Dynamics Land Systems website. http://www.gdls.com/programs/bison.html (accessed October 27, 2007).

[40] General Dynamics Land Systems website. http://www.gdls.com/programs/lav2_coyote.html (accessed October 27, 2007).

[41] Canada used approximately 500 Bison eight wheeled, and an additional number of Grizzly six wheeled, LAV-II vehicles, before acquiring the LAV-III infantry carrier and the related 8 wheeled Coyote vehicle. See: J.E. Vos, Strykers for Canada? Canadian Forces internal document responding to a New York Times article, Directorate Policy, December 12, 2002. Released under Access to Information Act, document number A0042339.

tested Canadian LAVs beginning in 1980, and ordered six configurations of the vehicles in 1982, activating its first "Light Armoured Vehicle Unit" in 1985.[42]

In General Eric Shinseki's 1999 U.S. Army Transformation plan, a light to medium weight armoured vehicle would equip a number of "Interim Brigade Combat Teams" or IBCTs, after 2002 called "Stryker Brigade Combat Teams" or SBCTs. These brigades would exist alongside "legacy" forces using the Abrams main battle tank and tracked Bradley infantry fighting vehicles, until both forces would be combined as the "Objective Force" equipped with the Future Combat System.[43] General Motors and General Dynamics Land Systems jointly won a contract on November 17, 2000, to produce LAV III eight-wheeled vehicles for the IBCTs.[44] The U.S. Army formally named the vehicle the Stryker in a ceremony at Fort Lauderdale, Florida, on February 27, 2002, in honour of two U.S. Medal of Honor recipients: Private First Class Stuart S.

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[42] United States Marine Corps School of Infantry, "Light Armored Vehicle Training Company History," http://www.cpp.usmc.mil/schools/soi/new/ait/lavhistory.htm (accessed October 27, 2007).

[43] Shinseki's plan is summarized in a number of U.S. Army sources. See for example: Joe Burlas, "Shinseki Leaves Indelible Legacy of Irreversible Momentum." http://www.army.mil/features/ShinsekiFarewell/FarewellArticle.htm. (accessed March 21, 2008). Shinseki's justification for the Stryker in the short term was that it would bridge a perceived gap between existing light forces and "legacy" heavy forces: "The heavy force is a magnificent warfighting force. It is not versatile enough or agile enough to meet all the missions that we are asked to perform today or that I see we'll be asked to perform in the next 25 years. The light force, the best light infantry in the world, we can get them all the places that we're asked to go but if it goes hot they lack the lethality and the survivability that our heavy forces have..." *United States Army Professional Video Collection* "Fort Lewis: The Transformation Has Begun," undated. Although Shinseki portrayed this as part of Transformation, it was not a new idea. According to the Marine Corps School of Infantry account, during the 1970s the United States decided to create a rapid deployment force to contend with escalating tensions in the Middle East. The U.S. Army considered various types of forces including those structured around light armoured vehicle, but in the end opted against them while the Marine Corps pursued the concept. Marine Corps School of Infantry, "Light Armored Vehicle Training Company History."

[44] General Motors and General Dynamics, "U.S. Army Awards General Motors, General Dynamics $4 Billion Contract to Supply New Armored Vehicles," (Warren, Michigan: General Dynamics joint press release with General Motors, November 17, 2000).

Stryker, who served in World War II, and Specialist Robert F. Stryker, who served in Vietnam.[45]

As configured for the U.S. Army, most Stryker variants weighed approximately 19 tons, with a top road speed in excess of 60 miles per hour, and a range in excess of 300 miles with 53 gallons of fuel.[46] Ten Stryker variants were to be acquired: an infantry carrier vehicle, a command vehicle, a mobile gun system, a fire support vehicle, a medical evacuation vehicle, a mortar carrier, an engineer squad vehicle, an anti-tank guided missile vehicle, a nuclear biological chemical (NBC) reconnaissance vehicle, and a standard reconnaissance vehicle.[47] The mobile gun system was to mount an automated turret[48] with a 105mm tank gun.

During the mid to late 1990s, Canada acquired a number of LAV-II Coyote vehicles which were equipped to serve as surveillance and reconnaissance vehicles. Overlapping with this acquisition, during the late 1990s to early 2000s the Canadian land force acquired a large fleet of LAV-III infantry carriers, which were given no other name than "LAV-III." The most significant difference between the Canadian LAV-III infantry carrier and the American Stryker infantry carrier was that the Canadian version mounted a turret with a 25mm chain gun which could provide light direct fire support to its infantry.

Subsequently, the Canadian land force Transformation plan announced in 2003 envisioned a Direct Fire Unit (DFU) composed of a Mobile Gun System (MGS) similar

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[45] United States Army, "Army Announces Name for Interim Armored Vehicle." http://www.army.mil/features/stryker/default.htm. Accessed January 13, 2010.
[46] United States Army, "Fact Files: Stryker." http://www.army.mil/factfiles/equipment/wheeled/stryker.html (accessed January 14, 2010).
[47] The GM GDLS Defense Group, *Stryker Family of Vehicles* (Washington, D.C.: General Motors Defense). The document is not specifically dated but originates in the early 2000s, as it describes the Stryker as a General Motors/General Dynamics Land Systems joint venture.
[48] Rather than having the turret interior as part of the crew space, as in most main battle tanks.

to that being developed for the Stryker program, a LAV-III vehicle equipped with a TOW-Under-Armour missile (LAV-TUA), and a LAV-based Multi Mission Effect Vehicle (MMEV) mounting an Air Defence Anti-Tank system (ADATS).[49] The ADATS was a large missile launching device with radar, electro-optic, and low light television observation and tracking systems, and laser guidance systems for its missiles. The TOW was a smaller missile launching device. Its acronym stands for "Tube launched, Optically tracked, Wire data link auto-guided missile," which is a literal description of it. Both the LAV-TOW Under Armour (LAV-TUA) and the Multi Mission Effects Vehicle (MMEV) were to have their missile launchers mounted on top of the chassis, generally where the turret would be on the infantry carrier or mobile gun system variants. The overall concept behind the Direct Fire Unit was that these three vehicle variants would operate as a single group by providing overlapping surveillance capabilities and ranges of precision fire.[50]

The Leopard 1 main battle tank which the Direct Fire Unit (DFU) was intended to replace was a German designed and built tracked vehicle in the 40 ton range. A 1950s-60s main battle tank design, it had been gradually upgraded through successive generations in the 1960s, 1970s, and 1980s. Canada acquired Leopard 1s in the late 1970s, and later upgraded the vehicles with parts from 1980s Leopard 1s in the late 1990s and early 2000s.[51] Its main armament was a 105mm tank gun which used NATO standard ammunition. The U.S. Abrams main battle tank, which was to become part of

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[49] Canadian Forces Chief of Land Staff document, "Implementing Army Transformation" (April 30, 2003). Accessed under Canadian Access to Information Act, document number A0042354. The Mobile Gun System was occasionally referred to as the "Main Gun System" or the "Medium Gun System" in some documents, correspondence and articles, but there is no difference in meaning between these names.
[50] Further detail on the Coyote is found in Chapter Two, and for the Direct Fire Unit, see Chapters Three and Four.
[51] See Chapter Four.

the "Legacy Force" in the 1999 U.S. Army Transformation plan, was a 1970s-80s main battle tank design in the 60 to 70 ton range. Early Abrams designs had a 105mm tank gun, while later Abrams models had a 120mm Rheinmetall tank gun. The Leopard 2 tanks acquired by Canada after 2006 were also main battle tanks in the 60 to 70 ton range with 120mm Rheinmetall guns. Both the Leopard 2 and Abrams had some design influences from the 1960s joint German-U.S. Main Battle Tank 70 (MBT-70) program, which was cancelled in the early 1970s.[52]

The Future Combat System (FCS) with which the U.S. Army intended to equip its "Objective Force" would likely have included a variant to provide tank-like heavy direct fire. The FCS vehicles were envisaged as lighter than Abrams main battle tanks or other tracked vehicles, such as Bradley infantry carriers. The Future Combat System (FCS) program was cancelled in the late 2000s.

While the following chapters deal with LAV-III based vehicles in greater detail, the section above provides an overview reference point for describing the vehicle designs and the history of the U.S. Army's and the Canadian land force's involvement with them.

Thinking About the Revolution in Military Affairs

The RMA discourse of the 1990s was split along three general lines of debate. The first was debate over how many RMAs had taken place in history, and whether technological factors alone, or the influence of culture and governments, combined to constitute a RMA. The second was between proponents of the RMA and those who

[52] For further detail on the Abrams and Leopard 2, see: Michael Jerchel, *Leopard 2 Main Battle Tank 1979-1998* (Oxford: Osprey Publishing, 1998); and Steven J. Zaloga and Peter Sarson, *M1 Abrams Main Battle Tank 1982-92* (Oxford: Osprey Publishing, 1993).

argued that information technology would simply cause an evolution, rather than a revolution, in military affairs. The third was a split between those who argued that technological and political change was causing low intensity conflict, rather than high intensity conflict, to become the dominant form of warfare.

A 1995 U.S. Army Strategic Studies Institute report observed that much of the "open-source literature" on the RMA had come to focus on "defining and describing military revolutions" rather than offering "comprehensive basic theories or broad policy choices and implications."[53] As discussed briefly in the Literature Review, Martin Van Creveld and Alvin and Heidi Toffler's work in the late 1980s and early 1990s divided history into three or four overall periods, the last of which would be dominated by information technology. In those two approaches, the only true military-technological revolutions occur at the junctures between the three or four technologically defined eras. In their models, military forces were beginning a transition from industrial age to information age technology and organization. By contrast, Krepinevich proposed four military-technical revolutions during the 19th and 20th centuries in his 1992 Office of Net Assessment paper, and up to ten over the course of a few centuries in his 1994 article "Cavalry to Computer."[54]

In a 1997 article entitled "Thinking about Revolutions in Military Affairs," Williamson Murray defines a large number of RMAs by emphasizing cultural factors. He argues that major military revolutions are preceded and followed by smaller

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[53] Steven Metz and James Kievit, *Strategy and the Revolution in Military Affairs: From Theory to Policy* (Carlisle Barracks, Pennsylvania: Strategic Studies Institute, U.S. Army War College, 1995), iii.
[54] See pages 20-23 of the Literature Review above.

revolutions in military affairs, which he describes as "pre- and after-shocks."[55] For him, at first appearance new developments amount to no more than "military revolutions" with a tactical or operational advantage. It is only in the longer-term process in which societal, political and organizational changes are linked to tactical and technological developments that a new "conceptual approach" to war is born.

In 1995 Jacob W. Kipp, then at the Foreign Military Studies Office of Fort Leavenworth, Kansas, summarized the second overall line of debate which divided analysts over the question of whether there was an evolution or a revolution in military affairs. He wrote that after the 1991 Gulf War, debate over whether a military technological revolution was underway had become "increasingly intense," pitting advocates of a revolutionary interpretation against doubters and supporters of an evolutionary one.[56] In an article for the summer 2000 edition of the Canadian Military Journal, Canadian military historian Scot Robertson found that little had changed in five years, quoting Kipp's comments, and adding that: "Undoubtedly, this debate will continue in the years to come."[57]

Review of the RMA literature reveals that there were also moderate positions between these two extremes. For instance, in a report produced in May 1994 for the U.S. Army War College Strategic Studies Institute, David Jablonsky, at that time Professor of National Security Affairs at the U.S. Army War College, emphasizes the importance of

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[55] Williamson Murray, "Thinking about Revolutions in Military Affairs," *Joint Forces Quarterly*, summer 1997.

[56] Jacob W. Kipp, "The Revolution in Military Affairs and Its Interpreters: Implications for National and International Security Policy" (paper, joint conference of the Foreign Military Studies Office and the Academy of State Management of the President of the Russian Federation, Moscow, September 1995). The paper was subsequently published on the Fort Leavenworth website: http://leav-www.army.mil/fmso/documents/rmapap.htm#8a (accessed August 18, 2008)

[57] Scot Robertson, "Experimentation and Innovation in the Canadian Forces," *Canadian Military Journal* 1, no. 2 (2000), 66.

historical continuity during military-technological revolutions, while still accepting that there is a RMA.[58] Nonetheless, as seen in Kipp's and Robertson's comments, analysts of the RMA perceived a division along these lines.

The third line of debate, over high intensity versus low intensity conflict, includes contributions by Van Creveld. In his 1991 book *The Transformation of War*, he argues that technological progress has reduced the difference between cheap and small and expensive and large weapons. His examples include the observation that while a modern jet fighter is more advanced than a World War II fighter, it can be shot down with a shoulder-mounted rocket launcher. By comparison, a flak gun that was expensive, difficult to transport and difficult to conceal was required to shoot down aircraft during World War II.[59] American strategic analyst and 1980s manoeuvre warfare theorist William S. Lind makes a similar argument in his "Fourth Generation Warfare" approach.[60]

RAND analysts John Arquilla and David Ronfeldt also suggest that technological change would increase the importance of low intensity conflict. In their 2001 book *Networks and Netwars*, they argue that telecommunications networks allow people to form geographically dispersed groups which discuss and develop ideas, often without a central hierarchical command. In such cases as terrorist and criminal organizations, such

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[58] David Jablonsky, "The Owl of Minerva Flies at Twilight: Doctrinal Change and Continuity and the Revolution in Military Affairs," in vol. 10 *Professional Readings in Military Strategy* (Carlisle Barracks, Pennsylvania: U.S. Army War College, 1994).

[59] Martin Van Creveld, *The Transformation of War* (New York: The Free Press, 1991), see in particular pages 30-31 and 212.

[60] William S. Lind, Keith Nightengale, John F. Schmitt, Joseph W. Sutton, Gary I. Wilson, "The Changing Face of War: Into the Fourth Generation," *Marine Corps Gazette* (October 1989), 22-26.

groups will be difficult to deal with, since it is usually not possible to eliminate them by terminating a leader or leadership.[61]

However, Arquilla and Ronfeldt also argue that "network" warfare can be used to the advantage of traditional Western powers, since activists and non-governmental organizations (NGOs) can have liberalizing effects in authoritarian regimes and failed states. Similarly, other analysts suggest that information technology can allow the armed forces of conventional states to advance in both high intensity and low intensity conflict. Jablonsky believes that the dichotomy between LIC and HIC was addressed early on in the RMA discourse by A. and H. Toffler. He remarks that their comments that new technologies ranging from sensors to nonlethal and robotic weapons may mean "that the new, Third Wave war form may, in time, prove to be just as powerful against guerrillas and small-scale opponents waging First Wave war as against Iraq-style Second Wave armies."[62] Historian and novelist Caleb Carr suggests that Unmanned Aerial Vehicles (UAVs), like the Predator drone, could be the "answer" to suicide bombers, since such vehicles could be cheaply mass produced and loss of an UAV would not entail loss of a pilot or an armoured vehicle crew.[63]

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[61] John Arquilla and David Ronfeldt, *Networks and Netwars* (Santa Monica: RAND, 2001). As a general cultural factor, it is also significant that increasing discourse on the RMA paralleled growing general enthusiasm in North American society over the "Information Revolution" during the 1990s. In some cases, civilian information technology consultants commented on the RMA. One example is Michael Erbschloe, who made a contribution that largely favours a low intensity conflict approach. In his 2001 book *Information Warfare*, he argues that the proliferation of information-age technology which enables the RMA has levelled the playing field between not only small and large powers but also between states, criminal and terrorist organizations, and private individuals. See: Michael Erbschloe, *Information Warfare* (Berkeley: Osborne/McGraw-Hill, 2001).

[62] Jablonsky, "The Owl of Minerva Flies at Twilight."

[63] Caleb Carr, *The Lessons of Terror* (New York; Toronto: Random House, 2003), 252-255. Carr writes: "...the Predator can become a modern army's answer to suicide bombers; the Predator is remote-controlled and thus governed by human intelligence rather than strictly by a computer, as is the case with cruise missiles... It is also highly effective against the kind of tactical, handheld (or, as military vocabulary now has it, "man-held") weapons that terrorists use heavily, such as shoulder-launched missiles, because it is

As can be seen, the debates on the RMA included points of view from analysts who agreed with Krepinevich's interpretation, those who rejected it, and those who chose a greater emphasis on low intensity conflict. While these diverse points of view likely influenced individual analysts and decision-makers within the U.S. Army, the greatest academic influences on its 1999 Transformation plan stemmed from RMA advocates such as Krepinevich. Its adoption of the RMA is dealt with in the remaining sections of this chapter.

1993 to 1997: Army XXI

The United States Army began to develop an increased emphasis on information technology in the 1993 version of its capstone[64] doctrine document, *FM 100-5 Operations*. It echoed some of Office of Net Assessment's interpretation of the RMA, but it did not embrace sweeping organizational change or development of new weapons platforms. Rather, *FM 100-5* presented the impact of information technology as part of an evolution towards greater jointness, operational mobility, and simultaneous operations throughout the depth of the battlefield that had been underway for a number of decades.[65]

Without specifically mentioning the RMA, the document outlines the effects that information technology was expected to have: "Microprocessing, miniaturization,

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pilotless and its loss involves no casualties. The Predator aircraft will be one of the salient weapons of the postmodern military..."

[64] "Capstone" is a phrase used within the U.S. and Canadian militaries describing an overall, high-level military doctrine document. This is to distinguish it from more detailed doctrine documents dealing with specific areas. In this example, the capstone document deals with how the U.S. Army should operate as a whole, while subsidiary doctrine documents would deal with such areas as intelligence doctrine, counterinsurgency doctrine, armoured vehicle unit doctrine, and so on.

[65] Headquarters, Department of the Army, *FM 100-5 Operations* (Washington, D.C.: U.S. Department of the Army, June 1993), vi.

communications, and space technologies have combined to permit almost real-time intelligence and information sharing, distributed decision making, and rapid execution of orders from a wide variety of forces and systems for concentrated effort."[66] Developing this theme, the 1993 *FM 100-5* emphasizes that "precise knowledge of the location of friendly units allows for rapid decision making, quick adjustments of fires, and greater protection of the force."[67] In addition: "The extended range and precision of direct and indirect fire weapon systems, using laser-guided munitions and integrated target acquisition systems, make firepower more lethal than ever before."[68]

Alongside these enhanced capabilities, challenges are viewed in the context of a more chaotic geopolitical environment. U.S. "national strategy" is defined as having a "global range,"[69] but: "Decreases in forward-deployed Army forces necessitate an Army that is prepared to deploy forces anywhere in the world on short notice."[70] The document also expects the Army to have to operate more frequently across a range of conflict, from war to "operations other than war."[71] The means of dealing with these challenges was unchanged from the previous decades since the Second World War: light forces would have rapid deployability but limited firepower and survivability, while heavy forces would deploy slowly but bring the firepower and survivability to win a decisive battle. The U.S. Army's doctrine as laid out in 1993 was to take advantage of information technology to give its light, heavy, and special operations forces a decisive edge in their traditional roles.

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[66] Ibid., 1-2.
[67] Ibid., 2-17.
[68] Ibid., 2-10.
[69] Ibid., 1-1.
[70] Ibid., 1-2.
[71] Ibid., 2-1. See also page 2-2: "Unconventional and conventional warfare can exist side by side, the one flowing to the other and back again."

The following year, 1994, the *Army XXI* program began with the publication of the U.S. Army Training and Doctrine Command (TRADOC) Pamphlet *525-5 Force XXI Operations*. *525-5* was intended to provide a framework for planning and experimentation amongst U.S. Army battle laboratories, doctrine writers, combat system developers and training personnel.[72] Referencing the themes of "the advent of the Information Age"[73] and an increasingly unstable strategic security environment,[74] it states that U.S. force planning was to shift from threat-based to capabilities based.[75] This was portrayed as a shift from designing forces primarily to confront the Warsaw Pact in Europe[76] to addressing "full-dimensional operations... be they War or OOTW (Operations Other Than War)."[77]

As in Krepinevich's 1992 definition of RMA, the writers of 525-5 identify successful change as combining technological advances with "innovative ways of considering and combining available and sometimes new technologies." They similarly note that many technologies which facilitated previous changes in military organization and doctrine were associated with the communication of information, including the telegraph, telephone, and radio.[78] By contrast with these past shifts, *FM 525-5* argues

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[72] Headquarters, United States Army Training and Doctrine Command, *TRADOC Pamphlet 525-5: Force XXI Operations, A Concept for the Evolution of Full-Dimensional Operations for the Strategic Army of the Early Twenty-First Century* (Fort Monroe, Virginia: United States Army Training and Doctrine Command, August 1, 1994), iii.

[73] Ibid., 1-1.

[74] Ibid., 1-1 – 1-2 and 2-1 – 2-6. In addition, concerns were raised about the effects of information technology on media and public opinion in this increasingly unstable security environment: "Information technological advances will ensure that future operations will unfold before a global audience. Access to media will allow global or official audiences to become involved in, or react to, any and all events." Ibid., 2-10.

[75] "Patterns in the conduct of future operations are sufficiently clear to set in motion changes in land warfare doctrine – as we did in the June 1993 FM 100-5. This concept projects that momentum into the future." Ibid., 1-6.

[76] Ibid., 3-17.

[77] Ibid., 1-3.

[78] Ibid., 1-5.

that information technology will likely make a "thousandfold" advance over the following twenty years.[79] As a result, military units would have to become "internetted" together,[80] military command structures would have to become less hierarchical in some respects,[81] and: "Advanced forces will possess the capability to achieve multiple operational objectives nearly simultaneously throughout a theatre of operations."[82]

Despite the emphasis on information technology-driven change, 525-5 emphasizes continuity as much as the 1993 FM 100-5, stating that: "While recognizing that the historically solidified bedrock of Army doctrine will not change greatly, the Army must ensure that the underlying concepts of operations captured in current doctrine continue to evolve."[83] In terms of concrete plans to bring about both increased "digitization of the battlefield"[84] and increased strategic mobility, it outlines the Army Battle Command System (ABCS), and the Army Strategic Mobility Program (ASMP). The ABCS was to provide a common operating environment for U.S. forces. Over the following decade, the U.S. Army implemented[85] many aspects of ABCS as it was described in 525-5:

> In the concept, the ABCS and software will use broadcast battlefield information, including real-time friendly and enemy situations, into a digitized image that can be displayed graphically in increasingly mobile and heads-up displays. These images will, in essence, depict a unit's actual battlespace... This system permits commanders at every level to share a common, relevant picture of the battlefield scaled to their level of interest and tailored to their special needs... Individual soldiers will be empowered for independent action because of enhanced

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[79] Ibid., 1-5.
[80] Ibid., 1-5.
[81] Ibid., 1-5.
[82] Ibid., 2-9.
[83] Ibid., 1-6.
[84] Ibid., 4-6. "Digitization" is used frequently in *525-5* and in subsequent documents during 1994-1997.
[85] The extent to which implementation was successful is open to debate and requires extensive study to quantify. The relevant point here is that ABCS development continued, and systems of this type have been deployed in Western military vehicles in combat over the subsequent decade and a half.

situational awareness, digital control, and a common view of what needs to be done.[86]

The Army Strategic Mobility Program (ASMP) at this point focused on the introduction of the C-17 large transport aircraft, and a new family of U.S. Navy large, medium-speed, roll-on/roll-off ships.[87] The possibility of a new generation of vehicles in the first half of the twenty-first century was discussed briefly, with the main idea being that advances in composite materials research would allow for lighter equipment with the same level of survivability as systems developed in the 1970s and 1980s.[88] Still, it was reiterated that "doctrine will remain the engine of change for Force XXI," rather than new platform development.[89] "Improved logistics asset visibility," indicating the ability to track items in inventory and shipping using computerized systems, was discussed briefly as an alternative method to reduce the weight of deploying forces and increase their operational tempo.[90]

Parallel to the development of *Force XXI* operations as embodied in *525-5*, a Department of the Army Digitization Special Task Force was formed in January 1994. After several months of study, the Army Digitization Office (ADO) was then established in July 1994.[91] The ADO was tasked with "acquisition and assimilation of Information-Age capabilities," or "digitization."[92] As described in the *Army Digitization Master Plan 1995* (*ADMP*), this was part of a three part effort to implement *Force XXI*. The other parts of the effort were redesign of the Operating Force, also called "Joint Venture," and

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[86] Ibid., 3-4.
[87] Ibid., 3-13.
[88] Ibid., 3-13 and 4-7.
[89] Ibid., 4-2.
[90] Ibid., 3-14 and 3-19.
[91] United States Army, *Army Digitization Master Plan 1995*, 8. The specific department and location responsible for publication is not shown on the document. It is archived at, and distributed by: Alexandria, Virginia, Defense Technical Information Center.
[92] Ibid., 8.

redesign of the "Institutional Army," being undertaken by the Deputy Chief of Staff for Operations and Plans.[93] "Joint Venture" organized a series of "Advanced Warfighting Experiments" (AWEs) which were to: "support decisions related to the redesign of the operational Army," as well as to "provide the key mechanism for evaluating the effectiveness of information technologies being developed under the digitization axis."[94]

As it prepared to conduct the AWEs, the U.S. Army began to consolidate and standardize its computing and communications systems in order to achieve the common operating environment envisioned for the Army Battle Command System. The first step in this process was the creation of additional planning documents. It developed a "Horizontal Integration of Battle Command Mission Needs Statement" (HIBC MNS) which was approved on January 10, 1995. The HIBC MNS was intended to establish "the baseline operational requirements for digitization of the battlefield and future command systems."[95] An "Army Battle Command System Common Operating Environment/Common Applications Requirements Document" (ABCS COE/CA ORD) was also created, to "further define" the operational capability needs defined in the HIBC MNS.[96] It was to outline how the Army's various command and control systems could be migrated into one integrated system.[97] The "Force XXI Battle Command Brigade-and-Below" (FBCB2) system started development in 1994-95, with a focus on defining "the need for the lowest level command and control interface capability" in the Army Battle Command System.[98] In addition, the Army "Enterprise Strategy" was to ensure

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[93] Ibid., 8.
[94] Ibid., 8-9.
[95] Ibid., 9.
[96] Ibid., 9.
[97] Ibid., 9.
[98] Ibid., 9.

that digitized Army systems would be interoperable with those of the U.S. Air Force and U.S. Navy, in accordance with the "C4I (Command, Control, Computing, Communications, and Intelligence) for the Warrior" concept created during this time frame by the U.S. Joint Chiefs of Staff. C4I for the Warrior was described by the Army as a "Joint system of Joint systems."[99]

The general approach laid out in these documents, as summarized in the 1995 *Army Digitization Master Plan*, was that the U.S. Army would take a four-step approach to digitizing the first experimental Force XXI units. First, new digital systems would be acquired according to the requirements laid out. Second, the "tactical internet" linking the new and existing systems would be fully developed and tested. Third, the operating systems on different platforms would be integrated. Finally, the system would be further enhanced by developing the "Battlefield Information Transmission System" (BITS) once integration problems were solved.[100]

Significantly, none of these plans involved acquisition of new weapons platforms. Rather, existing platforms would be digitized either through upgrades to built-in computing and communications systems, or through the use of what were termed "appliqué"[101] technologies:

> For a platform that has no capability now, the applique [sic.] will consist of a Global Positioning System (GPS) receiver, a computer unit (commercial, ruggedized or militarized), and an interface to the Single Channel Ground and Airborne Radio System (SINCGARS), and/or Enhanced Position Location Reporting System (EPLRS) radio. A common "core" application software capability will reside in all appliques [sic.], regardless of platform. Additional software modules will provide the interface with embedded systems on the M1A2

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[99] Ibid., 55.
[100] The four steps are outlined on page 9 and discussed extensively throughout the document.
[101] The U.S. Army consistently used the term "applique" without an accent on the final "e," although Canadian English frequently uses "appliqué."

> tank, AH-64, and OH-58D aircraft. Selected platforms from the Marine Corps and the Air Force will also require appliques to participate in the experiments.[102]

The focus of the appliqués was to take advantage of "Commercial Off the Shelf" (COTS) technology wherever possible. The baseline requirement was that installation kits would provide some shock and environmental protection for otherwise commercially available digital systems. Where these were found to be insufficient, somewhat more expensive "ruggedized" mountings and casings would be used. In certain applications, it was expected that fully "militarized" components would be needed, with shock and environmental protection integrated into the computer, requiring cooperative development work with industry and greater expense.[103] The appliqués were handled under the Force XXI Battle Command and Below (FBCB2) program, and a development contract was awarded in January 1995.[104] U.S. Army units organized as part of the Louisiana Maneuvers Task Force (LAMTF) were to be equipped with upgrades and appliqués.[105] By 1996, the 4th Mechanized Infantry Division, formerly the 2nd Armored Division, at Fort Hood, Texas, was designated as the Experimental Force or EXFOR which would be converted into an *Army XXI* division.[106]

While maintaining a focus on taking advantage of information technology as cheaply as possible, the writers of the 1995 *Army Digitization Master Plan* also expressed satisfaction with the existing inventory of U.S. Army weapons platforms, and displayed little sense of urgency with the need to proceed with notional lighter weight platforms such as those briefly discussed in *525-5 Force XXI Operations*:

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[102] Ibid., 40.
[103] Ibid., 40.
[104] Ibid., 37.
[105] Ibid., 12.
[106] U.S. Army Digitization Office, *U.S. Army Digitization Master Plan (1996)* (Washington, D.C.: United States Army, March 1996), 9-1.

> In the 1980s, the Army fielded the Abrams tank, Bradley Fighting Vehicle (BFV), Apache attack helicopter, Multiple Launch Rocket System (MLRS), and Patriot Missile System. These investments, along with other new systems and improvements to then-existing platforms, made possible the design of new organizations and the implementation of new doctrine – AirLand Battle. These revolutionary advancements were proven on the battlefields of the Gulf War... For the remainder of the 1990s and into the beginning of the next century, the modernization program of the Army is not as robust as it was in the 1980s... Incremental modernization of current weapons systems is planned... Interoperable digitization of the battlefield has the potential to provide means for the next renaissance of military art and science, in the same manner that the infusion of digital technology into the American society is providing a transitional bridge from the Industrial Age to the Information Age.[107]

The U.S. Army's account of its Advanced Warfighting Experiments (AWEs) demonstrates that during the mid-1990s it followed a vision focused on expanding digitization, rather than on acquiring new platforms. In the 1995 *Army Digitization Master Plan*, two 1994 events, "Desert Hammer" and "Desert Capture III," were described as having become a baseline for future AWEs.[108] Two more were expected in 1995: "Focused Dispatch" and "Warrior Focus," while the "critical event," "Brigade Task Force XXI," was expected to take place in 1997.[109] Subsequently, the U.S. Army conducted more AWEs than were outlined in the 1995 document. The 1996 *Army Digitization Master Plan* describes "Focused Dispatch" and "Warrior Focus," as well as "Prairie Warrior/Mobile Strike Force," and a Joint Service "Theater Missile Defense" AWE.

"Focused Dispatch" was conducted as a series of Mounted Battlespace Lab sponsored experiments from April to August 1995 at Fort Knox, Kentucky. It focused on maximizing information connectivity and determining the need for changes in command processes and functions and in organization that would be facilitated by greater flow of

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[107] *Army Digitization Master Plan 1995*, 22-23.
[108] Ibid., 8-9.
[109] Ibid., 8-9.

information.[110] The "Prairie Warrior/Mobile Strike Force" Advanced Warfighting Experiment (AWE) took place in May 1995 at the TRADOC Battle Command Lab at Fort Leavenworth, Kansas. It was reported that, "limitations of the simulation," inexperience with digitized equipment, and the use of immature technologies resulted in no significant advantages for the digitized battle staff over a traditional staff structure.[111] In addition, appliqué hardware and software were not available for vehicles with no built-in digitized systems in time for the exercise.[112] The Theatre Missile Defense AWE also took place in May, 1995. Appliqués were not available for this exercise either, but the Army Digitization Office nonetheless concluded digitization would provide a benefit at brigade and joint task force levels.[113] The "Warrior Focus" AWE was conducted at the Joint Training Readiness Center at Fort Polk, Louisiana, in November 1995. The U.S. Army indicated that it established the basic requirements for digital equipment which could be carried by soldiers on foot. Various types of digital technology were experimented with to simulate the planned capabilities of appliqués for infantry and special operations forces (SOF), and new communications software was successfully used.[114]

Looking ahead, the U.S. Army Digitization Office in 1996 still considered the "Task Force XXI" AWE, now scheduled to progress in phases from June 1996 to February 1997, to be the "critical event."[115] This extended timeline was intended to allow for equipment fielding and operator training, followed by sub-unit training and

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[110] *Army Digitization Master Plan (1996)*, 8-5.
[111] Ibid., 8-5.
[112] Ibid., 8-5.
[113] Ibid., 8-5.
[114] Ibid., 8-5.
[115] Ibid., 8-6.

exercises before assembling the entire digitized brigade for an exercise at the U.S. National Training Center.[116] Also, planning for a "Prairie Warrior 96" Advanced Warfighting Experiment (AWE) later in 1996 was underway.[117] In 1995, a division level experiment, the "Division XXI" AWE, had been planned for the U.S. Army's fiscal year 1998 (FY98), and a corps exercise for the 2nd quarter of FY99.[118] By 1996, the "Division XXI" exercise was planned to begin in November 1997. However, the 1996 Army Digitization Master Plan indicated that resources available for it and the following corps level experiment had been reduced, and as a result, both were expected to produce less concrete results.[119]

In other respects, the 1996 U.S. *Army Digitization Master Plan* (ADMP) reflected the concepts and themes developed in the 1995 version, but added a great deal of additional detail that had been produced by the *Army XXI* program. C4I, interoperability, and shared situational awareness are all discussed in greater detail, as are various aspects of the Army Battle Command System, Tactical Internet, and Force XXI Battle Command Brigade-and-Below system. A fourth type of appliqué had been added in addition to the COTS, ruggedized and militarized categories; a "DSSU," described as "a small, Litton Lightweight Computer used to integrate dismounted soldiers into the digital battlespace."[120]

Despite limited resources, a "Task Force XXI" AWE was completed in March 1997. A firsthand account of the exercise can be found in a paper by Mark Hanna, at the time a Lieutenant Colonel who followed the results of AWE at the Fort Irwin National

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[116] Ibid., 8-6 – 8-8.
[117] Ibid., 8-5.
[118] *Army Digitization Master Plan 1995*, 35.
[119] *Army Digitization Master Plan (1996)*, 8-8 – 8-9.
[120] Ibid., 7-3.

Training Center along with a U.S. National Defense University group. As described by Hanna, a 5000 man digitized Brigade Combat Team (BCT) was successfully fielded.[121] Over 7000 pieces of equipment, including the previously planned appliqués, were installed on over 900 vehicles modified into 180 different configurations.[122]

Hanna's impression was that "Task Force XXI" was successful, but demonstrated that there were still significant problems with the U.S. Army's implementation of digitization. The Tactical Internet, he wrote; "is the central feature and key element of the digitized force."[123] He found that friendly situational awareness worked well, but "high resolution and accuracy concerning the enemy... is more difficult to achieve."[124] Horizontal integration of the digital systems – linking units at the same tactical level – had proven more difficult to achieve than vertical integration allowing higher command echelons to observe the activities of subordinate units.[125] The tactical Internet, he added, was "apparently" more useful to higher commanders than to soldiers and leaders at the point of contact.[126] Also, power requirements for dismounted infantry appliqués presented problems, overloading the infantry with too much weight.[127] Finally, the Army had not adequately dealt with the problem of "information overload," nor with the danger that the Tactical Internet made it "dangerously easy" for leaders to micromanage their

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[121] Mark Hanna, "Task Force XXI: The Army's Digital Experiment," *National Defense University Strategic Forum* 119 (July 1997), 1-6.
[122] Ibid.
[123] Ibid.
[124] Ibid.
[125] Ibid.
[126] Ibid.
[127] Ibid.

subordinates.[128] Still, Hanna believed that "More training and experience with the new technology will allow ground force units to maximize its capabilities and potential."[129]

While various observers and participants in "Task Force XXI" likely had varying views of its success, Hanna's report illustrates that the U.S. Army had made progress in implementing the digitization concepts outlined in its 1994-96 digitization and *Force XXI* plans. Between 1993 and 1997, it had developed upgrades to existing digital systems and digital appliqué packages which allowed it to build a Tactical Internet at a brigade level and experiment with the capabilities of this system.

However, during 1996 and 1997 a growing emphasis on strategic and operational mobility would emerge. In that context, success with extensively digitizing U.S. military forces would be interpreted to mean replacing heavier tracked vehicles with lighter armoured vehicles could be not only possible but preferable. This shift in emphasis was driven by policy changes initiated by the U.S. Joint Chiefs of Staff and U.S. Department of Defense legislatively mandated reviews, leading the U.S. Army leadership to initiate the studies that would lead to Transformation.

1996 to 1997: Emphasis on Mobility Increases

In 1996, the U.S. Joint Chiefs of Staff issued the new capstone document, *Joint Vision 2010*. It outlines four operational concepts: dominant maneuver, precision engagement, full dimensional protection, and focused logistics. Three of the concepts, dominant maneuver, precision engagement, and full dimensional protection, prescribe

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[128] Ibid.
[129] Ibid.

linking together the digital systems of the U.S. Army, Navy and Air Force to develop a common 'picture' of a "battlespace."[130] *Joint Vision 2010* states that linking the digital networks of the three services will create a system of systems that will provide an "interactive" view of friendly and enemy operations within a conflict or potential conflict area. It describes this interactive picture as "dominant battlespace awareness."[131] This was not all new for the U.S. Army. Dominant battlespace awareness reflects the "joint system of joint systems" outlined in the Army Digitization Master Plans, as well as the Army Enterprise Strategy and the "C4I for the Warrior" concept.

Nonetheless, there was increasing focus on mobility. The definition of dominant maneuver mentions operational mobility, but the focus is on the ability to interact over large distances rather than on the specific speed of individual platforms. The document defines dominant maneuver as "the multidimensional applications of information, engagement, and mobility capabilities to position and employ widely dispersed joint air, land, sea, and space forces to accomplish the assigned operational tasks."[132] Precision engagement is defined as the use of a system of systems to locate an objective or target, engage it, assess the level of success in engaging it, and "retain the flexibility to reengage with precision when required."[133] Taken together, precision engagement and full-dimensional protection emphasize the importance of engaging the enemy first, thereby reducing the importance of passive protection such as heavy vehicle armour. As

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[130] The writers of Joint Vision 2010 use the term battlespace, instead of the traditional term battlefield, to emphasize the airspace and space over a combat zone on the ground, as well as the sea space around it, and the underwater areas below the surface of the sea.
[131] U.S. Joint Chiefs of Staff, *Joint Vision 2010* (Washington, D.C.: U.S. Joint Chiefs of Staff), 13. The printed version has no date of publication, but is cited as being published in 1996 by various sources, including the U.S. Army War College Library, which lists the publication date as 1996 followed by a question mark.
[132] Ibid., 20.
[133] Ibid., 20.

described in *Joint Vision 2010*, full-dimensional protection is the reverse side of precision engagement, using superior battlespace awareness combined with long-range fires to avoid being engaged first. It is stated that the "primary prerequisite" for full-dimensional protection is "control of the battlespace to ensure our forces can maintain freedom of action during deployment, maneuver and engagement, while providing multi-layered defences for our forces and facilities at all levels."[134] The document reiterates at various points that information superiority is necessary to enable these three capabilities.[135]

Strategic mobility is in part addressed by the focused logistics operational concept. As seen above in *FM 525-5*, reducing logistics requirements through greater efficiency was proposed as a way to reduce the weight of deploying forces:

> Focused logistics will be the fusion of information, logistics, and transportation technologies to provide rapid crisis response, to track and shift assets even while enroute, and to deliver tailored logistics packages and sustainment directly at the strategic, operational, and tactical level of operations. It will be fully adaptive to the needs of our increasingly dispersed and mobile forces.[136]

Joint Vision 2010 argues that the four operational concepts will facilitate military operations across the spectrum of conflict, from humanitarian assistance to high intensity conflict. It calls this capability "full spectrum dominance," instead of using the term "full-dimensional operations" which the U.S. Army had used between 1993 and 1996. To a large extent, then, it simply summarizes and reinforces the concepts that the U.S. Army had been developing in the preceding years. Dominant maneuver, precision engagement, full dimensional protection, focused logistics, information superiority, and full spectrum dominance are relatively clear terms which summarize the various ideas

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[134] Ibid., 22.
[135] For example: "We must have information superiority: the capability to collect, process, and disseminate an uninterrupted flow of information while exploiting or denying an adversary's ability to do the same. Information superiority will require both offensive and defensive information warfare (IW)." Ibid., 16.
[136] Ibid., 24.

that were being tested. However, despite addressing the spectrum of operations, *Joint Vision 2010* is focused on technologically advanced state adversaries and the lethality of the high intensity conflict battlefield as the central future concerns.

Regarding opposing military forces, it states that: "Our most vexing future adversary may be one who can use technology to make rapid improvements in its military capabilities that provide asymmetrical counters to US military strengths, including information technologies."[137] Also, like the Soviets in the 1970s and 1980s and Krepinevich in 1992, the plan firmly states that the increased precision of weapons enabled by advances in computers and communications will: "provide an order of magnitude improvement in lethality."[138] Drawing on these two factors, the argument is made that adaptations to this "increasingly lethal battlespace" will likely take the form of "increased stealth, mobility, dispersion, and pursuit of a higher tempo."[139] Regarding mobility specifically, it is stated that:

> Increased dispersion and mobility are possible offensively because each platform or each individual warfighter carries higher lethality and has greater reach. Defensively, dispersion and higher tempo complicate enemy targeting and reduce the effectiveness of area attack and area denial weaponry such as weapons of mass destruction (WMD).[140]

In terms of strategic mobility, *Joint Vision 2010* defines the U.S. as having worldwide strategic interests, such as "enlarging the community of free market democracies."[141] As a result, power projection, enabled by "rapid strategic mobility," is defined as "the fundamental strategic concept of our future force."[142] In these two ways

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[137] Ibid., 10-11.
[138] Ibid., 13.
[139] Ibid., 14.
[140] Ibid., 14-15.
[141] Ibid., 3.
[142] Ibid., 4. The concept of "strategic" used in *Joint Vision 2010* appears to be a substitute for distance and the requirements for movement of a unit from home base to a theatre of operations. As such, it deals more

Joint Vision 2010 greatly emphasized both operational and strategic mobility, although in other respects it was simply refining and summarizing the same basic concepts as the U.S. Army had been dealing with in its *Force XXI* program between 1993 and 1996. The Army quickly responded to *Joint Vision 2010* during 1996 with *Army Vision 2010.*

Army Vision 2010 focuses on the full spectrum dominance concept described in *Joint Vision 2010.* While it acknowledges the importance of joint operations,[143] it makes the argument that the Army is the best suited of the U.S. military services to deal with the lower and middle portions of the spectrum of conflict in an uncertain geostrategic environment. It bases this argument on the position that the Army is the only force that can control populations and territory, as well as perform civic action such as "nation-building" projects and "peacetime engagement."[144] It states that these capabilities allow land power to: "make permanent the otherwise transitory advantages achieved by air and naval forces."[145] At the same time, it also states that the "Euro-Middle East" and "Asian Arc" regions are inherently unstable but contain a number of large nation states which, despite having less military capability than "wealthy democracies," have access to the "most advanced" military technology, creating a significant danger.[146] Therefore, *Army Vision 2010* argues that the U.S. Army must be capable of fighting and winning in high

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with operational effectiveness than the strategic impact of operations, although the assumption made in the document may have been that a rapid operational effect would end conflict quickly, therefore having a strategic effect.

[143] U.S. Department of the Army, *Army Vision 2010*, 1.

[144] Ibid., 3.

[145] Ibid., 2.

[146] Ibid., 7. *Army Vision 2010* states: "This phenomenon creates a new danger in the future, i.e., conflict with a nation having a very sophisticated and symmetric capability... In the Euro-Middle East region... oil and radical fundamentalism serve as potential catalysts to armed conflict... In the Asian Arc region... the shortage of food and arable land will pose increasingly demanding challenges in the next century. China alone has 1.2 billion people, making the U.S. population, by comparison, 'right of the decimal point.'"

intensity conflict.[147] These arguments illustrate that the U.S. Army had adopted the general interpretation of RMA inspired by Krepinevich, and also suggest that it was engaging in governmental politics, manoeuvring to present itself as more strategically relevant and deserving of funding than the U.S. Air Force and Navy.

Army Vision 2010 discusses precision fires, detailed information, and precise detection capabilities, as well as the *Joint Vision 2010* concept of dominant maneuver, which it equates to what it calls "decisive operations."[148] The concepts of precision engagement and full dimensional protection are described almost identically to how they are presented in *Joint Vision 2010.*[149] The comment to "mass effects... not forces" is also included, along with "win the decision cycle."[150] These reflect the idea of striking an opponent simultaneously with munitions fired from widely dispersed weapons platforms. Most significantly, however, *Army Vision 2010* adopts the growing emphasis on both strategic and operational mobility seen in *Joint Vision 2010.* It argues that a future "power projection force" will be equipped with "lighter, more durable, multipurpose warfighting systems." Lighter systems, it states, will reduce the amount of strategic airlift or sealift required for Army forces; "as well as the size and complexity of the logistics tail needed to sustain the force."[151]

As in *Joint Vision 2010*, "full dimensional protection," rather than the passive protection of heavy vehicle armour, is invoked as providing protection for this type of force.[152] The possibility of incorporating "stealth" characteristics into ground vehicles is

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[147] Ibid., 8.
[148] Ibid., 12.
[149] Ibid., 13-14.
[150] Ibid., 12.
[151] Ibid., 11. Elsewhere, the approach is summed up with the statement: "We must lighten up the heavy forces and heavy up the capabilities of the light forces." Ibid., 9.
[152] Ibid., 14.

also discussed.[153] "Focused logistics" is outlined as an additional method to further improve mobility by reducing sustainment requirements.[154] Essentially, technology is conceptualized as providing information superiority, which combined with greater mobility will then provide protection for land forces by enabling them to avoid being targeted or hit by the enemy. By both moving quickly and being able to locate and target opponents faster, they will be able to destroy their enemies before being engaged themselves.

Army Vision 2010 also describes itself as the "linchpin" between Force XXI and the "emerging long-term vision" of the *Army After Next* program.[155] *Army After Next* is not discussed in further detail, but as will be shown below, it would follow the lead of *Joint Vision 2010* and *Army Vision 2010* in emphasizing a perceived emerging requirement for greater mobility.

During the rest of 1996 and in 1997, additional policy documents took up the shift in focus to mobility. The 1997 version of the *United States Army Posture Statement,* a document presented each year to the U.S. Congress, remains focused on highlighting *Force XXI* digitization initiatives and the continued importance of heavy forces.[156] However, it also contains the arguments that continuing digitization will reduce the fog of war and be a force multiplier,[157] and complains that Army modernization "is badly in need of more resources."[158] As opposed to the satisfaction with the U.S. Army's existing inventory of weapons platforms described in *525-5 Force XXI Operations*, and the

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[153] Ibid., 12 and 15.
[154] Ibid., 15-16.
[155] Ibid., 2.
[156] U.S. Army, *A Statement on the Posture of the United States Army Fiscal Year 1997*, by Togo D. West, Jr and Dennis J. Reimer (Washington, D.C.: Office of the Chief of Staff, U.S. Army, Congressional Activities Division, 1997), 11 and 72-81.
[157] Ibid., 83-85.
[158] Ibid., 10.

appliqué digitization approach of *Force* XXI, the *Posture Statement* argues that eventually "additional technological improvements of today's systems will provide only marginal benefits."[159]

The 1997 version of the *Quadrennial Defense Review*, a document that, since 1996, the U.S. Armed Forces are required to produce at the beginning of the term of each newly elected president,[160] takes a position more strongly corresponding to that in *Joint Vision 2010* and *Army Vision 2010.* It repeats the view that there is an uncertain future strategic environment and that armed forces with "full spectrum dominance" are required.[161] It also increasingly uses the term "transformation" in association with the RMA. This is first seen in *Joint Vision 2010* with the statement: "Joint Vision 2010 creates the template to guide the transformation of these concepts into joint operational capabilities."[162] The *1997 Quadrennial Defense Review* states that "we must meet our requirements to shape (the international security environment) and respond in the near term, while at the same time we must transform U.S. combat capabilities and support structures to be able to shape and respond effectively in the face of future challenges."[163]

The *Quadrennial Defense Review* outlines a four part plan. Firstly, it calls for pursuit of a "focused modernization effort" to replace "aging systems" and incorporate "cutting-edge technologies" into U.S. military forces. The second part is to "continue to

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[159] Ibid., 46.
[160] U.S. Department of Defense, *1997 Quadrennial Defense Review* (Washington, D.C.: U.S. Department of Defense, May 1997). The legislation mandating Quadrennial Defense Reviews is: *National Defense Authorization Act of 1996*, Public Law 104-201. The relevant section of the law is archived online by the Federation of American Scientists: http://www.fas.org/man/docs/qdr/quad_leg.html (accessed Monday, June 22, 2009). The 1997 *Quadrennial Defense Review* is also hosted online by the U.S. Department of Defense: http://www.fas.org/man/docs/qdr/quad_leg.html (accessed Tuesday, August 3, 2010). The legislation is also provided on a webpage hosted by the Commonwealth Institute in Cambridge, Massachusetts: http://www.comw.org/qdr/backgrd.html (accessed Thursday, August 12, 2010).
[161] Ibid., sections II and III. The publicly available copies of the 1997 *Quadrennial Defense Review* do not have page numbers, but rather separate numbered sections.
[162] U.S. Joint Chiefs of Staff, *Joint Vision 2010*, 34.
[163] U.S. Department of Defense, *1997 Quadrennial Defense Review*, section III.

exploit" the RMA, and the third is to exploit what is termed a "revolution in business affairs." Finally, the fourth is to: "Insure or hedge against unlikely, but significant, future threats in order to manage risk."[164] Continuing with the transformation theme, it states that the U.S. must "prepare now to meet the challenges of an uncertain future by transforming U.S. combat capabilities to be able to shape and respond effectively well into the 21st century."[165] This idea is reinforced by then Chairman of the U.S. Joint Chiefs of Staff, John M. Shalikashvili, in his comment in the report that: "Our challenge is to balance risk between near-term requirements and the need to prepare for the longer term."[166]

The *1997 Quadrennial Defense Review* is relatively conservative regarding U.S. Army force structure. It recommends that in the near term of the late 1990s, the Army retain six heavy and four light divisions,[167] and that it continue with acquisition of heavy force weapons platforms such as the Crusader self-propelled howitzer and Comanche helicopter.[168] However, referencing *Joint Vision 2010*, it argues that "transforming U.S. forces for the future" must begin. In terms of the longer-term transformation objectives, Andrew Marshall's Office of Net Assessment was heavily involved:

> OSD's Office of Net Assessment has also developed an Operational Wargaming Program with support from the Services... The Department's science and technology (S&T) efforts are directly linked to *Joint Vision 2010* concepts and are guided by concept-related Defense Technology Objectives (DTOs). Each DTO identifies a specific future technology advancement that will be developed or demonstrated...[169]

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[164] Ibid., section III.
[165] Ibid., section III.
[166] Ibid., section X.
[167] Ibid., section V.
[168] Ibid., section VII.
[169] Ibid., section VII.

In the case of the U.S. Army, the "Future Combat System" (FCS) was identified as a Defense Technology Objective. In the *1997 Quadrennial Defense Review* it is described as offering "the potential of executing future dominant maneuver concepts with smaller, lighter, and more mobile ground forces."[170] As discussed above in the section on defining the technology in this study, the FCS ultimately became part of the 1999 U.S. Army Transformation plan. It was to be used to equip the "Objective Force" by 2012, after the development of the "interim combat brigade teams" with their near-term light to medium weight armoured vehicles. First, however, the U.S. Army would study a range of weapons platform options in the *Army After Next* program.

The final of the set of major U.S. policy documents issued during 1996-1997 which called for a greater emphasis on mobility was the report in December 1997 of the National Defense Panel: *Transforming Defense: National Security in the 21st Century.* The panel was composed of retired U.S. generals, admirals, and defence academics, including Andrew Krepinevich. It was created under the Military Force Structure Review Act of 1996, the same legislation that had required the U.S. military to produce the *1997 Quadrennial Defense Review.*[171] It envisions a near future consisting of rapid technological change, rapid obsolescence of existing and near-term technologies including weapons platforms, and of short wars conducted quickly by highly mobile forces using information superiority.[172] It also uses the term "transformation"

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[170] Ibid., section VII.
[171] *National Defense Authorization Act of 1996*, Public Law 104-201, sec. 923 and sec. 924.
[172] National Defense Panel, *Transforming Defense: National Security in the 21st Century, Report of the National Defense Panel December 1997*, by Philip A. Odeen, Richard L. Armitage, Richard D. Hearney, David E. Jeremiah, Robert M. Kimmit, Andrew F. Krepinevich, James P. McCarthy, Janne E. Nolan, and Robert W. RisCassi (Arlington, Virginia: National Defense Panel, 1997).

extensively, and argues that the U.S. military must begin transforming immediately to deal with security threats in the 2010-2020 time period.

Like *Joint Vision 2010* and the other 1996-97 documents discussed above, the National Defense Panel report predicts an increasingly uncertain geopolitical security environment, although it goes further to include the likelihood of new and unexpected threats both around the world and to the U.S. homeland itself. It presents a complex model of "geopolitical revolution." Like the work of A. and H. Toffler and Van Creveld, it focuses on the idea that information technology is transforming industrial age economies into "information-based economies," and so places the RMA within the context of a far-reaching technological and cultural change.[173]

As with the other 1996-97 documents, jointness, information technology, power projection and rapid deployability are core themes in the National Defense Panel report. U.S. defence policy and industrial base are criticized as still being based on a Cold War model that must change to fit the new information age.[174] It is more aggressive than the *1997 Quadrennial Defense Review* in recommending major changes to United States defence policy. For example, it argues that the two-theater of war construct[175] that the U.S. military was maintaining during the 1990s was consuming too much funding and requiring too large a number of personnel, and that this money and effort should be transferred to transformation instead.[176]

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[173] Globalization, described as the emergence of a "global, interdependent marketplace," demographic and social pressures, and a perception that nonstate actors are gaining increasing power are all merged with the RMA by the panel. Ibid., 5-8.
[174] See covering letter in ibid., and 74-78.
[175] The two theatre of war construct was essentially the idea that the U.S. military should have sufficient forces to fight and win two theatre-level campaigns simultaneously; a plausible 1990s example would be simultaneous wars with Iraq and North Korea.
[176] National Defense Panel, *Transforming Defense: National Security in the 21st Century*, 23-24.

Combined with these criticisms, the call for rapid deployability is put forward more forcefully than in the other 1996-97 policy documents.[177] As with the *Joint Vision 2010* dominant maneuver, precision engagement, and full dimensional protection concepts, the National Defense Panel report envisions U.S. ground forces operating with greater dispersion and placing emphasis on "seeing deep" to destroy the enemy before being targeted themselves.[178] As in *Army Vision 2010*, the statement "Concentration of effects, not forces" is used in connection with this thinking.[179] The same model of information superiority being achievable, and being used to eliminate the need for passive protection, emerges. In addition, the National Defense Panel report combines it with highly optimistic notions about rapid technological progress and the possibility of designing lightweight armoured vehicles with "stealth" characteristics.[180]

With this focus on new platforms, criticism of continuing modernization of existing weapons systems is carried further than in the *1997 United States Army Posture Statement*. The report states that: "The transformation to a force for 2010-2020 should not be dominated by efforts to modernize legacy systems that will have much less utility in the future."[181] Continuing upgrades of the M1 Abrams tank, as well as the acquisition

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[177] The report states: "We must be able to project military power much more rapidly into areas where we may not have stationed forces... Toward that end, our ability to project combat power anywhere in the world will require new technologies, operational concepts, and capabilities to meet the new challenges. First among these new challenges is the need for a much smaller force "footprint" characterized by fewer but more capable attacking troops and platforms supported by an even smaller logistics element." Ibid., 33.
[178] Ibid., 33-34.
[179] Ibid., 45.
[180] The panel argues that: "The ability to move our forces rapidly and in the right configuration is key to their effectiveness. Most importantly, the greater their mobility, the greater their protection... Increasingly, any force that can be seen is likely to be hit. The best protection, therefore, is not to be seen. At the same time, the ability to avoid detection affords the opportunity for tactical surprise... The stealth embodied in our planes and submarines today will be increasingly important for our air, sea, *and* ground forces tomorrow..." Ibid., 45.
[181] Ibid., 44.

of the Crusader howitzer and the Comanche helicopter, are singled out for criticism.[182] In terms of future land force capabilities, the panel expresses a preference for a "twenty-first century tank" that would rely on "speed, agility, and hyper-velocity gun technology" and would have an "appropriate weight range" of 30-35 tons.[183] This would be part of a "more expeditionary" Army, with greater urban warfare capability, other lighter equipment, and vertical lift systems rather than rotary-wing aircraft for transportation.[184] Finally, the report endorses the *Army After Next* program that was underway by late 1997, suggesting that III Corps and forward-deployed U.S. Army forces be migrated to *Army XXI* structures as soon as possible, while the remainder of the U.S. Army should transform to an *Army After Next* immediately.[185] This approach resembles the division between the interim combat brigade teams and the "legacy force" that would emerge in the U.S. Army Transformation plan in 1999-2000.

1997 to 1999: Army After Next

The U.S. Army's *Army After Next* program followed the approach of the 1996-97 policy documents discussed above in focusing on strategic and operational mobility. However, it did not immediately settle upon the notion of a tank in the 30 ton range as proposed in *Transforming Defense: National Security in the 21st Century*. As described in the 1997 *Annual Report on The Army After Next Project to the Chief of Staff of the Army*, the Chief of Staff of the Army and the Commander of United States Army

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[182] Ibid., 49.
[183] Ibid., 47.
[184] Ibid., 47.
[185] Ibid., 49.

Training and Doctrine Command (TRADOC) established the *Army After Next* program in February 1996.[186] It was designed as "a series of free-play tactical, operational, and strategic war games and war-game excursions designed to explore the character of future warfare."[187] Initially, *Army After Next* was focused on the period beyond the year 2010, and intended by the U.S. Army to "break free" of "incremental" change and "not be constricted by near-term budgetary and institutional influences."[188] It would study a broad range of new force structures and weapons platforms including air-mechanized forces, not simply lighter armoured ground vehicles.

The stated desire to break free of incremental change demonstrates clearly that the U.S. Army had internalized the views of RMA advocates such as Krepinevich. The belief repeated here is that weapons system development and acquisition programs based on the RMA would be the opposite of incremental change.

The argument the U.S. Army made in 1997 was that the *Army After Next* would provide "the physical speed and agility to complement the mental agility inherited from Force XXI."[189] This statement invokes the connection between information superiority and an imperative for greater strategic and operational mobility. The "mental agility" of *Army XXI* refers primarily to the capability of a "digitized" military force with a tactical internet to collect and distribute a great deal of information and the revised command and control techniques required to handle the volume of information and act upon it. As seen

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[186] United States Army, *Knowledge & Speed: The Annual Report on The Army After Next Project to the Chief of Staff of the Army, July 1997* (Washington, D.C.: United States Army, 1997). There are some discrepancies between accounts; according to retired U.S. Major General Robert H. Scales Jr., the *Army After Next* program was underway by the fall of 1995. He recounts heading it between that time and summer 1997. See: Robert H. Scales, Jr., *Future Warfare.* (Carlisle Barracks, Pennsylvania: U.S. Army War College, 1999), xi.
[187] United States Army, *Knowledge & Speed*, 2.
[188] Ibid., 1.
[189] Ibid., 1.

above, by the time of the "Task Force XXI" exercise in early 1997, *Army XXI* had made significant advances in this area. "Physical speed and agility", however, reflect the *Joint Vision 2010* concepts of dominant maneuver, precision engagement and full-dimensional protection where information superiority and rapid movement replace the heavy armoured forces of the late Cold War. This idea is further reinforced elsewhere in the 1997 *Army After Next* annual report: "Increasing the speed of movement across all three levels of warfare (tactical, operational, and strategic) must become the driving imperative of future military development."[190]

The 1997 *Army After Next* annual report drew on historical analysis to justify an increasing emphasis on mobility. It argues that throughout history, evolving technology has had military applications which alternately favour offensive or defensive operations, and that these alternating cycles accelerated greatly as a result of the industrial revolution.[191] Precision firepower, it is stated, once again turned the advantage to the defence by the mid-1980s, as attacking forces can be identified and destroyed at far greater ranges, meaning that there is a larger "deadly zone," potentially extending over hundreds of kilometres, to cross.[192] The way to deal with this, the document indicates, is by accelerating: "the speed of movement across the deadly zone by an order of magnitude or greater."[193] As with *Joint Vision 2010* and the other 1996-1997 policy documents, the 1997 *Army After Next* annual report demonstrates a focus on high intensity conflict in

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[190] Ibid., 11.
[191] The U.S. Army's approach in this document is similar to the analysis of military historians such as Archer Jones. See page 21 of the Literature Review.
[192] United States Army, *Knowledge & Speed*, 2. Hundreds of kilometers is an estimate; the document states: "By the mid-1980s, technology had extended the tactical deadly zone to what were once operational and possibly strategic distances." Traditionally, tactical distances might be the space within a few hundred meters or a few kilometers of the "front line;" operational zones potentially comprise entire countries (a theatre of operations), thereby indicating depths of hundreds of kilometers, while strategic distances could encompass entire continents or perhaps the whole world.
[193] Ibid., 2.

which a near-peer competitor state will use precision firepower and information technology enabled capabilities against U.S. forces.

Another argument made in the report for proceeding rapidly with change is that late Cold War vehicles such as the Abrams and Bradley are estimated to wear out in approximately twelve years,[194] which, counting from 1997, would be the year 2009. The report states that: "...every revolution, whether political, economic, or military, unfolds in evolutionary steps. Generally, at least half a generation, about 15 years, is required for vision and ideas to mature..."[195] In this way, the U.S. Army suggested that development of a new generation of weapons platforms which would be fielded after the year 2010 had to begin in the 1990s, in order to avoid having to acquire more of the existing types of vehicles which were now supposedly insufficiently mobile.

The above arguments, as used by the U.S. Army, might give the impression that American planners expected opponents to be mirror images of U.S. forces in their use of information technology. This is not altogether true. The initial *Army After* Next exercises addressed concerns about an enemy using "asymmetric" tactics against U.S. forces, but within the more general context of state-against-state high intensity conflict. The 1997 *Army After Next* annual report describes a number of *Army After Next* war games that the U.S. Army conducted that year at the TRADOC Analysis Center at Fort Leavenworth, as well as at the Winter War Game 97 at Carlisle Barracks.[196] Analysis of the games was done by a number of agencies, including the TRADOC Analysis Center and the RAND Corporation.[197] The *Army After Next* Blue forces used a theoretical

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[194] Ibid., 5.
[195] Ibid., 3.
[196] Ibid., p. 11.
[197] Ibid., Appendix B.

mechanized airmobile set of vehicles consisting of "lighter surface fighting vehicles" coupled with "advanced airframes," which transported them into the theatre of conflict at speeds "as great as" 200 kilometres per hour and could also provide operational mobility within the theatre.[198]

The war games used the standard paradigm of "Blue" versus "Red," with Blue representing U.S. forces and Red representing an opponent. The report states that:

> Red's learning curve rose sharply as the games progressed. Confronted by overwhelming combat power, he resorted to asymmetric responses in an effort to offset Blue's advantages. He recognized early on that Blue's superiority, particularly in firepower and information dominance, eroded over time. Any action that heightened ambiguity or complexity, and thus increased the time Blue needed to gain control of the situation, benefited Red. Therefore, Red moved rapidly to complex terrain – urban, suburban, and, in some cases, forests and mountains... The lesson is obvious. For the 2020 Blue Forces, time is the worst of enemies.[199]

More generally, the report outlines that:

> The principal finding of the Leavenworth games was that mobility, characterized predominantly by speed of maneuver, proved to be the most important factor contributing to battlefield success. Further, battlefield knowledge actually enabled speed, though the precise relationship to date remains difficult to determine.[200]

Army After Next proceeded with a focus on mobility and with attempts to understand how to head off asymmetric responses by opposing forces. Halfway through 1997 the RAND Arroyo Center began a study for TRADOC into a very light *Army After Next* battle force that could consist largely of dismounted infantry, airlifted as necessary into a theatre of operations. They would use anti-armour weapons such as RPGs as well as the joint concept of "reach-back." This would mean that they would receive information from U.S. satellites, UAVs, and other sensors and have the ability to call in

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[198] Ibid., 13.
[199] Ibid., 14.
[200] Ibid., 12.

precision strikes from such weapons platforms as U.S. Navy ships,[201] U.S. Air Force aircraft, as well as U.S. air force and Army missiles. The concern in this study was with trying to develop a force that could be deployed quickly enough to stop an opponent from reaching and entrenching in urban areas, and thereby forcing U.S. Army forces to fight in complex terrain. The report found that a very light force might suffer significant losses.[202]

The RAND Arroyo Center continued to be involved in the *Army After Next* war game cycles during 1998 and 1999. In its 1998 report, *Issues Raised During the Army After Next Spring Wargame*, it was dealing with another scenario in which Red forces advanced into urban terrain before Blue forces were able to prevent them from doing so. At this point the U.S. Army was examining a model where *Army After Next* "strike forces" would deploy rapidly into the conflict theatre while *Army XXI* type heavy divisions were being transported. *Army After Next* forces were once again air-mechanized, with the "lighter armoured vehicles" carried by the "advanced airframes" defined as being in the 15-ton range. The *Army XXI* forces were intended to provide heavy combat power in case the *Army After Next* air-mechanized forces were too light to fight the culminating battles of the campaign alone. The report stated that: "The dominant feature of this wargame was the inability of Blue to deploy a decisive force in a timely manner... The early-arriving forces were therefore not decisive and the decisive forces arrived late."[203]

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[201] Ships offshore can, for instance, launch cruise missiles to support ground forces well inland.
[202] John Matsumura; Randall Steeb; Thomas Herbert; Scot Eisenhard; John Gordon; Mark Lees and Gail Halverson, *The Army After Next: Exploring New Concepts and Technologies for the Light Battle Force* (Santa Monica, California: RAND Arroyo Center, 1997/98 (exact date of publication not evident)).
[203] Walter L. Perry, Bruce R. Pirnie, and John V. Gordon IV, *Issues Raised During the Army After Next Spring Wargame* (Santa Monica: RAND Arroyo Center, 1999), xi.

As outlined by the 1998 RAND report, the earlier 1996-1997 *Army After Next* war games had emphasized the advantages of air-mechanized forces, while the 1998 spring war game had been designed to examine in greater detail the disadvantages of such a force.[204] The main drawbacks that were found were that 15 ton vehicles lacked the armour protection to fight in close engagement in complex terrain, and that enemy air defences posed too great a threat.[205] The report argues that: "...air defense suppression could be extremely difficult, especially as concerns low-altitude nonemitting systems, including guns and shoulder-fired missiles."[206]

As a result of these limitations, RAND recommended that the Army examine a number of other concepts for its future forces. These were an "air/sea-lifted" light armour force using combat vehicles weighing in the 20 to 30 ton range, and a sea-lifted medium armour force with combat vehicles in the 30 to 40 ton range. Their 1998 report suggests that 20 to 30 ton vehicles: "...might have enough protection to accept close engagement in constrictive terrain," while 30 to 40 ton vehicles would have this protection and also the capability to carry "significantly greater" numbers of infantry.[207] In the RAND analysis, 20 to 30 ton vehicles could be airlifted "in sufficient numbers" to fight in the first days of a campaign, and could be designed as a wheeled force capable of traveling at up to 80 mph on land.[208] Their report suggests 30 to 40 ton vehicles would have to use tracks rather than wheels due to the need to distribute weight[209] to achieve

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[204] Ibid., p. xiv.
[205] Ibid., 40-42.
[206] Ibid., 42.
[207] Ibid., xv.
[208] Ibid., 42.
[209] Weight distribution is an important aspect of vehicle design. Wheels have small contact areas with the ground, meaning that the wheels of a heavier vehicle are more likely to sink into surface, especially softer soils. The wheels of a very heavy vehicle may create ruts in, or even break through, hard surfaces such as

"acceptable" ground pressures.[210] Therefore, such vehicles would be slower in theatre. Also: "Such forces would be too heavy for airlift unless much larger and more capable airlifters were developed."[211] RAND had come to a similar recommendation as that of the 1997 National Defense Panel report.

The focus on strategic and operational mobility found in the *Army After Next* program also appeared in the *1998 United States Army Posture Statement*. Written by the same authors as the 1997 Posture Statement discussed above, it gave less emphasis to *Army XXI* and more to *Army After Next*. Concerns about funding for "modernization" are raised again: "Thus far, we have succeeded in maintaining near-term readiness, but we have sacrificed modernization, one of the keys to long-term readiness."[212] It defines *Army XXI* as an "improved Army," but *Army After Next* as a "totally different Army."[213] This totally different army: "...must be more strategically and tactically mobile, more versatile, more lethal, and logistically unencumbered."[214]

The U.S. Army's commitment to the new vision of greater strategic and operational mobility would, by the following year, result in the *Army After Next* program transitioning into U.S. Army "Transformation." In its 1999 report on the *Army After Next* war game cycle, the RAND Arroyo Center stated that the U.S. Army's Transformation plan included "some features" of *Army After Next* research.[215] In a retrospective

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pavement. With a much larger ground contact area, tracks allow a heavy vehicle to move over softer surfaces than a wheeled vehicle of the same weight.

[210] Perry, Pirnie, and Gordon, *Issues Raised During the Army After Next Spring Wargame*, 43.

[211] Ibid., 43.

[212] United States Army, *A Statement on the Posture of the United States Army Fiscal Year 1998*, by Togo D. West, Jr and Dennis J. Reimer, 33. http://www.army.mil/aps/98/acronym.htm (accessed June 29, 2009).

[213] Ibid., 5.

[214] Ibid., 5.

[215] Walter Perry, Bruce Pirnie, John Gordon IV, *The Future of Warfare: Issues from the 1999 Army After Next Study Cycle* (Santa Monica: RAND Arroyo Center, 2001).

summary of the previous three years of war games, it indicates that by the end focus had come to rest on combat vehicles weighing between 2.5 to 26 tons.[216]

In 1999 a "hybrid force" consisting of *Army XII* heavy forces and *Army After Next* "strike forces" or "battle forces" was examined, with the conclusion being that both types of forces would have roles to play in potential future campaigns.[217] In terms of the *Army After Next*, 26 ton armoured vehicles had been studied in greater detail during 1999.[218] These constituted what RAND called, in the context of *Army After Next*, a "heavier battle force."[219] At this point, as compared to its 1997 and 1998 reports, RAND further emphasized drawbacks of such battle forces, even a "heavy" one, discussing the concept of passive protection: "Like all such forces, they trade passive protection for mobility, causing their survivability to become an issue."[220] The possibility that greater strategic and operational mobility would be difficult to achieve even with lighter forces is also discussed in the 1999 report:

> The Future Combat Vehicle, as played in AAN SWG-99, weighed no more than 26 tons on the assumption that a follow-on aircraft to the C-130 would be able to lift 30 tons. But such an aircraft may not be built, or may not be available in large numbers... Moreover, building 26-ton vehicles with sufficient survivability in close combat would be difficult, even assuming great improvements in active protection.[221]

As discussed in the introductory section above, the early 2000s U.S. Army plan for Transformation consisted of "transforming" a number of brigades into interim brigade combat teams equipped with light or medium weight armoured vehicles, while retaining "heavy" forces with Abrams and Bradley vehicles until both were unified into an

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[216] Ibid., xii.
[217] Ibid., xx.
[218] Ibid., xxi-xxii.
[219] Ibid., 71.
[220] Ibid., xix.
[221] Ibid., 71.

"Objective Force" equipped with the Future Combat System. The Future Combat Vehicle described above indicates that the final cycle of *Army After Next* war games was already moving in this direction. Regarding the transition from *Army After Next* to Transformation, RAND suggested in 1999 that the question of the survivability of the Objective Force still had to be addressed.[222] Nonetheless, the U.S. Army retained the underlying assumption that information superiority meant that much less passive protection was needed for future armoured vehicles.

Although the Army had originally intended to avoid incremental change through its *Army After Next* studies, by 1999 its leadership decided that increased mobility would have to be pursued in the near term. The result was a Transformation program based on the acquisition of Light Armoured Vehicle (LAV)-III based vehicles as an interim solution. As a result, the first step in implementing the RMA would, after all, entail making changes to an existing weapons system.

1999: Transformation

Following the final *Army After Next* studies, the U.S. Army announced its "Transformation" program in October 1999. In the press release "Army Announces Vision for the Future," dated October 12, 1999, it was stated that the then-Secretary of the U.S. Army Louis Caldera and then Chief of Staff of the U.S. Army Eric K. Shinseki had "unveiled a vision of a more strategically responsive U.S. Army" during the annual

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[222] Ibid., 54.

meeting of the Association of the United States Army in Washington, D.C.[223] In accordance with *Joint Vision 2010*, *Army Vision 2010*, and other planning documents produced in 1996-97, the focus was on dominating a full spectrum of operations and on rapid deployment:

> The Army intends to begin immediately to develop a force that is deployable, agile, versatile, lethal, survivable, sustainable and dominant at every point along the spectrum of operations... The vision statement establishes a goal to deploy a combat brigade anywhere in the world within 96 hours after liftoff, a warfighting division on the ground in 120 hours, and five divisions within thirty days.[224]

Caldera is reported as having commented that:

> The Army's highly adaptive strategy to man, modernize and manage America's vital land-power capitalizes on insights gained during deployments and the Army's intense experimentation efforts... Our commitment to meeting these challenges compels comprehensive transformation of the Army.[225]

The immediate aim was to "field a prototype brigade-size force" that would use: "off-the-shelf systems, as resources permit and as quickly as possible, to jumpstart development of concepts and doctrine, organizational design, and training."[226] These brigades would use "communications and information technology" to reduce "numbers and types of systems" needed in conflict areas, thereby reducing their logistical footprint and increasing speed of deployment.[227] The Army also announced that it would "consider the advantages of developing all wheel forces."[228] Shinseki stated that: "We

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[223] United States Army, *Army Announces Vision for the Future*, press release (Washington, D.C.: October 12, 1999). Archived by the Federation of American Scientists, : http://www.fas.org/man/dod-101/army/unit/docs/r19991015vision095.htm (accessed March 27, 2008).
[224] Ibid.
[225] Ibid.
[226] Ibid.
[227] Ibid.
[228] Ibid.

will begin to immediately transform the entire Army into a more dominant and strategically responsive force."[229]

A similar news release, "Caldera says change is in the Army's future," stated that the U.S. Army "needs to deploy quicker and change to meet new threats."[230] It reported that Caldera addressed "the view" that the Army's heavy divisions are "too slow," saying: "The new timetable of this new world dictates that to be the relevant force of choice for the nation for emergency response... we have to get there faster."[231] Following the announcement, Caldera and Shinseki held a press conference on October 12, 1999, in which they discussed the Transformation plan. During the conference, Shinseki addressed the question of lighter armoured vehicles, stating:

> We have had several studies between track and wheeled capabilities over time. And I think the ones I'm familiar with, which are 15, maybe 20, years old, talk about a certain weight, you have to transition from wheeled to tracked vehicles, only because you need that to go mobile across country. In the last 20 years, wheeled technology in this country has come a long way, driven primarily by our off-time recreational interests. We also understand there is great capability, technology-wise, to lessen the weight of our vehicles, and we can bring these two together.[232]

Later in the press conference, he added that:

> If technology provides the answers we think are going to come in, then what we have traditionally described as light and heavy will begin to merge. And I think you will see that the entire transformation will go towards capabilities that give those divisional formations lethality that the heavy forces have and the agility of the light forces.[233]

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[229] Ibid.

[230] United States Army, *Caldera says change is in the Army's Future*, by Connie E. Dickey, press release (Washington, D.C.: October 12, 1999). Archived by the Federation of American Scientists: http://www.fas.org/man/dod-101/army/unit/docs/a19991013caldausa.htm (accessed March 27, 2008).

[231] Ibid.

[232] Louis Caldera and Eric K. Shinseki, statements made during press conference, October 12, 1999. Transcript publication information: Association of the United States Army, *Press Conference Secretary of the Army Louis Caldera and Chief of Staff of the Army General Eric K. Shinseki* (Washington, D.C.: Association of the United States Army, 1999). Archived by the Federation of American Scientists: http://www.fas.org/man/dod-101/army/unit/docs/r19991014ausapress.htm (accessed March 27, 2008).

[233] Ibid.

Part of this approach was that information superiority could be achieved, and would therefore allow U.S. forces to identify and destroy an opponent before coming under fire themselves. This is the implication in Shinseki's statement that:

> There are many ways to increase survivability while lowering the weight to your weapons platforms, to your tanks, that are not entirely dependent on science and technology which may or may not be available today or on the horizon, including the survivability that you give to a platform because you are not expecting to take a direct hit.[234]

Later on still, Shinseki brought the ideas of wheeled vehicles and information superiority together more explicitly, saying that:

> ...I think we have had significant advances in wheeled technology and not in track technology. And we think that, given the descriptors that I gave with low-observable, long-range acquisition, where you now can design vehicles that don't have to take the first premise as being, if hit, will it survive? So if you can take that out of the equation, you can now begin to lower the weight of the platforms you design.[235]

In addition, Shinseki remarked that transformed forces would have rapid deployability, being able to put a "combat-capable brigade anywhere in the world in 96 hours," without "pre-deployment planning and rehearsal."[236] In addition, he indicated that "many of the concepts you have seen" in the *Army After Next* "strike force will be incorporated."[237]

Following Shinseki's and Caldera's October 1999 press conference, the U.S. Army Training and Doctrine Command (TRADOC) held a press briefing in Washington, D.C., on December 16, 1999, with Colonel Joseph Rodriguez, then Director for the Transformation Axis, TRADOC, and Colonel Michael Mahaffey, then Director of Battle

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[234] Ibid.
[235] Ibid.
[236] Ibid.
[237] Ibid.

Lab Integration, Technology and Concepts, TRADOC. The two colonels provided further detail on the concept that the distinction between heavy and light forces should vanish. They stated that the Army would no longer use terms such as heavy brigade, medium brigade, or light brigade to describe newly transformed formations, but rather the term "combat brigade team."[238]

Regarding deployability, Rodriguez stated that: "everything in this brigade has to fit in a C-130 aircraft. If it doesn't fit in a C-130, it doesn't go into the brigade. That's a key parameter."[239] Deployability would be further enhanced by "reach-back," both in terms of logistics and in terms of intelligence, meaning that the brigade would not need to take its entire logistical and support structure with it.[240] The reduced fuel consumption of lighter armoured vehicles, as compared to Abrams tanks and Bradley infantry fighting vehicles, was also cited as a major logistical improvement.[241]

TRADOC also further reinforced the link between information superiority and eliminating the need for the type of passive armoured protection found on heavy armoured vehicles. Rodriguez stated that with the M1 Abrams tank and Bradley infantry fighting vehicle:

> In today's heavy force, we enjoy tremendous overmatch... That allows us to make a mistake... But this force (the Brigade Combat Team) cannot recover from a mistake. It may not recover from a mistake... So they can't blunder into the enemy... They make up for it with the close fight using internetted combined arms.[242]

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[238] Joseph Rodriguez and Michael Mahaffey, comments made during press conference, Washington D.C., December 16, 1999. Transcript publication information: U.S. Training and Doctrine Command, *Transcript of the Training and Doctrine Command (TRADOC) Press Briefing, Status of Brigade Combat Team Development at Fort Lewis and Planned Performance Demonstration at Fort Knox* (Washington, D.C.: TRADOC, 1999). Archived by the Federation of American Scientists: http://www.fas.org/man/dod-101/army/unit/docs/991216-briefing_tradoc_press.htm (accessed March 27, 2008).

[239] Ibid.

[240] Ibid.

[241] Ibid.

[242] Ibid.

Rodriguez and Mahaffey also argued that this type of force would be more effective operating in "complex and urban terrain" and in peacekeeping missions, stating that Abrams and Bradley vehicles are optimized for "open and rolling" terrain.[243] They stated that with lighter vehicles, the emphasis would shift to the infantry fighting dismounted with close support from the vehicles that had carried them into battle. The argument made was that in urban combat this would be preferable to driving large vehicles through constricted roads, alleyways and other space.[244]

By focusing on light armoured vehicles, deployability, "internetted" combined arms tactics, and scenarios such as urban warfare, TRADOC's approach to the Brigade Combat Teams clearly continued the approach seen in the final round of *Army After Next* experiments earlier in 1999.

In November 1999, the U.S. Army was loaned forty-six LAV-IIIs from the Canadian land force.[245] They were used for testing in place of Abrams tanks by the 3rd Brigade, 2nd Infantry Division at Fort Lewis, Washington.[246] In a press conference held on November 19, 1999, Lieutenant General James T. Hill, the commander of I Corps and Fort Lewis, commented that:

> People have said that we're taking away the tank... But what is a tank? A tank is a movable, maneuverable platform that is survivable and shoots something off that goes out and kills something else. The tank has been evolving since World War I. We are just continuing the evolution.[247]

Although it examined LAV-IIIs from the outset of its Transformation program, the U.S. Army also conducted other light/medium armoured vehicle trials. In January

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[243] Ibid.
[244] Ibid.
[245] Tom Bradbury, "Fort Lewis readies for initial brigade testing," *Army News Service,* November 22, 1999.
[246] Ibid.
[247] Ibid.

2000, it announced that thirty-five "state-of-the-art" medium armoured vehicles from the U.S., France, Turkey, Canada, Germany, Switzerland, and Singapore were being tested in a month-long "Platform Performance Demonstration" at Fort Knox, Kentucky.[248] The requirements to deploy a brigade in 96 hours, for it to deploy on C-130 aircraft, and for it to be "combat ready upon arrival," were all reiterated in this announcement.[249]

The LAV-III was eventually selected as the platform for what came to be described as the "Interim Combat Brigade Teams." Plans were developed for ten LAV-III variants.[250] Transformation of the 3rd Brigade, 2nd Infantry Division and the 1st Brigade, 25th Infantry Division proceeded.[251] On July 12, 2001, the 172nd Infantry Brigade (Separate), the 2nd Armored Cavalry Regiment (Light), the 2nd Brigade, 25th Infantry Division (Light), and the 56th Brigade of the 28th Infantry Division (Mechanized) were designated to transform.[252]

In February 2002, the U.S. Army family of LAV-III based vehicles was collectively named "Stryker," and the Interim Combat Brigade Teams became known as Stryker Combat Brigade Teams.[253] In 2001-2002 timeframe, the U.S. Congress ordered additional testing of the Stryker against the tracked M-113 infantry carrier.[254] According to the United States General Accounting Office, this was: "Because these brigades are an

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[248] Ali Bettencourt, "Army testing lightweight combat vehicles at Knox," *Army News Service*, January 3, 2000.
[249] Ibid.
[250] The GM GDLS Defense Group, *Stryker Family of Vehicles*. As described above on page 50 in the section "Defining the Technology in this Study," these comprised an infantry carrier vehicle, a mobile gun system, a reconnaissance vehicle, a mortar carrier, a command vehicle, a fire support vehicle, an engineer squad vehicle, a medical evacuation vehicle, an anti-tank guided missile vehicle, and a NBC reconnaissance vehicle.
[251] U.S. Army, *Army Announces Locations of Next Interim Brigade Combat Teams*, press release, U.S. Army Public Affairs Office, July 12, 2001.
[252] Ibid.
[253] United States Army, "Army Announces Name for Interim Armored Vehicle."
[254] United States General Accounting Office, *Military Transformation: Army's Evaluation of Stryker and M-113A3 Infantry Carrier Vehicles Provided Sufficient Data for Statutorily Mandated Comparison* (Washington, D.C., May 2003), 1-4.

entirely new organizational design, many questions have arisen as to the unit's cost, combat effectiveness, and suitability."[255] However, the General Accounting Office confirmed that the U.S. Army had done sufficient testing and that its Transformation plan was sound.[256]

What criticism might the "many questions" mentioned by the General Accounting Office have entailed? One example is the testimony before the United States Congress House Armed Services Committee by retired Colonel Douglas Macgregor in 2004. Macgregor testified that:

> Current Army transformation programs are not informed by the realities of modern combat or rigorous testing and experimentation... Large quantities of light infantry with nothing more than the weapons they can carry after they dismount to attack from either up-armored HMMWVs or Strykers will sustain heavy losses... The greatest irony is that our current inventory of tanks and armoured fighting vehicles actually arrive as quickly as the so-called light force... The current Stryker brigade combat team lacks the joint C4ISR, firepower, protection, mobility and organic logistical support to be a full-dimensional warfighting organization.[257]

In his 2003 book, *Transformation Under Fire*, Macgregor states that once information superiority was endorsed as "the foundation for future defense transformation" in *Joint Vision 2010*, there was "tremendous pressure to validate it rather than scrutinize it." He comments that: "A close observer of joint experimentation remarked at the time that the process reminded him of the Queen's declaration in *Alice in Wonderland*: "First the verdict, then the trial!'"[258]

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[255] Ibid., 1.
[256] Ibid., 11.
[257] House Armed Services Committee, *Army Transformation: Implications for the Future*, testimony by Douglas Macgregor, July 15, 2004. Posted at: http://www.comw.org/pda/fulltext/0704macgregor.pdf (accessed October 18, 2007).
[258] Douglas A Macgregor, *Transformation Under Fire*, (Westport, Connecticut: Praeger, 2003), 19.

While the original vision of the RMA focused on digitization pursued through the *Force XXI* program generated little of this type of criticism, the testimony of those such as MacGregor illustrates that there was significant division in the U.S. defense community over the Transformation plan initiated in 1999.[259]

The emergence of such factions is suggestive of internal organizational bargaining within the U.S. military. Such a hypothesis, in keeping with the governmental politics model, is made in Thomas K. Adams' book *The Army After Next*, published in 2008. Adams' main focus is on interservice rivalry. For Adams, the U.S. Army's attempt to develop faster, lighter, more deployable formations from the late 1990s to the mid 2000s reflected the Army's concerns about retaining relevance when it perceived that air power was gaining more attention as a transformational aspect of military capability.[260]

The U.S. Army's 1999 Transformation plan is treated here as a single influence in the organizational bargaining within the Canadian land force. However, it is suggested that the U.S. Army was going through a similar process of intragovernmental interactions. The approach to RMA inspired by Krepinevich was only one possible interpretation of RMA to emerge during the early to mid 1990s, but once it was endorsed by the Joint Chiefs of Staff, the U.S. Army pursued it. In 1999, General Shinseki decided

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[259] Another account illustrating reservations concerning U.S. military enthusiasm about extensive near-term RMA-inspired change is that of retired U.S. Major General Robert H. Scales Jr. Writing in 1999, he states that when he led the initial phase of the *Army After Next* program: "We did not anticipate that a real revolution in military affairs could be even a remote possibility in less than half a generation. Also, with few exceptions, we felt that for at least the next decade the nation would be able to achieve its security goals with the materiel and structures on hand today." Although not as critical of U.S. Army plans to implement RMA as MacGregor, he also comments that: "Recurring proposals to substitute advanced technology for conventional military capabilities... reflect a peculiarly American faith in science's ability to engineer simple solutions to complex human problems... This is not the first time we have been lured by promises of high-tech, bloodless victory." See: Scales, Jr., *Future Warfare*, xi and 17.

[260] Adams, *The Army After Next*. However, Adams does not develop an extensive literature review or identify a specific governmental politics methodology. Also, while he focuses on interservice rivalry, he does not delve as deeply into interactions between the organizations which make up the U.S. Army.

that it was necessary to start Army Transformation immediately, and the only way to do that was by pursuing incremental change using an existing weapons system.

Conclusion

In the early 2000s, the U.S. Army still sought a relatively lightweight vehicle with greater survivability than the Stryker, and so continued with its Future Combat System (FCS) plans for the Objective Force in parallel with the development of the Stryker brigade combat teams. The FCS was to include a new generation of armoured ground vehicles in the 30-35 ton range, preferably with stealth characteristics, as proposed in the 1997 National Defense Panel report. However, as demonstrated by the remarks concerning Transformation made by General Shinseki, Lieutenant General Hill, and TRADOC personnel, the focus on increased mobility that started to emerge in 1997 had gained ascendance in the U.S. Army leadership by 1999. This was what led to the near term plan to acquire the Stryker as an interim vehicle.

The focus on mobility emerged with *Joint Vision 2010*, *Army Vision 2010*, the *1997 Quadrennial Defense Review*, and the 1997 National Defense Panel Report. These policy statements linked increased mobility with the concept of information superiority that emerged in early analysis of the RMA during 1992-93. Information superiority was expected to facilitate force protection through the use of precision fire, thereby eliminating the need for passive heavy armoured protection on combat vehicles. Following this lead, through the *Army After Next* studies and its own Transformation

plan, the U.S. Army confirmed that lighter combat vehicles which could theoretically be deployed quickly were necessary.

A central assumption had been made: information technology could be leveraged to provide information superiority. It would be possible to identify opponents from a distance and engage them under favourable conditions. This conceptual assumption would be mirrored by the Canadian capability development organizations as they studied RMA, as will be shown in Chapter Two. The Canadian land force senior leadership would also incorporate it into its plans in 2003. As will be seen in Chapter Three, leveraging the U.S. Stryker program appeared in 2003 to offer a cost effective way for the Canadian land force to pursue its Direct Fire Unit (DFU).

In Chapters Three and Four, it will be seen that the problem with this aspect of the Canadian approach was that the U.S. Army had underestimated the complexity of planned changes to the LAV-III to produce the Mobile Gun System (MGS) Stryker variant. Although it was supposed to be an easily developed interim vehicle, it quickly developed problems typical of many developmental weapons systems: delays, added complexity, and cost overruns. While these issues were impeding progress, many in the U.S. Army abandoned the central assumption of information superiority. The decision by U.S. Army leaders to pursue Transformation in the near-term had by the mid 2000s produced a program with the typical trend innovation aspects of incremental change at excessive cost. The Canadian land force would encounter the same problems, both because of its involvement with the U.S. MGS, and because of unexpected issues with its own independent Multi-Mission Effects Vehicle (MMEV).

Chapter Two
Canada Adopts the RMA and Transformation Agenda

This chapter concentrates on the interactions of two of the direct actors involved with the Canadian interpretation of the RMA and Transformation, the Canadian land force senior leadership and the Canadian capability development system. It also shows how U.S. academics and U.S. Army decision-makers who favoured a mobility centric interpretation of the RMA, as seen in the previous chapter, acted as indirect influences upon the Canadian organizations. During the second historical period of 1997 to 2003 dealt with here, two significant broad changes took place. First, the organizational structure of land force capability development, which would later come into disagreement with the land force leadership over the Direct Fire Unit (DFU), was established. Second, it was a period in which the land force leadership and capability development organizations adopted the RMA and Transformation agenda. During these years capability development studied the concept of replacing Canada's Leopard 1 tanks with light armoured direct fire vehicles in the context of the RMA. These studies provided many of the arguments that the land force leadership would use in 2003 to put the DFU plan rapidly into effect.

The reorganization of capability development initiated by the land force leadership was driven both by a growing concern over the RMA and specific Canadian concerns. The leadership perceived a threefold crisis. First, reduced military budgets were delaying procurement programs, and land force equipment was wearing out.[1]

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[1] As seen in the previous chapter, the U.S. Army started to voice similar concerns in its Posture Statements after 1995. Generally speaking, the 1990s were a period of reduced military spending in Western countries. In the early 1990s, many political leaders sought a "peace dividend" of reduced military spending following the end of the Cold War. In Canada, cutbacks were deep because of concern about the federal

Second, the land force was being deployed on an increased number of peacekeeping and peace enforcement missions, which used up funds and accelerated wear-out of materiel.[2] Third, growing concern was emerging about maintaining interoperability with U.S. forces in the context of the RMA. In these circumstances, the land force leadership decided that restructuring was necessary in order to define relevant future procurement programs. It followed the lead of the U.S. Army which, as seen in the previous chapter, began to shift from threat based to capability based planning in 1994 at the same time as it initiated the *Army XXI* program.[3]

Although the capability development system was supposed to study the ideas of the RMA and a more uncertain future security environment, the land force leadership had already accepted an element of both by initiating the reorganization. The new system was supposed to identify the type of future conflicts that the land force would be involved in, and then develop procurement programs for new technology in a manner that would be linked to new doctrine and new organizational structures. As seen in the previous chapter, linking technological, organizational and doctrinal change was inherent in Andrew Marshall's definition of the RMA.[4] Also, capabilities-based planning was

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deficit and debt. Debt reduction became a national policy to the extent that references to it appeared in military planning documents such as *The Land Force Strategic Direction and Guidance*. The important point here is that despite these generally similar circumstances, the U.S. Army still had a much larger budget, enough to pursue the *Army XXI* and *Army After Next* programs described in the previous chapter, and to initiate Transformation in 1999, with both an interim armoured vehicle program and a Future Combat System (FCS) development program. Canada was still in the position of being a smaller country with a much larger ally, facing significantly greater constraints.

[2] Again, the U.S. expressed similar concerns. *Army Vision 2010* points out that while the U.S. Army had conducted ten "notable" deployments between 1950 and 1990, it deployed twenty-five times between 1990 and 1996. U.S. Department of the Army, *Army Vision 2010* (Washington, D.C.), 1. The Canadian land force deployed on a number of coalition missions alongside the U.S. during the same years, most significantly to the republics of the former Yugoslavia.

[3] See Chapter One, page 68, which explains the rationale for this change together with the terminology.

[4] Andrew Marshall defines RMA as: "A major change in the nature of warfare brought about by the innovative application of new technologies which, combined with dramatic changes in military doctrine

inherently a structure which assumed that the world had become more unpredictable, and a clearly defined threat could no longer be automatically identified.

The reorganized capability development system would follow its mandate between 1997 and 2003, and study the RMA extensively together with new weapons systems designs, including light armoured vehicle replacements for tanks. In summary, its organizational logic was as follows: through examination of possible future situations, the system was supposed to identify the most likely gaps in the land force's capabilities. Once a gap was identified, a potential procurement program could be recommended to land force leadership, and, if approved, a Project Charter, Statement of Operational Requirement (SOR), and a number of other documents could be created which would justify an acquisition program. It would then be approved by joint review at the level of the Canadian Forces and Department of National Defence. At that point, such actions as a request for proposals (RFP) to industry could take place, and potential new weapons systems could be reviewed and chosen. This capabilities based approach was designed to fit in with more general Department of National Defence procurement guidelines which had been followed for decades.

By following its mandate, capability development identified likely future conflict scenarios and the general type of new armoured vehicle acquisitions that would be needed, but as of 2003 it did not identify a specific capability gap with certainty or recommend new armoured vehicle procurement. It identified likely future requirements which were very similar to those identified by the U.S. Army in its *Army After Next* and Transformation programs between 1997 and 1999. The influence of U.S. academics and

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and operational and organisational concepts fundamentally alters the character and conduct of military operations." See page 59, footnote 46.

the U.S. military is clear in many of these capability development studies. For example, an initial study of future armoured vehicle concepts began with a quote from a U.S. analyst, while in a later wargame U.S. military and RAND corporation personnel were present. Close cooperation with the U.S. was logical for two reasons. First, since the land force was concerned about maintaining interoperability with the U.S., it was important for it to try to coordinate its procurement plans with the Americans. Second, due to the general context of budget constraints and aging equipment described above, it did not have the funds to pursue extensive independent experimentation. There was no lack of effort on the part of capability development, rather it was constrained by being a small organization influenced by, and at times having to rely on, a much larger ally.

The first section of the chapter, "The Canadian Land Force Reorganizes Capability Development," demonstrates how the rationale for reorganization described above emerged in 1997. It then briefly describes the roles of the sub-organizations within capability development that would be directly involved with the Direct Fire Unit (DFU) program. The capability development reorganization, like the Canadian procurement system generally, is highly complex, so only a bare framework can be presented here. The section also places the reorganized capability development system within the context of the Department of National Defence procurement system.[5]

The second section, "The Initial Future Armoured Vehicle Studies," describes a concept study by capability development and a wargame involving the Armoured Corps. The pattern of studies on lightweight tank-like procurements which dominated the 1997-

[5] Chapter One established the context of the RMA and the approach of U.S. academics and the U.S. Army which would indirectly influence the Canadian land force during 1997-2003. Essentially, this section establishes the context of the Canadian procurement system. Only by understanding the multiple contexts which surrounded the DFU program can it be understood why it was initiated and why it was cancelled.

2003 period, emerged first in 1998. New vehicles were recommended to enhance capabilities in the context of the RMA, but there was not an expectation that tanks would be replaced until after 2010.

Adoption of the RMA continued gradually. Later in 1998, the land force fully adopted U.S. Army positions within the context of specific Canadian concerns about peacekeeping and resource constraints. This is shown in the third section, "RMA Inspired Visions of the Role of a Land Force and the Future Security Environment are Adopted." Also in 1998, the Canadian Forces (CF) studied RMA joint level, creating a context in which the land force was encouraged to pursue the concept. This is shown in the fourth section, "The Canadian Forces Endorses RMA at the Joint Level," which also illustrates how U.S. military and academic viewpoints influenced the overall CF approach. The fifth section, "Incremental Modernization and Additional Studies, 1999-2003" shows capability development and the land force leadership moving towards the model of U.S. Army Transformation. At the same time, the Canadian land force also built up a large inventory of LAV-III based vehicles. The final section, "2002-2003: The Final Armoured Vehicle Studies Before the Direct Fire Unit" illustrates that, despite pressure to take a U.S. Tranformation approach, capability development did not conclude that there was a clear reason to develop an organization along the lines of the Direct Fire Unit (DFU).

Although the studies and policy statements of these sub-periods are inevitably to some extent repetitive, they demonstrate the organizational logic of the land force leadership and the capability development system. The leadership moved closer to U.S. statements on the RMA and Transformation because of a desire to retain relevance with

the U.S. and other allies which were also adopting the RMA. The capability development system pursued its mandate to study these concepts and develop the rationale for future acquisitions. These shifts took place as Canadian military budgets gradually began to increase, creating the possibility of new – though small by American standards – acquisition programs.

The Canadian Land Force Reorganizes Capability Development

The land force leadership initiated reorganization of capability development in the fall of 1997. In September of that year, an internal planning session was held at the 1st Canadian Division headquarters in which then Brigadier-General Mike Jeffery, who would later become Chief of Land Staff from 2000 to spring 2003,[6] suggested that the land force's capability development processes were too slow and had to be accelerated.[7] At the same meeting, then-Major-General Ray Crabbe encouraged thinking "outside the box."[8] Similarly, concerns were raised about budget cuts and the perception that land force staff had time to do little more than crisis management.[9] The following month, October 1997, a meeting was held by the senior army leadership to deal with resource

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[6] Jeffery was at that time the Commandant of the Canadian Land Forces Command and Staff College. The Direct Fire Unit plan would be initiated in May 2003, at the time that command of the land force transferred from him to Lieutenant General Hillier.

[7] Department of National Defence, "Transformation and the Army of Tomorrow," by Andrew Godefroy, in *Toward Land Operations 2021: Studies in Support of the Army of Tomorrow Force Employment Concept*, ed. Andrew Godefroy and Peter Gizewski (Kingston, Ontario: Directorate of Land Concepts and Design, 2009), 3-1 – 3-10.

[8] Ibid.

[9] See: Andrew Godefroy, "Chasing the Silver Bullet: The Evolution of Capability Development in the Canadian Army," *Canadian Army Journal*, spring 2007, 61. See also the Commander's foreword to: Department of National Defence, *The Land Force Strategic Direction and Guidance*, Chief of the Land Staff (1998), and Department of National Defence, *Land Force Development Process* (precise date unclear), 1-2 – 1-5.

limitations, issues surrounding leadership, and the implications of technological change.[10] The RMA was the central concern in terms of technological change at the meeting. The land force leadership produced the following statement:

> Due to rapid changes in technology, the nature of warfare is in transition. A "Revolution in Military Affairs (RMA)" is imminent, if not already underway. In the changes in operational concepts, weaponry and doctrine which are anticipated, there are both opportunities to be exploited and risks to be countered.[11]

The first result of the fall 1997 meetings was a document outlining a general strategy for renewed planning for the future, *Land Force Development Process*.[12] It emphasizes that the land force combat development process that had been in place between 1974 and 1991 was no longer relevant in a new, more uncertain global security environment and in the face of resource constraints.[13] As the U.S. Army did in 1994, it dismisses previous combat development systems as producing equipment designed specifically to meet a Warsaw Pact threat in northern Europe.[14] As a result, it states that the land force will shift to capability based planning, replacing the designation "combat

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[10] Department of National Defense. Chief of the Land Staff, *The Land Force Strategic Direction and Guidance* (1998). Commander's Foreword, 1-3.

[11] Ibid., Commander's Foreword, 3. The focus on RMA was new for the Canadian land force. For example, the July 4 1996 draft of the Canadian Forces doctrine manual CFP 300-1, *Conduct of Land Operations*, can be used as a baseline for the land force's approach to doctrine and information technology in the mid-1990s. While it emphasized some concepts related to information technology, it remained focused on the "manoeuvre warfare" approach that had been adopted by many NATO armies during the 1980s and was still the doctrinal approach of the British Army and U.S. Marine Corps. It also uses more traditional terminology. It outlines manoeuvre, firepower, protection, and sustainment as four of six core combat functions, along with command and information operations, rather than the *Joint Vision 2010* equivalents of dominant maneuver, precision firepower, full-dimensional protection and focused logistics. See: Department of National Defence, *CFP 300-1* (July 4 1996 draft).

[12] Although the document does not have a date of publication, its content indicates that it precedes the more concrete steps taken during 1998 and 1999.

[13] Department of National Defence, *Land Force Development Process*, 1-4 - 1-7.

[14] Ibid., 1-4. The document notes that much of this planning was based on potential operations at a corps level, while Canadian deployments during the 1990s were generally not expected to be above brigade size. The Corps 86 and Corps 96 plans are provided as examples of planning that is no longer relevant.

development" with "land force development." It takes the position that capability based planning will produce a better rationale to justify land force procurement requirements.[15]

The *Land Force Development Process* outlines in detail the restructuring of the many sub-organizations which make up the capability development system. Of most importance in terms of armoured vehicle studies, and the later bureaucratic politics of the Direct Fire Unit (DFU) program, was the creation in 1996-97 of the Land Force Doctrine and Training System (LFDTS) based primarily in Kingston, Ontario. The LFDTS included the Directorate of Land Strategic Concepts (DLSC), the Directorate of Land Synthetic Environments (DLSE), the Directorate of Army Doctrine (DAD), and the Directorate of Army Training (DAT). Together, these organizations were to undertake the development and design of new weapons system concepts together with development and design of new organizational, doctrinal and training plans. Specifically, the DLSC was responsible for developing recommendations for new procurements, while the DAD would undertake initial analysis up to the point of submitting a project to the Chief of Land Staff (CLS). Upon CLS approval, a Statement of Operational Requirement would be created. As will be seen later in this chapter, the DLSE would also conduct analysis of potential new weapons systems through computer simulations.

In addition, the LFDTS was affiliated with the Infantry, Artillery, Armour and Tactics schools across the country. As will be shown, this system on occasion experimented with new concepts during training programs and in operations manuals. The changes did not take place all at once, but rather throughout the 1997 to 2003 period.

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[15] Specifically, the document states that: "The strength of CD [Combat Development] work was in its contributions to doctrinal development, to organizational models for force structuring and mobilization planning and to the enhancement of a professional understanding of fully integrated army operations. However, CD work did not meet with the same degree of success in producing the rationale needed to justify army requirements..." Ibid., 1-4 - 1-5.

By the early 2000s, the Land Force Capability Development Continuum chart shown in Figure 2-1 had been created to summarize the system. While the copy provided is dated October 2006, it is virtually identical to the structure that was in place by 2003.[16] Although the chart shows the entire weapons system procurement and management system in detail, the most important sections to focus on in dealing with the Direct Fire Unit (DFU) program are under the headings "Conceive" and "Manage." These indicate the stages at which Personnel, Research & Development, Infrastructure and Organization, Concepts, Doctrine and Collective Training, Information Management, Equipment, Supplies and Services (PRICIE) analysis, and the creation of a Statement of Operational Requirement (SOR), are normally supposed to take place.[17]

The land force allows for some amount of flexibility to exist in the system, and it is possible for one step to take place slightly later in the process than would normally be expected.[18] However, the creation of a SOR would still normally take place before announcement of a specific weapons system acquisition. Comparing the Land Force Capability Development Continuum to the general structure of Department of National Defence procurements in Figure 2-2 illustrates this. As will be seen in Chapters Three and Four, the land force leadership did not produce a SOR for components of the DFU

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[16] Many details clarifying the restructuring were provided to the author by Directorate Land Concepts and Design (DLCD) staff. The DLCD is the successor organization to the DLSC. While all of the information is publicly available, it is nowhere summarized in a single document. The *Land Force Development Process* and *The Land Force Strategic Direction and Guidance* provide some of the information, while other details can be found on the Land Force Doctrine and Training System (LFDTS) website, including the affiliation between the LFDTS and the combat arm schools. Interview with DLCD staff, April 2011. Land Force Doctrine and Training System, http://armyapp.forces.gc.ca/lfdts-sdift/default-eng.asp (accessed April 20, 2011).

[17] The only exception to this is the "fast track" or "unforecasted operational requirement" categories which can be requested by managers or operational commanders, as shown in the right hand category of Figure 2-1. However, as will be seen, the DFU was not officially "fast tracked." Rather, a SOR was produced for the Mobile Gun System (MGS) after a major political and military announcement, while in the case of the Multi-Mission Effects Vehicle (MMEV), the land force leadership attempted to begin implementation of the project before receiving ministerial approval.

[18] Interview with DLCD staff, April 2011.

before announcement. Likewise, the land force leadership would be criticized by the Vice Chief of Defence Staff (VCDS) for not conducting adequate PRICIE analysis of parts of the program. The VCDS was responsible for strategic planning at the overall Canadian Forces (CF) level, including the Strategic Capability Investment Plan (SCIP) that was in place during the early 2000s.[19] The VCDS' criticisms would be framed in terms of these processes and the need for ministerial approval.

The graphic in Figure 2-2 describing the legislative and regulatory framework of the Canadian military procurement system was created by Alan Williams, who was Assistant Deputy Minister (Materiel) from 1999 to 2005. The ADM(Mat) is responsible for the civilian management aspects of Canadian defence procurements at the Department of National Defence (DND). Aaron Plamondon places the standard stages of procurement shown in Williams' picture into historical context as follows:

> Although the steps have been given different names over time, the procurement process has essentially included a definition of military requirement; validation of the requirement; government approval of the project, including funding; creation of an official Statement of Requirement (SOR); selection of a procurement strategy; bid solicitation and source selection; negotiation and award of contract, with the possible inclusion of another for long term In-Service Support (ISS); administration of the contract to purchase the piece of equipment decided on; and finally delivery of the product.[20]

As described in the Introduction, Industry Canada and Government Works and Public Services Canada would normally become involved during the later stages of consultation with industry in order to determine industrial regional benefits (IRBs) to various parts of Canada. In the case of a weapons system which is built entirely within Canada, such as LAV-III based vehicles, this step would not necessarily be significant.

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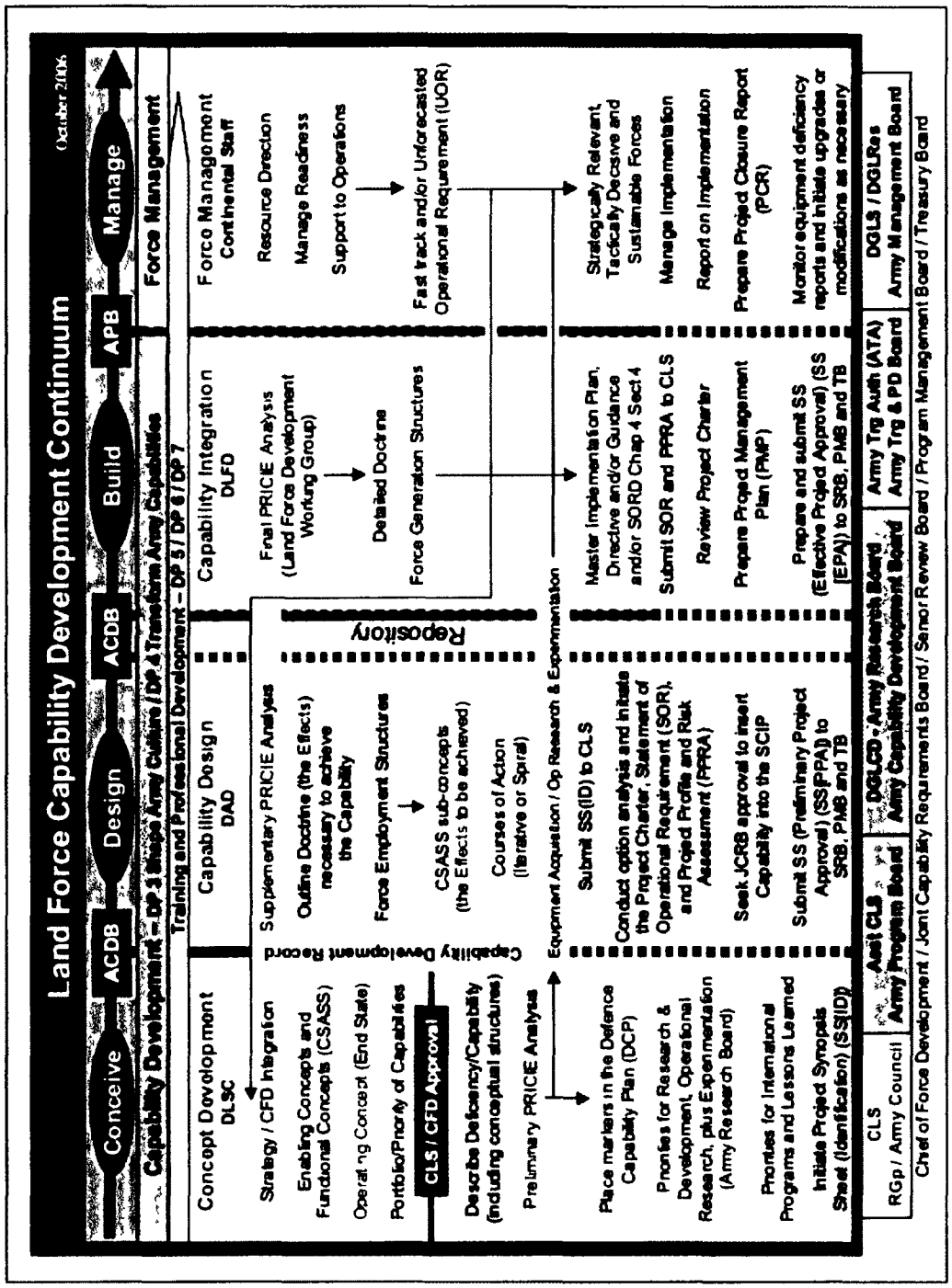
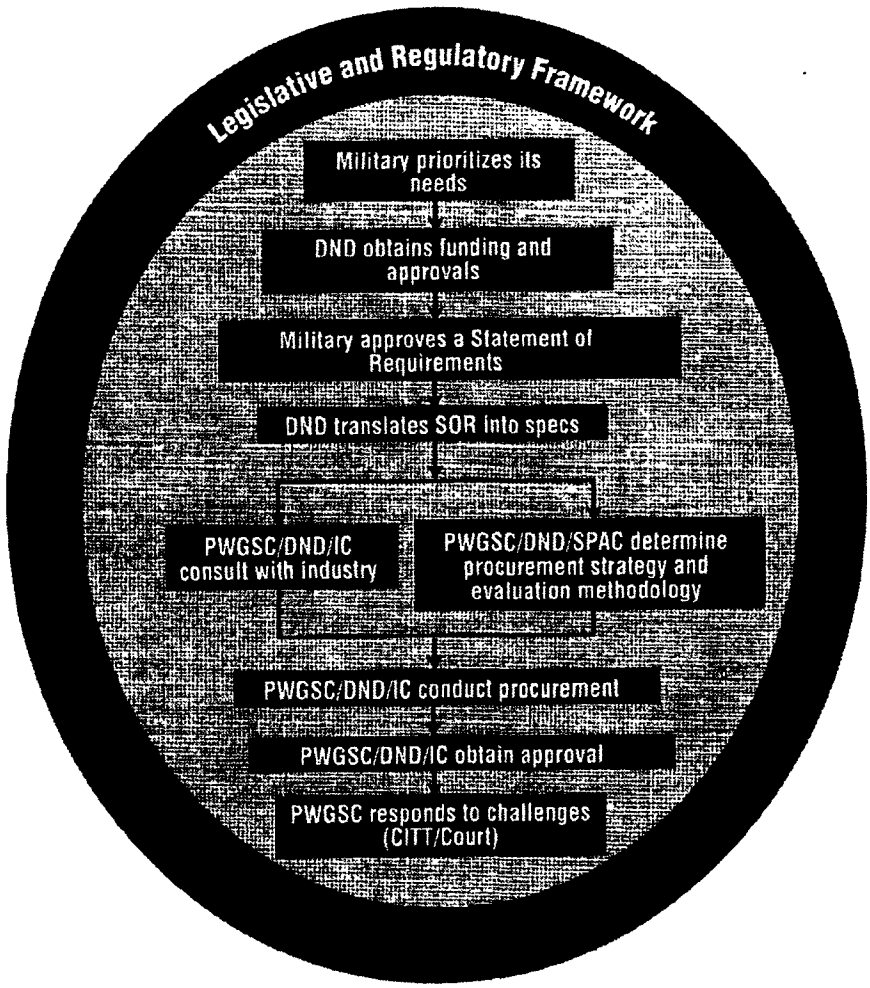
[19] Alan S. Williams, *Reinventing Canadian Defence Procurement* (Montreal and Kingston: Breakout Educational Network in association with McGill-Queen's University Press, 2006), 30.
[20] Aaron Plamondon, *The Politics of Procurement: Military Acquisition in Canada and the Sea King Helicopter* (Vancouver: University of British Columbia Press, 2010), 3.

Figure 2-1: Land Force Capability Development Continuum[21]



[21] Department of National Defence, *Land Force Capability Development Continuum* (2006). Provided by DLCD staff, April 2011. "Conceive" and "Design" equate to capability development with the Land Force Doctrine and Training System (LFDTS) in Kingston, while "build" and "manage" equate to procurement procedures and operations directed from National Defence Headquarters (NDHQ) in Ottawa.

Figure 2-2: Military Procurement Legislative and Regulatory Framework[22]



[22] Williams, *Reinventing Canadian Defence Procurement*, 3. In the graphic, IC is short for Industry Canada, PWGSC is short for Public Works and Government Services Canada, DND is short for Department of National Defence, and SOR is short for Statement of Operational Requirement.

Nonetheless, standard procedure would still be for the military to produce a strong justification for a program before advancing to procurement.

Although the process is more detailed, the above section summarizes the mandate of the reorganized capability development system within the legislative and regulatory framework of Department of National Defence (DND) procurement. Capability development was to establish the likely future conflict scenarios in which Canada could be involved, identify capabilities which would likely be needed, and develop recommended procurement strategies. Such strategies would then proceed through the established Department of National Defence (DND) procurement process. The remaining sections of this chapter show how the capability development organizations pursued their mandate between 1998 and 2003 as the land force fully adopted the RMA.

The Initial Future Armoured Vehicle Studies

The Directorate of Land Strategic Concepts (DLSC) was created in 1997.[23] It began work quickly, producing an *Armour Combat Vehicle Concept Paper* for May 19, 1998. The paper begins with a quotation from a 1997 *Parameters* article by then-U.S. Lieutenant Colonel Ralph Peters: "The key to the future of armored warfare lies in disregarding what we expect a tank to be in order to focus on what we need the tank of

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[23] Department of National Defence, Land Force Doctrine and Training System, *Five Years of Development of New Sources of Information for a Canadian Brigade*, by Fred Cameron and Roger Roy, (2002), 1. They describe the Land Force Doctrine and Training System as a "fledgling" organization in 1997. The Canadian Forces Base Kingston states that LFDTS evolved out of the Army Training Authority, which was established in Kingston in March 1997, eventually being authorized as LFDTS by the Minister of National Defence as a Regular Force formation on September 5, 2000. http://www.army.forces.gc.ca/asu_kingston/lfdts.aspx (Accessed January 29, 2011). DLCD staff recall beginning DCLS operations in 1996; it would not be unusual for a new organization to require a number of months to "stand up" before it becomes officially operational. Interview with DLCD staff, April 2011.

the future to do."[24] The text of Peters' article reflects the ideas about information superiority and greater mobility that were becoming current in the *Army After Next* program at that time.[25] By placing Peters' comments in the introduction of the *Armour Combat Vehicle Concept Paper*, the Directorate of Land Strategic Concepts (DLSC) writers were demonstrating both a belief that armoured vehicle design would change significantly in the future, and strong familiarity with the concepts embodied in *Army After Next* and U.S. Army Transformation in the late 1990s. More generally, their choice to begin the paper in this way demonstrates the influence of U.S. academic and military positions on Canadian perspectives of the RMA and Transformation.

The Concept Paper states that infantry must be protected in armoured personnel carriers and, once deployed, supported by a direct fire capability.[26] The immediate step in this process, already underway in the late 1990s, was the modernization of the Canadian Leopard 1s into the Leopard 1 C2, which was planned to be complete in 2001.[27] The paper is focused on two further goals, described as phases one and two:

> Phase One. With current funding of approximately $825M, replace 195 Cougars during the period 2002-2005. At the operational level, the requirement is for a light vehicle... capable of providing mobile direct fire in support of some combat

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[24] Ralph Peters, quoted in: Department of National Defence, *Armour Combat Vehicle Concept Paper* (Kingston, Ontario: Directorate of Land Strategic Concepts, 1998), 1.

[25] See: Ralph Peters, "The Future of Armored Warfare," *Parameters*, autumn 1997, 50-59. Peters argues that armoured vehicles designed for non-urban warfare will need to become very fast moving, and will likely use long-range indirect fire precision weapons in addition to, or perhaps in place of, direct fire systems. Parallel to this, he envisions urban warfare as becoming far more important in the 21st century, due to the growing size of cities and his belief that opponents will seek to draw technologically advanced armies into complex environments in order to negate their advantages and inflict heavy casualties on them. He uses the Russian experience fighting Chechen insurgents in Grozny in the mid 1990s as an example. Based on this, he emphasizes that vehicles designed for urban warfare must become more manoeuvrable, and that both non-urban and urban armoured vehicles must be designed to engage in constant information warfare, using such tactics as spoofing enemy sensors and deploying small robotic drones to gather non-line of sight information. As seen in Chapter One, information superiority and rapid mobility became core parts of the U.S. Army interpretation of RMA.

[26] Department of National Defence, *Armour Combat Vehicle Concept Paper*, 1.

[27] Ibid., 1.

> operations and the full spectrum of non-combat operations including domestic and peace support operations.
> Phase Two. Replace the Leopard, sometime after 2010, with a vehicle optimised for the most demanding combat operations. This project will require separate funding. Phase Two... will leverage the experience gained during PH 1, consider Future Army capability and force employment concepts, and take advantage of the emerging technologies that will be available post-2010.[28]

The concept paper was, therefore, dealing with two types of potential vehicles that would provide a combination of light and heavy direct fire support. As it continues, the influence of U.S. military and academic perspectives of RMA once again appears. It defines a complex future geostrategic security environment, similar to that defined by the U.S. Army. Here it also references the work of Alvin and Heidi Toffler in stating that new and unforeseeable forms of conflict will emerge as the world becomes divided between those regions which have advanced into the information age and those which remain primarily industrial or agricultural economies.[29] A multipolar world, increasing world population, increasing numbers of refugees, lack of resources such as food, and failed and fragile states are all described as amongst the new set of problems.[30] A danger arising from opponents using asymmetric strategies against Western forces is stated as well.[31] "Proliferation of advanced weapons systems" and the acquisition of modern armoured vehicles by developing states are also highlighted as threats.[32] These problems are defined as potential threats to worldwide Canadian interests as well as to the interests of Canada's allies. The ability to work with U.S. forces and multinational forces in both

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[28] Ibid., 1.
[29] The specific quotation is: "The world is moving from a two-level to a three-level power system, with agricultural economies at the bottom, smokestack economies in the middle, and knowledge-based, or Third Wave, economies likely, at least for a time, to occupy the top of the global power pyramid. In this new global structure, war, too, is trisected. Trisection sets the context in which most wars from now on will be fought. And those wars will be different from those most of us imagine." Alvin and Heidi Toffler, quoted in ibid., 2.
[30] Department of National Defence, *Armour Combat Vehicle Concept Paper.*
[31] Ibid., 2-3.
[32] Ibid., 6-7.

high and low intensity conflicts is identified as the overall conceptual solution in this situation.[33]

Having taken a similar view of the future security environment to that of the U.S. Army, the Concept Paper also identifies "the future of warfare" in like manner. This definition includes six points. The first is that: "A revolution is occurring that places knowledge, in various forms, at the core of military power."[34] The second is the argument that virtually every aspect of warfare has become automated, and so there is a requirement to transmit large amounts of data in a variety of forms.[35] Third, survival on the battlefield is described as requiring stealth, mobility and dispersion, because future weapons are expected to use precision instead of massed firepower to destroy targets.[36] Fourthly, the paper states that smart weapons will require "smart" junior leaders and soldiers, since authority will be "pushed" to the "lowest level possible."[37] To this it adds the fifth point that by employing "intelligent technology," small units will be able to accomplish more than the "traditional highly structured organizations of the past."[38] Finally, the sixth point is that the speed of warfare will increase because of computers, telecommunications and satellites, and as a result: "The most critical parameter in the future will be time."[39]

The concept paper therefore defines RMA broadly in the same way as U.S. Army documents of the late 1990s, with such features as information technology, an increased tempo of battlefield operations, increased dispersion, and a requirement for less

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[33] Ibid., 2-3.
[34] Ibid., 3.
[35] Ibid., 3.
[36] Ibid., 3.
[37] Ibid., 4.
[38] Ibid., 4.
[39] Ibid., 4.

hierarchical organizations. It also outlines the same specific requirements for future armoured vehicles as the U.S. *Army After Next* and Future Combat System programs: stealth and mobility. The connection made earlier by the Americans in the late 1990s is repeated: the proliferation of precision weapons will make mobility and stealth essential for survival, rather than the passive protection of heavy armour. The document combines these ideas with the "manoeuvre warfare" doctrine of the Canadian forces: "Within current Canadian manoeuvre doctrine, tactical and operational agility will remain a fundamental requirement."[40]

The specific requirements for future armoured combat vehicles identified in the concept paper stem from the adoption of the U.S. Army's approach. The phase one light armoured combat vehicle (ACV) is given the following requirements: "ACV (PH 1) will be a vehicle with accurate firepower, capable of destroying main battle tanks and lesser targets, that trades off armour protection needed for warfighting for high strategic and operational mobility, high sustainability and low operating costs."[41]

In this 1998 document, it is already anticipated that this vehicle would work in concert with a LAV-III equipped with the Tow-Under-Armour system,[42] which, as described in the introduction, was part of the Direct Fire Unit (DFU), alongside the Mobile Gun System (MGS) and Multi-Mission Effects Vehicle (MMEV). The Concept Paper mandates that the phase one vehicle be capable of travelling at the same speed as LAV-III infantry carriers, that it be light enough to operate on "third world country" infrastructure, and preferably be optimized for transport by strategic airlift.[43] Due to its

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[40] Ibid., 5.
[41] Ibid., 9.
[42] Ibid., 9.
[43] Ibid., 11-12.

light armour, the possibility of using an indirect fire guided missile, along with or in place of a direct fire cannon, for stand-off capability against main battle tanks is also discussed.[44] A basic air defence capability is also envisioned for this vehicle.[45] Finally, a requirement for the vehicle to include "stealth" technology is proposed, although how "signature reduction measures" are to be achieved is not specified, apart from a requirement that: "Vehicle and turret height be minimised."[46] In 2004 to 2005 the Multi-Mission Effects Vehicle (MMEV) was to supply a similar indirect fire capability, along with an air defence capability.

A wheels versus tracks discussion in terms of Canadian armoured vehicle planning is also inaugurated with this 1998 concept paper. The argument is similar to that presented by U.S. General Shinseki the following year during his announcement of U.S. Army Transformation:

> The debate over which method is superior is not as clear-cut as it once was. Tracks will always provide better mobility over the worst types of ground such as wet clay soils; however, advances in wheeled drive train technology permit wheeled vehicles to have good cross-country mobility in most conditions. Advanced suspensions, advanced tire designs and central tire inflation give wheeled vehicles (up to 30 tonnes) comparable tactical mobility and endurance to tracked vehicles. Current wheeled vehicles have superior operational mobility including road speed, range and endurance over tracked vehicles. This advantage in road mobility may outweigh the loss of some tactical mobility, especially on the dispersed battlefield and in OOTW [Operations Other Than War] where operational mobility is more important than tactical mobility.[47]

However, unlike in the later Direct Fire Unit (DFU) program, the phase one armoured combat vehicle is not envisioned as a replacement for tanks in the concept

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[44] Ibid., 12. The Soviet T-72 is used as the benchmark for stand-off capability against main battle tanks.
[45] Ibid., 13.
[46] Ibid., 13-14.
[47] Ibid., B-1.

paper.[48] As seen above, this role is given to the follow-on phase two vehicle. The paper outlines the results of various Canadian land force wargames in 1997-98 which included the conceptual[49] Armoured Combat Vehicle (ACV), such as *Quarré de Fer*. *Quarré de Fer* found that a 20 to 30 ton Armoured Combat Vehicle was too lightly armoured and lacking in tactical mobility to manoeuvre openly when in sight of the enemy. Its results state that "the ACV could not be used boldly and aggressively in warfighting situations... The study recommends the MBT not be replaced by the ACV in the armoured regiment for warfighting."[50]

The *Quarré de Fer* wargame and the *Armour Combat Vehicle Concept Paper* demonstrate that land force capability development considered light armoured direct fire vehicles in the context of RMA as early as 1998, but also that it did not recommend such vehicles as tank replacements. A tank replacement vehicle was not considered for the period before the year 2010, and capability development was waiting to see what "emerging technologies" might become available for it. Additional studies of armoured vehicles would take place over the following years, but a significant amount of effort would also go into confirming the relevance of the RMA to the land force.

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[48] Ibid., 11.
[49] Various methods can be used to simulate conceptual vehicles in a wargame, from mock-ups to computer simulations.
[50] Ibid., D-1 to D-2.

RMA Inspired Visions of the Role of a Land Force in the Context of an Unstable Future Security Environment are Adopted

While capability development studied the RMA, the land force leadership increased emphasis on the concept. Guidance from the land force leadership during 1998 has two predominant characteristics: a desire to retain interoperability and relevance with allies by adopting the RMA, and attempts to portray the RMA as relevant to Canada.

In a new capstone document published in early 1998, *Canada's Army*, the role of a land force within a joint context is defined similarly to the 1997 U.S. Army strategic direction document *Army Vision 2010*.[51] It states: "Although the sea and air elements of the Canadian Forces have a similar role and are equally vital for national defence, the army alone possesses the capability to seize and hold ground, dominate terrain, and physically protect land-based resources and people."[52] Like its U.S. Army counterparts, the land force leadership was attempting to portray its service as relevant and deserving of increased funding.[53]

As in the U.S. case, the document links the land force's relevance to the perceived more unstable future security environment.[54] While specific Canadian concerns are listed, such as Canadian sovereignty and collective security arrangements with allies, its main point is that the land force has greater staying power across the anticipated

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[51] Department of National Defence, *Canada's Army*. The document is dated 01/04/1998, which likely refers to January 4, 1998, but given that Canadian documents may use either British or American numerical dating systems, may also refer to April 1, 1998. According to CF personnel the author spoke with, CF documents should not use numerical dates, but those that do may list either the day or the month first. It was described as "a mess that should not have been allowed to occur."

[52] See: Department of National Defence, *Canada's Army*, 2, and U.S. Army, *Army Vision 2010*, 3.

[53] Department of National Defence, *Canada's Army*, 25-26. As in the meeting of the land force senior leadership in fall 1997, the combination of reducing military funding and an increasing tempo of deployments on peacekeeping and peace support missions is identified as a major challenge.

[54] Ibid., 68, 61-62, 73, and 112-113. The "modern security environment" is defined as "exceedingly complex" with changing political, social, demographic and environmental aspects.

widening spectrum of conflict.[55] RMA is described in terms similar to those used by the U.S. Army between 1997 and 1999.[56] Finally, the American perception that there is a need for greater mobility and deployability for land forces appears. Again, some specific Canadian concerns are added to the American idea. For instance, it is stated that Canada is the world's second largest country, and that therefore rapid mobility is needed for defence of home territory, not just for overseas operations.[57] Nonetheless, the overall message is not greatly different from *Army Vision 2010.* The document illustrates that the land force leadership was drawn in two directions: attempting to portray its service as relevant to Canada, and attempting to closely match the plans of its allies.

Soon after *Canada's Army, The Land Force Strategic Direction and Guidance* was published.[58] It provides further detailed direction from the leadership for the continuing reorganization of capability development during the 1997 to 2003 period. Once again, some specific Canadian concerns are placed within a discussion focused on pursuing the RMA. For instance, limiting spending to facilitate federal debt reduction is described as part of the strategy.[59] However, the main intent is to segment planning horizons in order to implement the RMA over the medium to long term, while managing

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[55] Ibid., 57. It is also stated in the same section that Canadian interests include global stability and peace in order to achieve conditions for economic prosperity. Another example of trying to emphasize relevance to Canada is an extended historical discussion of the role of military forces in Canadian national development. Such comments are minimal in U.S. documents such as *Army Vision 2010.* See ibid., 5-27.

[56] Ibid., 113. The document states: "Rapid advances in technology based on the silicon chip and ever more powerful computers will dramatically affect the way future operations are conducted. These and other developments are currently driving what has been termed the revolution in military affairs. This revolution is characterized by an unprecedented capability to collect, process, manage and disseminate vast amounts of data and information in real or near-real time, leading to comprehensive and continued awareness of events and situations... Digitization, directed energy weapons, volumetric explosives, smart and brilliant munitions, and the general ability to use deadly violence with greater speed, range, and accuracy will generate changes not only in tactics and procedures – as the Gulf War demonstrated – but affect policies at the strategic and operational levels."

[57] Ibid., 93.

[58] *The Land Force Strategic Direction and Guidance* is dated to July 16, 1998.

[59] Department of National Defence, *The Land Force Strategic Direction and guidance*, Chapter 1, 5 (each chapter has separate page numbering).

risk and budgets in the short term. The document creates planning horizons of four years, five to ten years, and ten to twenty-five years. These are described as the *Army of Today*, the *Army of Tomorrow*, and *The Army of the Future* respectively.[60] These designations would recur in capability planning documents to beyond 2003.

Referring back to Figure 2-1, the four year planning horizon corresponded to management of existing weapons systems. The five to ten year and ten to twenty-five year planning horizons would encompass conceiving or identifying future systems, and then justifying and procuring them. In terms of the initial armoured vehicles studies, maintaining and upgrading the Leopard 1 would have fallen within the nearest "Army of Today" horizon. The phase one light armoured direct fire vehicle would have fallen into the five to ten year "Army of Tomorrow" horizon, while the phase two light armoured direct fire vehicle, a potential tank replacement, would have fallen into the ten to twenty-five year "Army of the Future" horizon. This approach also paralleled the implementation of RMA that would be announced in U.S. General Shinseki's 1999 Transformation plan. As seen in Chapter One, it included acquisition of the LAV-III based Stryker as an interim vehicle, while the Future Combat System (FCS) would be developed and begin to be fielded around 2010.

That such similarities with the U.S. Army were not coincidental is clear in *The Land Force Strategic Direction and Guidance*. It states that "foreign force development" will necessitate change in order for the land force to maintain interoperability with allies.[61] The U.S. *Army After Next* program, which led directly to Shinseki's Transformation program with its emphasis on light armoured vehicles, is described in this

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[60] Ibid., Introduction, 3, and Chapter 2, 4-5.
[61] Ibid., Chapter 1, 4.

context.[62] The document also takes the view that other NATO allies were also adopting the U.S. interpretation of RMA, once again generating interoperability concerns.[63] As a small force with a number of larger allies, the land force leadership felt pressure to justify future acquisitions which would be standardized with allies' weapons systems, despite the federal government's emphasis on limiting military spending in the 1990s.

The *Land Force Strategic Direction and Guidance* also includes a Canadian version of the RMA concepts of dominant maneuver (sic., U.S. term), precision engagement, full dimensional protection, and focused logistics found in *Joint Vision 2010* and *Army Vision 2010*. Using a phrase reminiscent of the "system of systems" popular in U.S. documents of the time, it states that there should be a "systems approach" to the five operational functions of "seeking," "commanding," "shooting," "shielding," and "supporting" because of technological trends.[64] Similarly to U.S. studies, it translates ideas about the RMA into concepts that can be applied directly to armoured vehicle design; seeking, shooting and shielding relate fairly directly to the traditional armoured vehicle design elements of mobility, firepower and protection. However, the interpretation of these ideas in the land force organizations was in flux. As will be seen in the following sections, capability development studies would soon reinterpret these five functions as "Command," "Sense," "Act, "Shield," and "Sustain."

While the land force leadership adopted more details of the U.S. Army's interpretation of RMA, capability development confirmed the U.S. approach that a chaotic future security environment was part of the context in which the RMA was

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[62] Ibid., Chapter 1, 4-5.
[63] Ibid., Chapter 1, 4-5. Specifically, the document lists *NATO Land Operations 2020*, the British Army program *British Army 2020*, and the Australian Army program *Australian Army 21* as examples.
[64] Ibid., Chapter 1, 7. Seeking and commanding would relate to dominant maneuver, shooting to precision engagement, shielding to full dimensional protection, and supporting to focused logistics.

unfolding. In August 1998, an annotated bibliography of the future security environment was produced by the Directorate of Land Strategic Concepts (DLSC) working together with other operational research groups.[65] It describes this work as fundamental to the *Future Army* ten to twenty-five year planning horizon.[66] In it, the RMA is linked to "emerging global trends," "the future of land warfare," "transnational problems," and "technology, information and space warfare."[67] The analysis of the annotated bibliography is that: "Most analysts agree that we will face a broad array of challenges in the future security environment of the early 21st century."[68]

The interpretation that this type of future security would be the geopolitical context of the RMA was then reiterated by another document produced later in 1998, *Some Recent Trends in Major Armed Conflicts*. This report focused further on failed states, with the implication that the land force might have to deploy quickly into chaotic situations in the future.[69]

The land force confirmed the link between the future security environment, RMA, and rapid deployability by the end of the year. In October, it sponsored a symposium on

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[65] Department of National Defence, *An Annotated Bibliography of the Future Security Environment* by Shaye K. Friesen, Directorate of Land Strategic Concepts (August 1998), iii. It states that: "This bibliography represents one of the first publications by the Future Army Team, which consists of the Directorate of Land Strategic Concepts (DLSC), supported by the Operational Research Advisors and the Scientific Advisor to the Command of the 1st Canadian Division.

[66] Ibid., iii.

[67] Ibid., i.

[68] Ibid., i-iii. Specifically, interstate rivalries, changing regional power balances, ethnic, religious and nationalistic problems, the influence of non-state actors varying from international criminal organizations to drug cartels, demographic change, demand for scarce resources, environmental change, and mass migration of refugees are all indicated as important factors.

[69] Department of National Defence, *Some Recent Trends in Major Armed Conflicts, 1988-1997* by Shaye K. Friesen, Operational Research Advisor and Directorate of Land Strategic Concepts (October 1998). The document includes quantitative data concerning conflicts which resulted in 1000 or more deaths during 1988 to 1997 to indicate that global instability was increasing. It also states that "there are strong expectations that Canada will become involved in efforts that are designed to prevent or resolve major armed conflicts... Which would mean that Canada would have to operate across a very broad spectrum of conflict scenarios in order to maintain stability."

the future security environment. An Operational Research paper, *Operational Implications Of The Future Security Environment*, was produced on the basis of this symposium in December 1998.[70] Once again, an uncertain and rapidly changing future security environment is identified based on the symposium proceedings, along with the requirement for a military force that can operate across a spectrum of conflict.[71] As in *The Land Force Strategic Direction and Guidance*, combining this demand with resource constraints in the context of 1990s Canadian shrinking defence budgets is pointed to as a significant challenge.[72] Despite this challenge, *Operational Implications Of The Future Security Environment* states that adopting new technology, including information technology, is central to creating a force that can operate across the spectrum of conflict.[73] Proliferation of "modern weapons systems" amongst "small nations and terrorist organizations" is also described as a threat. The document states that:

> The CF will continue to require a rapid strategic deployment capability to ensure that defence objectives can be met. Strategic lift must be enhanced to ensure high readiness units can be deployed to theatre in time to make a difference... The impact will be smaller but more capable force packages able to deploy world-wide as part of some larger multi-national effort, within a short time frame... Manoeuvrability in the area of operations is critical therefore forces must be structured and equipped to promote agility which will ensure decisive speed and tempo can be maintained.[74]

With these three documents the Canadian land force reinforced its adoption of the interpretation that the future promised an unpredictable security environment and much instability in the developing world. It also drew a link, similar to the U.S. Army, between such a security environment, modern technology, and the need for greater strategic and

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[70] Department of National Defence, *Operational Implications Of The Future Security Environment* by Scot Robertson, Directorate of Operational Research (Joint & Land) (December 1998), i. Note: Scot is incorrectly cited as Scott Robertson in some publications.
[71] Ibid., 1-3.
[72] Ibid., 1.
[73] Ibid., 5-6.
[74] Ibid., 6.

operational mobility. The land force's capability development organizations had followed the mandate given them by the senior leadership in 1997. They had drawn on the studies of Canada's main ally and created a rationale for the land force to pursue new acquisitions in order to retain its strategic relevance. In 2003 this rationale would be used as a main justification for the Direct Fire Unit (DFU) program.

The Canadian Forces Endorses RMA at the Joint Level

In the above section, the adoption of much of the American interpretation of the RMA by the Canadian land force leadership and capability development system during 1998 has been seen. In 1998, the RMA also drew the attention of the Canadian Forces (CF) leadership at a joint level. The result was the creation of a RMA Operational Working Group and the organization of a symposium under the auspices of a number of Department of National Defence (DND) organizations.[75] At a broad level, endorsement of the RMA by the Canadian Forces leadership assured the land force that it was taking the correct approach. Specifically, the symposium demonstrates the continued strong influence of the indirect actors identified in the Introduction, academia and the U.S. military, on Canadian interpretations of RMA. Canadian, American and British

[75] The Defence Management Committee, the Director General Strategic Planning (DGSP), and the Chief of Research and Development (CRAD) were involved. On May 21, 1998 the Defence Management Committee decided that a Canadian perspective on RMA was necessary. DGSP and CRAD were given a mandate to form working groups with DND and industry representation to study the subject, including the RMA Operational Working Group, and to convene the symposium. See: Department of National Defence, *Canadian Defence Beyond 2010 – The Way Ahead: An RMA Concept Paper*, RMA Operational Working Group, National Defence Headquarters (May 31, 1999), iv. Also: Department of National Defence, Vice Chief of Defence Staff, http://www.vcds.forces.gc.ca/dgsp/pubs/rep-pub/dda/rma/intro_e.asp (accessed March 18, 2008).

academics participated, as well as serving and retired Canadian, American and British personnel.[76]

The conference was entitled the *1998 Symposium on Canadian Defence Beyond 2010*. While transcripts of the conference proceedings are not available, the Canadian Forces Vice Chief of the Defence Staff (VCDS) website provided its interpretation of the conclusions of the symposium for several years.[77] A primary statement was that: "Examining and understanding the Revolution in Military Affairs (sic.) is vital if Canada is going to successfully compete in the future international environment." The RMA was defined as having "the potential to touch all areas of our military structure."[78] The Canadian Forces (CF) was encouraged to foster "free thinking" and experimentation, to consider "alternative futures," and to undertake "cohesive, focused and intensive study."[79]

Based on the symposium, the VCDS posted a definition of the RMA similar to that of the U.S. The main difference is that it defines a timeframe over which the RMA was expected to unfold:

> A Revolution in Military Affairs (RMA) is marked by a fundamental transformation in military affairs that results from changes in weapon technology and equipment, operational concepts and military organizational methods. RMAs

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[76] Brigadier General Jeffery, the future Chief of Land Staff (CLS), was one of the participants, showing that the land force senior leadership was both influencing, and being influenced by, overall acceptance of the RMA by the Canadian Forces. Also, well known American military historians and analysts were present, including Williamson Murray, who wrote a number of articles on the RMA. RMC Professor Michael Hennessy served as Master of Ceremonies. Department of National Defence, Vice Chief of Defence Staff, "Agenda of the 1998 Symposium on Canadian Defence Beyond 2010," http://www.vcds.forces.gc.ca/dgsp/pubs/rep-pub/dda/rma/agenda_e.asp (Accessed March 18, 2008)

[77] Department of National Defence, Vice Chief of Defence Staff, http://www.vcds.forces.gc.ca/dgsp/pubs/rep-pub/dda/rma/Primer3_e.asp (accessed March 18, 2008). This website was checked again on August 24, 2010, and it no longer existed. The same is true of the other VCDS websites linked to the symposium. However, the Department of National Defence should retain records of the conference which could be accessed through the Access to Information Act.

[78] Ibid.

[79] Ibid.

> usually take place over a few decades and profoundly affect, and often replace, existing warfighting practices.[80]

Another section of the website discussed the Soviet work on the Military Technical Revolution (MTR) during the 1980s, as well as U.S. Army 1990s studies although for the most part it did not distinguish between the objectives in *Army XII* and those in *Army After Next.*[81] It also credited U.S. Admiral William Owens, who was Vice Chairman of the U.S. Joint Chiefs of Staff during the mid 1990s, with developing the idea of a "system of systems,"[82] although as seen in the Chapter One, this concept appears to have been originally described by Krepinevich in 1992 as the "network of systems."

The following month, December 1998, the Directorate of Operational Research (Joint & Land) published a paper: *The Revolution in Military Affairs: Possible Implications for Canada.* It quotes Andrew Marshall's definition of the RMA, adding the analysis that: "What is important to note in this definition is the inter-relationship between four key components, namely technology, doctrine, operational concepts and organizational concepts."[83] It focuses on information technology related capabilities, rather than new weapons platforms, as central to the RMA.[84] It also discusses debate over the RMA, without distinguishing between academic debate and debate within the

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[80] Vice Chief of Defence Staff, http://www.vcds.forces.gc.ca/dgsp/pubs/rep-pub/dda/rma/primer_e.asp (accessed March 18, 2008)

[81] Vice Chief of Defence Staff, http://www.vcds.forces.gc.ca/dgsp/pubs/rep-pub/dda/rma/Primer2_e.asp (accessed March 18, 2008).

[82] Ibid. The Canadian land force adopted a specific U.S. military definition of system of systems, stating that: "Admiral William Owens... developed the idea of a 'system of systems' that will enable any military user to employ numerous sensors (i.e. satellites, shipborne radar, remote acoustic devices) in concert to expeditiously find, fix and finish military targets."

[83] Department of National Defence, Directorate of Operational Research (Joint & Land), *The Revolution in Military Affairs: Possible Implications for Canada* by Scot (sic.) Robertson (1998), 3. It is also similar to Krepinevich's interpretation of RMA in that includes a discussion of the concept from a historical perspective, stating that there have been "more than a dozen" events over the preceding 500 years that could be characterized as revolutionary in military terms. Ibid., 2.

[84] Ibid., 5. "ISR" (intelligence, surveillance, reconnaissance), "near perfect battle assessment," "dominant battlespace knowledge," "near perfect mission assignment," "communication," "precision," are all listed as important information technology capabilities.

U.S. military or other armed forces.[85] It presents the concern that a technology gap may emerge between the U.S. military and its allies, as the U.S. adopts new technology and force structures more quickly, and it briefly discusses resource limitations faced by the Canadian Forces (CF).[86] It does not come to clear conclusions on the implications of RMA for Canada, apart from reiterating the importance, already seen above, of creating a Canadian perspective on the RMA.[87] Even so, it significantly endorses the importance of the concept and further study of it by Canadian military organizations.

The RMA Operational Working Group presented its report the following spring.[88] Entitled *Canadian Defence Beyond 2010 – The Way Ahead*, it includes input from the Department of National Defence (DND) and CF, academia, and industry.[89] Its stated purpose is to identify areas that need to be examined, and in some cases, to propose solutions to problems, while also stressing the "interdependent" nature of doctrine, technological change and organizational restructuring.[90] However, funding constraints are discussed, and the document states that it does not offer a "step-by-step process" to guide the Department and the Canadian Forces from 1999 to 2010 or 2025.[91]

Canadian Defence Beyond 2010 demonstrates influence by U.S. academia and U.S. policy statements. Like many of the documents described above, it quotes Andrew Marshall's definition of the RMA directly. Alongside this, it offers a broader version of the concept, resembling Alvin and Heidi Toffler's approach:

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[85] Ibid., 1.
[86] Ibid., 6-7.
[87] See ibid., 7-8.
[88] The document is dated May 31, 1999. See: Department of National Defence, *Canadian Defence Beyond 2010*.
[89] Department of National Defence, *Canadian Defence Beyond 2010*, iv.
[90] Ibid., p. v.
[91] Ibid., p. v.

> The conduct and character of war is changing. Essentially, rapidly integrating technologies (information, sensor, and precision technologies) are effecting massive changes in our global society, and in how business and the military operate. In the widest sense, the information age is replacing the industrial age.[92]

The comment about changes in business is followed up later in the document: "the global marketplace is driving change in the industrial sector... This profound change will be accelerated by the linkages between [the] RMA and the Revolution in Business Affairs (RBA)."[93] These comments are reflective of American studies which discussed the RBA, such as the 1997 *Qaudrennial Defense Review*. More generally, the idea that information technology would affect the military and business in parallel ways was an example of the general enthusiasm for the "information revolution" that emerged during the late 1990s.[94]

A Venn diagram, almost identical to one used in the Directorate of Operational Research (Joint & Land) paper, *The Revolution in Military Affairs: Possible Implications for Canada*, is used to illustrate military capabilities perceived to be stemming from information technology:

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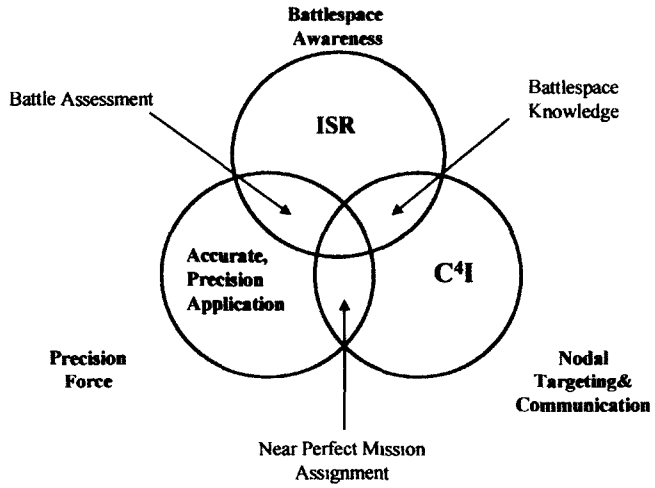
[92] Ibid., p. vi.
[93] Ibid., viii.
[94] This enthusiasm is also illustrated by the creation of the "dot-com" stock market bubble that ultimately burst in 2000-2001.

Figure 2-3: *Canadian Defence Beyond 2010* RMA Venn Diagram[95]



RMA is described as occurring at the intersection of the three spheres.[96] In addition to the concepts of battlespace knowledge, precision strike, and battlespace assessment shown on the diagram, strategic mobility/manoeuvre and protection are also listed as important capabilities and doctrinal concepts.[97] These closely resemble the doctrinal concepts of dominant manoeuvre, precision engagement, full-dimensional protection, and focused logistics articulated during 1997 in *Joint Vision 2010* and *Army Vision 2010*, rather than the official late 1980s "manoeuvre warfare" doctrine and principles of war of the Canadian land force.[98]

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[95] Ibid., vi.

[96] See: ibid., vi, and Department of National Defence, *The Revolution in Military Affairs: Possible Implications for Canada.* The Directorate of Operational Research document uses "dominant battlespace knowledge" instead of "battlespace knowledge" and "near perfect battle assessment" instead of "battle assessment."

[97] Department of National Defence, *Canadian Defence Beyond 2010*, ix.

[98] It can be argued that manoeuvre warfare doctrine overlapped with RMA thinking. In 1985 Richard Simpkin, widely accepted as one of the main creators and proponents of "manoeuvre warfare" doctrine, wrote that manoeuvre warfare was changing. It would be "really about not firepower but information. For it is really the acquisition, processing and dissemination of information that lies at the root of the speed and accuracy with which fire can now be applied... from the military point of view, it may be easier to consider what information technology cannot do..." The effects of precision firepower would be to "disperse mass

The RMA Working Group report made ten specific recommendations. The nature of these recommendations emphasized that the Canadian Forces should treat the RMA as a core concern. Most significant were four. First, it wanted the establishment of a permanent working group on the RMA. Second, it recommended a "systematic approach" to interoperability both within the Canadian Forces and with allies. Third was establishment of a Canadian joint experimentation facility together with close collaboration with the U.S. joint experimentation facilities. Fourth, a Canada-U.S. cooperative program for technology research and development was called for. The other recommendations were tangentially relevant to the RMA.[99] These recommendations state a willingness to borrow from U.S. RMA research and a desire to collaborate with the U.S. on technology development.

The array of work on the RMA and the future security environment seen above contributed to a new capstone document on National Defence planning produced by the Canadian Forces in June 1999, *Shaping the Future of the Canadian Forces: A Strategy for 2020*. It uses very similar or identical phraseology to various of the preceding

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in the form of a "net" of small detachments with the dual role of calling down fire and of local quasi-guerrilla action. Because of its low density, the elements of this net will be everywhere and will thus need only the mobility of the boot." Richard Simpkin, *Race to the Swift: Thoughts on Twenty-First Century Warfare* (London: Brassey's, 1985), 168-170. Most likely, "dominant maneuver" became part of American RMA doctrine because of the previous popularity of manoeuvre warfare. As in Simpkin's comments quoted here, new capabilities stemming from information technology were seen as building on still-relevant aspects of manoeuvre warfare and "AirLand Battle" doctrines. The core point for this study is the discussion and adoption of late 1990s U.S. RMA-based concepts and terminology in Canada, rather than the conceptual overlap and aspects of continuity between manoeuvre warfare and RMA.

[99] It also called for: fifth, a system to respond to asymmetric threats, sixth, the exploitation of space-based capabilities (in particular for communication and surveillance); seventh, new paradigms for acquisition and support of military materiel, eighth, a more efficient military supply chain, ninth, optimizing human factors to deal with rapid information flow on the battlefield, and tenth, human resources changes. Discussion of asymmetric threats was frequently mixed together with analysis of the RMA in late 1990s U.S. studies. Satellite surveillance and communications were a core aspect of the increased data flow needed in Krepinevich's reconnaissance-strike complex model of RMA. As seen in U.S. sources and Canadian studies in this chapter, more efficient supply chains using radio frequency identification chips and other such systems were also described as part of the RMA. Optimizing acquisition and support, human factors and human resources changes were often discussed in late 1990s documents as necessary to implementing the RMA effectively. See: Department of National Defence, *Canadian Defence Beyond 2010*,. vii-ix.

planning documents in describing the future security environment, the RMA, capabilities based planning, and other issues.[100] As a capstone document, its importance lies in what emphasis it places on certain issues. The information age, the RMA and changes in business management are brought together.[101] The phrase "Revolution in Strategic Affairs" is used to describe the perceived unpredictable and changing future security environment occurring together with changes in technology.[102] Unlike earlier land force capstone documents, it fully embraces the joint term battlespace in place of the traditional term battlefield.[103] Along with the focus on battlespace and information technology, it adopts the vision of rapid obsolescence of weapons systems found in the 1997 U.S. National Defense Panel report with the statement: "The portability, range, precision and lethality of weapons will continue to improve, while the effective life span of sensors and weapon systems will decrease due to the rapid pace of technological change."[104]

Strategy 2020 also structures scenarios about the future similarly to the 1997 U.S. National Defense Panel report. That report constructed three possible future worlds for analysis: "Shaped Stability," a world in which international cooperation and economic development has created a relatively stable international order; "Extrapolation of Today,"

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[100] See: Department of National Defence, *Shaping the Future of the Canadian Forces: A Strategy for 2020* (June 1999). For example, like *Canadian Defence Beyond 2010* it uses Andrew Marshall's definition of RMA, although it does not reference him. See page 1. The document also states: "Following detailed Departmental analysis, Strategy 2020 incorporates lessons learned from a wide range of initiatives and studies" (Foreword) and: "In developing Strategy 2020, the Defence Leadership Team started with the current Defence mandate and mission and then reviewed current geopolitical, technological and military trends. It also engaged military and civilian defence experts through a series of symposia and conferences that examined emerging defence issues, challenges and opportunities." *Strategy 2020*, 2. The studies conducted would have included those discussed above in this chapter.

[101] Ibid., 1.

[102] See: ibid., 1.

[103] A specific quotation is: "Militarily, the battlespace of the future will be global in scope, ranging from the sea floor to space. The emerging cyber-space environment adds another dimension to the battlespace. Military operations will be conducted at an accelerated pace, requiring rapid co-ordiantion of political and military objectives and increasing dependence upon information. Ibid., 5. This term is not used in *CFP 300-1, Conduct of Land Operations* or in *Canada's Army*.

[104] Ibid., 5.

based on a projection of trends current in 1997, and; "Competition for Leadership," in which hostile regional alliances are challenging the world power balance of the 1990s.[105] As recounted in *Strategy 2020*, the Canadian Forces "senior leadership team" considered "three alternate futures – a benign world reflecting strategic stability, a base case built around continued regional instabilities and consistent with the emerging strategic environment outlined above, and a malignant world reflecting even greater instability and rivalry."[106]

The document produces a standard late 1990s interpretation of future force structure and technological requirements based on the factors it discusses: "At its core, the strategy is to position... the CF to provide Canada with modern, task-tailored, and globally deployable combat-capable forces that can respond quickly."[107] The one key specific Canadian difference that is highlighted is that: "The institution does not have the resources to permit multiple radical shifts across the spectrum of capability. Rather, change must be evolutionary, focused on operational effectiveness."[108] The U.S. military interpretation of RMA is thus adopted, but the document proposes that the Canadian land force should phase in changes more slowly. This appears likely to be an act of pragmatism driven by necessity, rather than being based on a specific difference in analytical approach.

The above set of documents produced by the Canadian Forces during the fall of 1998 and the spring of 1999 show clear links to analysis produced by U.S. Army

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[105] National Defense Panel, *Transforming Defense: National Security in the 21st Century, Report of the National Defense Panel December 1997*, by Philip A. Odeen, Richard L. Armitage, Richard D. Hearney, David E. Jeremiah, Robert M. Kimmit, Andrew F. Krepinevich, James P. McCarthy, Janne E. Nolan, and Robert W. RisCassi (Arlington, Virginia: National Defense Panel, 1997), 8-9.
[106] Department of National Defence, *Strategy 2020*, 5.
[107] Ibid., 6.
[108] Ibid., 13.

programs, and adoption of similar RMA concepts to those produced in the U.S. during the 1990s. The direct influence of some of the academic works on RMA examined in Chapter One can also be seen. In this context, the Canadian land force was being encouraged to move ahead with the RMA, despite resource limitations. Because of these resource limitations, no immediate plans were put in place to pursue acquisition of new weapons platforms. It would, however, pursue less expensive programs and continue studies of the RMA before its leadership decided to replace main battle tanks.

Incremental Modernization and Additional Studies, 1999-2003

From 1999 to 2003, there were two key trends. First, the land force acquired additional LAV-II and LAV-III based vehicles and new Intelligence, Surveillance, Target Acquisition and Reconnaissance (ISTAR) systems. This set of equipment would provide the justification that standardizing on LAV platforms would yield logistical benefits that the land force leadership would use in 2003 for the Direct Fire Unit (DFU) program. Second, capability development continued to pursue its organizational mandate, conceptualizing capabilities that would be needed in the context of an unstable future security environment and RMA. The influence of U.S. Army continued in much of the capability development work, including participation in Canadian studies by U.S. personnel. Interoperability concerns were also a recurring theme. However, capability development also questioned the manner of U.S. implementation of the RMA. While it recommended pursuing RMA inspired force structures, it frequently suggested doing so in an evolutionary manner, in order to minimize not only financial but operational risks.

On March 8, 1999, the land force published the *Future Army Development Plan.* This strategic guidance document builds on the concepts seen in *The Land Force Strategic Direction and Guidance*, with focus on the ten to twenty-five year "Army of the Future" planning horizon. It also discusses allied planning programs, in particular noting that Australia, the U.K., and Canada have had "full allied participation" in *Army After Next* war games.[109] The Directorate of Land Strategic Concepts (DLSC) and the land force leadership are identified as the core of the "Future Army Team" dealing with this planning horizon.[110] Service staffs, joint staff, and other research directorates are placed in the "extended team."[111] Land force officers and non-commissioned officers, together with allies, academia, and industry are described as part of the "virtual team."[112] The future security environment, information technology, and concerns about a technological gap with U.S. forces are defined in much the same way as in earlier 1997-98 Canadian land force documents.[113] However, unlike previous documents, it argues that capability development and adoption of new technology can continue in a resource-constrained environment, with the implication that the land force could begin to implement similar plans to those of allied forces.[114]

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[109] Department of National Defence, Canadian Forces, *Future Army Development Plan* (March 8, 1998), 3 and 16-18. British, Australian, and NATO programs, and the earlier U.S. *Army XXI* program, are specifically discussed.
[110] Ibid., 12.
[111] Ibid., 12.
[112] Ibid., 12. In terms of academia, "strategic institutes" and universities are both specifically listed.
[113] See: ibid., pp. 19-23.
[114] This argument is made in a section entitled "Lessons of History," which states that: "a: the draw-down of the Canadian Army in 1919 to dangerous levels of unpreparedness in 1939 offers a negative example of how not to conduct force development, and b: the successful modernization and training plan for the German Army of Hans von Seeckt in 1921, within severe political and financial limitations, offers a positive example, especially when compared to the stagnation that occurred during the interwar period in the allied armies. Ibid., 24.

Limited acquisitions were already underway. The first LAV-III infantry carriers entered service in 1999, with a total of 543 vehicles being delivered by 2004.[115] An additional 108 remaining vehicles were delivered soon after that,[116] including an initial allotment of variants with the Tube launched, Optically tracked, Wire data link auto-guided missile (TOW) that the land force leadership later decided to include in the Direct Fire Unit (DFU). The later vehicles also included command post, forward observation and engineer variants.[117] The basic Canadian LAV-III infantry carrier vehicle differed most significantly from the basic U.S. Stryker infantry carrier[118] in that it carried a turret-mounted 25mm M242 chain gun in addition to coaxial and turret mounted machine guns. This 25mm cannon allowed it to provide significant direct fire support to infantry, although it was still too light to be effective against heavier armoured vehicles and heavily hardened targets. The land force also continued with its planned upgrade of its Leopard 1s to the Leopard 1 C2 configuration, extending the lifespan of the tanks by several years, and with the acquisition of LAV-based Coyote Intelligence, Surveillance, Target Acquisition and Reconnaissance (ISTAR) vehicles.

Returning to capability development, in July, 1999 the term "Transformation" began to be used more extensively in some Canadian land force documents. In that month the Directorate of Land Strategic concepts published the paper *Transforming an Army: Land Warfare Capabilities For The Future Army*. It included input from the

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[115] Department of National Defence, Canadian Forces Army Equipment website, http://www.army.forces.gc.ca/land-terre/equipment-equipement/item-eng.asp?product=64 (accessed August 25, 2010).

[116] Department of National Defence, *2003-2004 Report on Plans and Priorities* (2004), 27.

[117] 494 were to be infantry section carriers, of which 181 were also equipped to be command posts; 47 were to be forward observation officer and mortar fire control vehicles, 71 were to be TOW Under Armour units, and 39 were to be engineer variants. See ibid and also Department of National Defence, Director of Policy Development, *Strykers for Canada?* by J.E. Vos (December 12, 2002). Accessed through the Canadian Access to Information and Privacy Act, file number A0042339.

[118] Which, as seen in Chapter One, would begin to enter service during 2001-2002.

Future Army "virtual team" of academia and allies based on a conference held in June 1999 in Kingston, Ontario.[119] It describes how capability development and the land force senior leadership began to explore in more depth the capabilities that were expected to be needed in the ten to twenty-five year *Future of the Future* planning horizon.

Much of *Transforming an Army* contains variations on the RMA ideas seen in previous documents, as well as speculative discussions about such things as nanotechnology. While much of this simply demonstrates that land force planning was now operating thoroughly within the context of RMA, three particular accounts from the conference are important in demonstrating the conceptual trends that would lead to the Direct Fire Unit (DFU) program.

First, Jan Arp, at the time a Brigadier General, described how the senior leadership, meeting as Army Council, had conducted a seminar war game deliberately similar to *Army After Next* seminars held by the U.S. Army. According to Arp "This got Army Council to think about what we need" in terms of future capabilities.[120] Second, Don L. Smith, Director of the Science and Technology Land at the National Defence Headquarters (NDHQ) Defence Research and Development Branch, described that organization's views on armoured vehicles. His description of providing protection to light vehicles also reflected U.S. concepts:

> LAV III's [sic.], Cougars, and Coyotes are extremely easy to kill. We are not going to armour them, but move into the notion of protect, sustain, act and sense. The protection issue of the Army is going to be a stealth issue... We are talking about... an Army with topsight, one that sees and knows all. The Future Army will have an instantaneous vision of what is going on with the enemy... When

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[119] See: Department of National Defence, Directorate of Land Strategic Concepts, *Transforming An Army: Land Warfare Capabilities For The Future Army*, edited by Shaye K. Friesen (July 1999), v. The conference included U.S., British and New Zealand army speakers.
[120] Ibid., 9.

> you know your own situation and the enemy's, you can have small units working in tightly orchestrated fashion.[121]

However, drawbacks were observed. *Transforming an Army* notes that in some *Army After Next* war games opponents forced Western "high tech" forces into urban combat, reducing their effectiveness. According to the document, "high tech" forces took fifty percent casualties before securing a city in one example.[122] This leads to the observation in the document that information superiority and stealth capabilities work better for forces in open terrain.[123] Although there was heavy U.S. influence on these studies, Canadian capability development was doing its job, re-analyzing the U.S. conclusions.

The third important comments from the conference were provided by then Major-General Hillier, who would become Chief of Land Staff (CLS) and a prime proponent of the Direct Fire Unit (DFU) plan in 2003. He argued that military operations in the future would almost always be multilateral and that traditional peacekeeping missions would be highly unlikely in the future.[124] For him, the nature of future multilateral operations would be peace enforcement. He suggested that 1990s operations in the former Yugoslavia demonstrated this, and also that light military forces on peace enforcement missions would not be sufficient to stop violence between warring groups.[125] His comments suggest that he was already considering a potential need for rapidly deployable armoured vehicles such as the Stryker. It is also significant that he was seconded to III Corps, U.S. Army at Fort Hood, Texas, at the time, since he would have been directly

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[121] Don L. Smith, "Technology and its Impact on the Military," in Department of National Defence, *Transforming An Army*, 17.
[122] Department of National Defence, *Transforming An Army*, 38.
[123] Ibid., 38.
[124] R.J. Hillier, "Multilateral Operations," in Department of National Defence, *Transforming An Army*, 135.
[125] Ibid., p. 136.

exposed there to the *Army After Next* plan and to the U.S. Army Transformation plan that General Shinseki was about to announce in October, 1999.[126]

In August, 1999 the Directorate of Land Strategic Concepts (DLSC) presented *The Future Security Environment*. It was based on another aspect of the July conference, an attempt to, as the DLSC writers put it, "gain closure" on the land force's ongoing discussion of the subject.[127] A number of aspects of the discussion of the security environment in the paper mirror the 1997 U.S. National Defense Panel report but modify the analysis from that found in the U.S. documents and *Strategy 2020*.[128] Nonetheless, it ultimately reconfirms the view that the future security environment will be unstable and unpredictable. It then turns to how capability development should proceed under these circumstances.

The Future Security Environment reinforces the approach that for Canada, adaptation to the set of issues described as RMA should effectively be evolutionary. Unlike *Strategy 2020*, it does not address evolution versus revolution from a financial perspective, but rather in terms of maintaining near-term readiness for the Canadian land force. Revolution requires replacing all capability at once, which can be high risk, while continuing doctrinal and organizational change combined with introduction over time of

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[126] *Transforming An Army* and as well as other documents indicate that General Hillier was stationed at Fort Hood at this time. Another example is: Department of National Defence, Lieutenant-General R.J. Hillier, CMM, CD Chief of the Land Staff biography, http://www.army.forces.gc.ca/lf/English/1_6_2_2.asp (accessed March 23, 2009).

[127] For the "gain closure" comment, see *Transforming An Army*, iv.

[128] While the U.S. Defense Panel report and *Strategy 2020* examine three alternate futures, *The Future Security Environment* identifies four. These are: "a world of anarchy," "a world dominated by multinational corporations," "a world dominated by competing superpowers," and "a high technology world of regions." It finds that the alternative futures have areas of overlap, and in reality the future will most likely combine features of all of them. However, it argues that by examining these four scenarios, force structure options can be validated, and it will be possible to determine whether a proposed structure will allow "an effective response" across the spectrum of conflict. Demonstrating that not only U.S. Department of Defense but also the academic debate on RMA influenced them, the writers of the document also refer to the world of anarchy as "Van Creveld's World." Department of National Defence, Directorate of Land Strategic Concepts, *The Future Security Environment*, (August 1999), 15 and 47.

some new technologies can have the same effect.[129] The comment is also made that the evolutionary approach provides more time to conduct operational research, simulation and experimentation to find the "best mix of technology."[130]

According to the Directorate of Land Strategic Concepts (DLSC) writers, risk has to be managed because globalization will reduce the geographic isolation that has insulated Canada from international conflict in the past.[131] *The Future Security Environment* also states that not only will the United States expect Canada to support its initiatives,[132] but more generally, as a member of the G8, NATO and the United Nations, the world community may expect Canada to undertake global responsibilities.[133] It is argued that, since Canada requires a "global strategic focus" due to such international commitments,[134] the Canadian land force must "retain a sustainable expeditionary capability, supported by adequate strategic and operational mobility."[135] This model of operational risk management and evolutionary implementation of RMA lent itself to plans to acquire light armoured direct fire vehicles as the Americans were doing, while leaving the organizational structure of the Armoured Corps largely unchanged.

In terms of American planning to acquire such vehicles, *The Future Security Environment* states that the U.S. *Army After Next* program is a "mature process." It includes the comment that, out of the programs of all of Canada's close allies, *Army After Next* is "the only credible process that has appeared so far for developing a Future

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[129] Ibid., 31.
[130] Ibid., 31.
[131] Ibid., 16.
[132] Ibid., 16.
[133] Ibid., 8.
[134] The statement is also made that: "As a mature industrial nation with global interests that are not immune to instability and unrest, Canada requires a global strategic focus." Ibid., 17.
[135] Ibid., 17.

Army."[136] In terms of how U.S. future land force programs affect Canada, the point is made that: "The challenge will be for Canada to scale down US products and processes that are relevant to our requirements so that they are affordable and achievable in a Canadian context."[137]

Like the 1997 U.S. *Quadrennial Defense Review, The Future Security Environment* deals with the notion that rapid changes to technology, doctrine and organization imply near-term risk, but that failing to evolve and adapt to change presents long-term risk. In these terms, the situation is framed as partially out of the control of the Canadian land force: "Canada has assumed a degree of risk through its decision to limit resources allocated to its military forces."[138] It is suggested that it may be possible to compensate for a lack of resources through "focused revolutions," which "may offer revolutionary improvement to one or two capabilities rather than the complete transformation of a military force."[139] The concepts of command, sense, act, shield and sustain, described in the *Land Force Strategic Direction and Guidance*, are discussed as a framework for carrying out focused revolutions.

Overall, *The Future Security Environment* represents an acceptance of the importance of extending digitization throughout land forces and the relevance of the U.S. future army planning process to the Canadian land force. However, post 1997 U.S. military approaches to technological change are again treated with reservation. As seen in Chapter Two, the U.S. 1997 National Defense Panel report envisioned a near future consisting of rapid technological change including short wars conducted quickly by

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[136] Ibid., 34.
[137] Ibid., 34.
[138] Ibid., 36.
[139] Ibid., 37.

highly mobile forces using information superiority. By contrast, *The Future Security Environment* quotes Geoffrey Blainey: "The idea that great advances in the technology of warfare inevitably lead to short wars was held by many generations but falsified by many wars."[140] The Directorate of Land Strategic Concepts (DLSC) was questioning whether information superiority could be achieved to as great an extent as the U.S. military believed it could be, and whether rapid deployment at the beginning of a campaign would end conflict as quickly as U.S. sources suggested.

Emphasis on study of the future security environment seems to have lessened somewhat after August 1998, implying that DLSC's report provided enough "closure" on the subject for the Canadian land force. The next important step in the incremental changes that took place between 1999 and 2003 was experimentation with Intelligence, Surveillance, Target Acquisition and Reconnaissance (ISTAR) and data fusion using the Coyote, an eight wheeled LAV-II generation vehicle.[141] This work was described in December 1999 in the report *Army Experiment 1: Intelligence Surveillance Target Acquisition And Reconnaissance (ISTAR)*. The work was undertaken at the request of the Director of Army Doctrine (DAD) by the Army Experimentation Centre and DLSC.[142] Preparatory data for the experiment was gathered from four sources: a series of wargames called BRONZE PIKE, Armour School Coyote vehicle field trials, doctrinal studies on information operations and ISTAR, and studies by students at the Royal Military College of Canada. A wargame seminar was then held by a team of 17 military and six civilian personnel to examine different scenarios for sensor and communications integration and

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[140] Quoted in ibid., 7.
[141] As a LAV-II, the Coyote was a direct predecessor to the LAV-III, DFU and Stryker platform.
[142] Department of National Defence, Directorate of Land Strategic Concepts and the Army Experimentation Centre, *Army Experiment 1: Intelligence Surveillance Acquisition and Reconnaissance (ISTAR)*, by Jacques Hamel; Fred Cameron, and Roger Roy (December 1999), 1.

organization of Coyote Intelligence, Surveillance, Target Acquisition and Reconnaissance (ISTAR) units.[143]

A key point in this study is that without organizational or doctrinal change and integration of sensor and communications networks:

> ...little, if any, benefit will accrue from the CF multi-billion dollar investment in sensor technology. Sensors are like fire support assets they must be commanded and coordinated to get the required effect. Previous generation sensors were tied to a specific weapon due to technological limitations. It is now neither essential nor effective to maintain this affiliation. The sensors must become as important as the shooter in the combat power model.[144]

The Canadian land force was then essentially at the same level of implementation of RMA as the U.S. Army had been with *Army XXI*. As with the U.S. appliqué approach, sensor and communications technology could be integrated onto a variety of platforms, either existing or newly acquired. The idea that such integration, rather than new weapons platforms, can achieve significant improvements is expressed in the report: "The speed and agility of the land forces should improve as the accuracy, reliability, and timeliness of information improve."[145] But, as seen above in *The Future Security Environment*, and in contrast to the late 1990s U.S. approach, reservations about the extent to which the RMA could be perfected are expressed: "In studying this issue we must guard against any attempt to create a perfect solution which would try to lift all the fog of war. In this case, 'better is the enemy of good enough.'"[146]

Four major areas of concern emerged during *Bronze Pike*. The first centred on where to locate data fusion and analysis: in the Coyote teams, in the battalion or brigade headquarters, or in a dedicated analysis cell. The second concerned integrating

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[143] Ibid., 3-4 and E-1.
[144] Ibid., 17.
[145] Ibid., 28.
[146] Ibid., 1.

computing and communications systems to develop a common operating picture for both the units in the field and the headquarters. The third dealt with balancing computer and voice communications, and the fourth with estimating how to develop specialized training and doctrine for ISTAR (Intelligence, Surveillance, Target Acquisition and Reconnaissance) and intelligence personnel.[147]

In the context of those concerns, the report adopts the concept of a tactical internet and the U.S. Army's specific definition of the "system of systems." It states that: "We must have a seamless information web to enable commanders to meet their information requirements."[148] It also states that the land force must: "Adopt a 'system of systems' focus in requirements and engineering."[149] Survivability of Coyote ISTAR units is discussed, with agreement on the idea that precision weapons and rapid communications will make the 21st century battlefield more lethal and require increased dispersion of units and platforms.[150] The document finds communications bandwidth to be the greatest existing limitation,[151] as well as financial constraints that forced Coyote ISTAR units to be reduced from seven or eight vehicles to five during the late 1990s.[152] It indicates that increasing the use of multi-spectral sensors, access to airborne assets such

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[147] Ibid., 5-20. Although the acronym ISTAR contains the word "intelligence," operation of ISTAR assets required specialized training, and ISTAR and other intelligence personnel were not necessarily interchangeable. More generally, for changing land force views on doctrine, organization and the role of the various members of a unit staff, the comment on page 15 is interesting: "To quote a participant: 'The IO [Intelligence Officer] is no longer the most junior or less tactically adept officers in the unit.' The same is true for the recce soldiers. However the converse is true in other fields. EW operators and Int Operators must receive more tactical training to enable them to survive on the more dispersed battlefield."
[148] Ibid., 19.
[149] Ibid., 21.
[150] Ibid., 20.
[151] Ibid., 7: "The biggest limitation is in communications. Combat net radios (CNR) and KL43 secure messaging are slow and have limited bandwidth. The lack of a data link to transmit sensor information increases the workload of operators."
[152] Ibid., 6.

as Unmanned Aerial Vehicles (UAVs), and addition of stealth reconnaissance land vehicles are likely future requirements.[153]

The result of more general work dealing with the LAV platform Coyote is also discussed. In ISTAR specific terms, the report finds that Coyote power management issues need to be addressed. It states that the vehicle must run its main engine frequently to provide the necessary power for the sensors. Better batteries, fuel cells, or an auxiliary generator are proposed as solutions.[154] Also, the report finds that: "In difficult and rocky terrain Coyote tires are not very durable... A combination of the following seems appropriate: (1) more spares (a quick, however, less durable solution); and (2) more resistant tires (a solution that requires time and engineering effort).[155]

The concerns about the tires reflect earlier reservations. As seen above in the *Armour Combat Vehicle Concept Paper*, the *Quarré de Fer* wargame series found that a wheeled 20 to 30 ton Armoured Combat Vehicle (ACV) was lacking in tactical mobility in off road situations. In December 1999, the LAV platform was not yet seen as a suitable replacement for tracked vehicles in all respects, although there was optimism that engineering effort could improve tire performance.

Even more generally, the land force concluded from the experiment that, despite reorganizing capability development to deal with the RMA during 1997-98, its knowledge of its own capabilities was lacking and further reorganization was necessary.[156] This situation again stands in contrast to the U.S. Army's position.

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[153] Ibid., 23, 27, and 6.
[154] Ibid., p. 22.
[155] Ibid., 22.
[156] The document states: "One important lesson from this experiment was the realization that most of the information to identify the issues and possible solutions was already available in one form or another, however its retrieval and fusion are less than simple. The Army has lots of information and personal knowledge; its collective understanding is however deficient... The first lessons from this experiment

Although it was also suffering resource constraints during the 1990s, the U.S. Army was able to conduct a brigade-level field experiment of *Army XXI* digitization and extensive *Army After Next* studies. The Canadian land force, however, was concerned at losing track of its own corporate knowledge despite developing new approaches to experimentation.

As planning continued in 2000, different aspects of the RMA were emphasized. As seen in Chapter Two, "focused logistics" was one of the core new doctrinal concepts promulgated in *Joint Vision 2010* and *Army Vision 2010.* In March 2000, the Directorate of Land Strategic Concepts published the study *Sustainment Capabilities For The Army Of The Future.* Produced under contract by a retired Brigadier-General and a retired Colonel, it stated that a "Revolution in Logistics Affairs" (RLA) was underway.[157] The core of this was the U.S. focused logistics concept, which the report broke down into a number of sub-components. "Smart sensors" would be embedded in equipment which would automatically report real time data concerning the locations of units, headquarters, logistics installations and levels of stocks of ammunition, fuel, and so on.[158] Digital Global Positioning System (GPS) transponders would track items of inventory during transportation.[159] Combined with new weapons systems that would use smaller quantities of more precisely targeted ammunition to achieve the same effects as 20th century weapons, they argued that rapid force projection would be enabled.[160] They stated that

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were, therefore, that the initial research phase of any experiment is not an optional step in the experimental process and that the Army must re-establish its archival and knowledge-based system." Ibid., 4.

[157] Department of National Defence, Directorate of Land Strategic Concepts, *Sustainment Capabilities For The Army Of The Future*, by Ernest B. Beno; John D. Joly, (March 2000), i , v, and 83.

[158] Ibid., vi.

[159] Ibid., vi and 85. This is described as "total asset visibility" in the study.

[160] Ibid., 83-85. Furthermore, they suggested that fusion of logistics data would allow for anticipatory and predictive logistics, ibid., 87.

focused logistics "will be fully adaptive to the needs of increasingly dispersed and mobile forces, providing support in hours or days versus weeks."[161]

This logistics study shows that the capability development organizations were moving to explore more aspects of the RMA. While the Intelligence, Surveillance, Target Acquisition and Reconnaissance (ISTAR) study emphasized maximizing existing platforms with greater communications bandwidth and new doctrinal approaches to data fusion and intelligence analysis, there was some impetus from the study of logistics to acquire more efficient weapons to support more mobile forces.[162] Coupled with this was an increasing emphasis on modelling and simulation. A paper produced by a working group organized by National Defence Headquarters in April 2000 stated that modelling would become much more complex as a result of increasingly joint operations.[163] The single battlespace, featuring the integration of land, air and sea forces, would require modelling "across functions, phases and programs."[164] It found that for the U.S.:

> Simulations available today can link the services virtually on a "synthetic battlefield" and create virtual veterans of joint warfare... Although DND/CF has expertise and models in some areas, we are not incorporating advanced techniques such as Simulation Based Acquisition in a coordinated way. We do not have a joint battlelab or a process/structure for using synthetic environments for the determination of joint capabilities that the future forces must have.[165]

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[161] Ibid., v-vi.
[162] Many of the technical advances that the authors of the report were discussing represented tangible improvements over previous technologies. For instance, radio frequency identification (RFID) chips have been used increasingly by military organizations to track inventories of equipment since the late 1990s. Nonetheless, the proliferation of "revolution" terms seen above – Revolution in Business Affairs, Revolution in Strategic Affairs, Revolution in Logistics Affairs – illustrates that many of the Canadian Forces' analysts continued to be caught up in general enthusiasm concerning the "information revolution." This happened despite the reservations seen in *The Future Security Environment* and *Army Experiment 1* about U.S. notions of information superiority and rapid mobility.
[163] Department of National Defence, National Defence Headquarters, Symposium Working Group/A Sub-Committee of the Strategic Capability Planning Working Group, *Modelling and Simulation: Enabling the Creation of Affordable, Effective 2020 Canadian Forces* (April 2000), III.
[164] Ibid., III.
[165] Ibid., V-VI.

The document tentatively proposes the creation of an implementation plan, and discusses the future strategic environment, the RMA, precision weapons and stealth technologies.[166] Implementation of some changes to simulation took place quickly at the level of crew and soldier training. During 2000, the Army Simulation Centre, later Directorate of Land Synthetic Environments (DLSE),[167] acquired a Leopard tank gunnery trainer, an anti-tank missile trainer, a LAV III gunnery trainer, and a simulator of the Coyote Intelligence, Surveillance, Target Acquisition and Reconnaissance (ISTAR) capabilities.[168]

The 1999-2000 *Annual Report* of the Chief of the Defence Staff references modelling and simulation work as an example of the steps being taken at that time to implement the RMA.[169] It also highlights three other points related to Canadian concerns in the context of the RMA. The first is maintaining interoperability with allies.[170] The capability to maintain instant communications and share intelligence and surveillance data with U.S. forces is outlined as the most important aspect of interoperability.[171] Second, it is optimistic that a defence funding increase in the 2000 Canadian federal

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[166] See, in particular: Ibid., 1-2.
[167] DLSE and the Army Experimentation Centre went through a number of name changes during the restructuring of capability development during the late 1990s and early 2000s. The Army Experimentation Centre officially started operations in Kingston in 1999. In 2000 it merged with the Joint Command and Staff Training Centre to become the Army Simulation Centre. After that, the combined group became the DLSE and the Army Experimentation Centre re-emerged as a branch within the Directorate. See: Robert Tesselaar, "Directorate of Land Synthetic Environments Update – The Army Experimentation Centre: Supporting Army Capability Development," *Canadian Army Journal* 9, no. 1 (2006): 6-8.
[168] Department of National Defence, "Update On Simulation in Canada's Army – TSWG 2/00" by F. Delanghe, *NATO Training Simulation Working Group (TSWG) Meeting, Kingston, ON, 25-28 September 2000*, http://www.army.forces.gc.ca/tswg/meetings/2000-02_Canada_kingston/Presentations/Ser%2012%20Canada%20National%20Update.pdf (accessed August 29, 2010)
[169] Department of National Defence, Chief of the Defence Staff, *Building on a Stronger Foundation: Annual Report of the Chief of the Defence Staff, 1999-2000* (2000), 23.
[170] Ibid., 23.
[171] Ibid., 22.

budget will help "in positioning the Canadian Forces for the future."[172] Despite this optimism, the third point is that "rust out" of existing equipment is a continuing concern.[173] In terms of dealing with rust out, the acquisition of the Coyote Intelligence, Surveillance, Target Acquisition and Reconnaissance (ISTAR) vehicles and LAV-III armoured personnel carriers are emphasized as significant accomplishments.[174] The completion of a Tactical Command, Control and Communications System project for the land force, is highlighted in the same terms.[175] Here, despite concerns about wheel or tire performance seen in some of the reports above, a definite preference for wheeled vehicles is expressed:

> In order to respond quickly and effectively to a broad range of threats anywhere in the world, Canada's Army is moving towards a predominantly wheeled vehicle inventory that requires less support, is easier to deploy, and yet provides adequate firepower and protection. For example, the Light Armoured Vehicle III is now entering service, and features a stabilized automatic 25mm cannon, a laser range finder, and both image intensification and thermal sights. These changes will improve the speed, agility and deployability of the Canadian Forces, while, at the same time, being more cost-effective.[176]

In line with U.S. General Shinseki's statements in the fall of 1999, the Canadian Forces leadership was then establishing a direct link between deployability and wheeled light armoured vehicles. Armoured school concerns about firepower and tactical mobility were avoided with the comment about "adequate" firepower and protection. The preference for a wheeled force was combined with the recurring Canadian military concern about resource constraints: while providing desirable mobility capabilities, the LAVs would be "more cost-effective." The Annual Report states that an Army

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[172] Ibid., 19.
[173] Ibid., 15.
[174] Ibid., 16.
[175] Ibid., 16.
[176] Ibid., 22.

Transformation project was established which would focus on producing a blueprint for the five to ten year Army of Tomorrow planning horizon, with emphasis on: "modernization, combat-capability and global deployability."[177]

While the Armoured School had reservations about all-wheeled forces, the Canadian Army Experimentation Centre was examining how the Leopard 1 C2 and the LAV-III might work together. A presentation by then Major Paul Roman in September 2000 outlined the Centre's simulation studies of evolving armoured vehicle doctrine at the brigade and below level.[178] Against an enemy equipped with Soviet/Russian materiel, as might be found in the Balkans during the 1990s, results showed that the addition of the LAV III to the brigade allowed it to block a "surprisingly large enemy force."[179] The presentation states that the LAV III vehicles were able to divert the attention of the enemy BMP 2 infantry carrier/infantry support vehicles, allowing the Leopard 1s to focus on destroying the enemy T72 main battle tanks.[180] By contrast, the Leopard 1 C2 alone was "defenceless" against the T72/BMP combination.[181]

In January 2001 the Directorate of Land Strategic Concepts (DLSC) produced the report *Future Army Capabilities: Sustain, Sense, Command, Act, Shield.* As expressed in its title, this report solidified the choice of these five "operational functions" as the Canadian land force's equivalents to the four American concepts of dominant maneuver, precision firepower, full-dimensional protection and focused logistics. The report was

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[177] Ibid., 21.
[178] Department of National Defence, "AEC Presentation NATO SIM WG," by Paul Roman, *NATO Training Simulation Working Group (TSWG) Meeting, Kingston, ON, 25-28 September 2000* http://www.army.forces.gc.ca/tswg/meetings/2000-02_Canada_kingston/Presentations/Ser%2015%20AEC%20Brief.pdf (accessed August 29, 2010)
[179] Ibid.
[180] Ibid.
[181] Ibid.

fully endorsed by Lieutenant General M.K. Jeffery who,[182] as seen above, had argued in 1997 that the land force's capability development processes were too slow and had to be accelerated. By 2001, he was Chief of the Land Staff (CLS), indicating that the approach taken at the Directorate of Land Strategic Concepts (DLSC) since 1997 now had the backing of the land force's most senior officer, and would therefore have influenced the entire organization.[183] Three points, in particular, stand out.

The first is that: "The Army must be capable of carrying out national priorities, even during periods of fiscal restraint."[184] As a result the report argues: "Those capabilities not deemed essential may be retained at lower levels of readiness or may even be discarded."[185] This approach to retention of capabilities would be important in terms of the Direct Fire Unit (DFU), as the argument would be that a direct fire capability was being retained, but that otherwise, tanks were not a core capability. It could also be argued that operation of the Main Gun System (MGS) retained much of the basic skill set needed to operate tanks – apart from experience with maintaining and repairing tracks – and so would qualify as retaining that capability at a lower level of readiness.

The second point is that Canadian Forces planners are said to no long envision rapid operational mobility as a capability solely required in the future. The report argues that the battlespace had already expanded significantly for the Canadian Forces during the 1990s in peacekeeping, peace enforcement, and low intensity conflict operations. It is pointed out that the Canadian battlegroup area of operations in Bosnia-Herzegovina

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[182] See: Department of National Defence, Directorate of Land Strategic Concepts, *Future Army Capabilities: Sustain, Sense, Command, Act, Shield* (January 2001), i-ii.
[183] The interpretation that Jeffery had a significant influence on Army development from 1997 when he was still a Brigadier General through to his time as CLS arises in some of the sources examined here. See, for instance comments by Fred Cameron and Roger Roy in Department of National Defence, *Five Years of Development of New Sources of Information for a Canadian Brigade*, 1.
[184] Department of National Defence, *Future Army Capabilities*, 5.
[185] Ibid., 5.

during the late 1990s covered an area of approximately 250 kilometres by 70 kilometres.[186]

The third significant point is in the manner that the report addresses what it calls "the heavies."[187] The growing battlespace and the need for operational mobility, it argues, demand that the "huge" quantities of fuel, ammunition and equipment maintenance and the "massive supply systems" required by existing heavy forces must be reduced.[188] A wide range of what were at the time immature technologies, including electrical, hybrid electrical, hydrogen, nuclear, beamed energy, and solar powered armoured vehicles are discussed.[189] As seen in the logistics studies above, the possibility that precision weapons would require comparatively little ammunition is also highlighted.[190] Finally, there is a discussion of building "ultra-reliability" into systems to reduce maintenance requirements.[191] These technologies were relevant to the examination, as the report was intended more to "generate discussion" than to be prescriptive in recommendations for new technology.[192] However, it may have been significant that all the armoured vehicles shown in graphics dealing with the future development of the land force in the document are wheeled, as seen in Figure 2-4.

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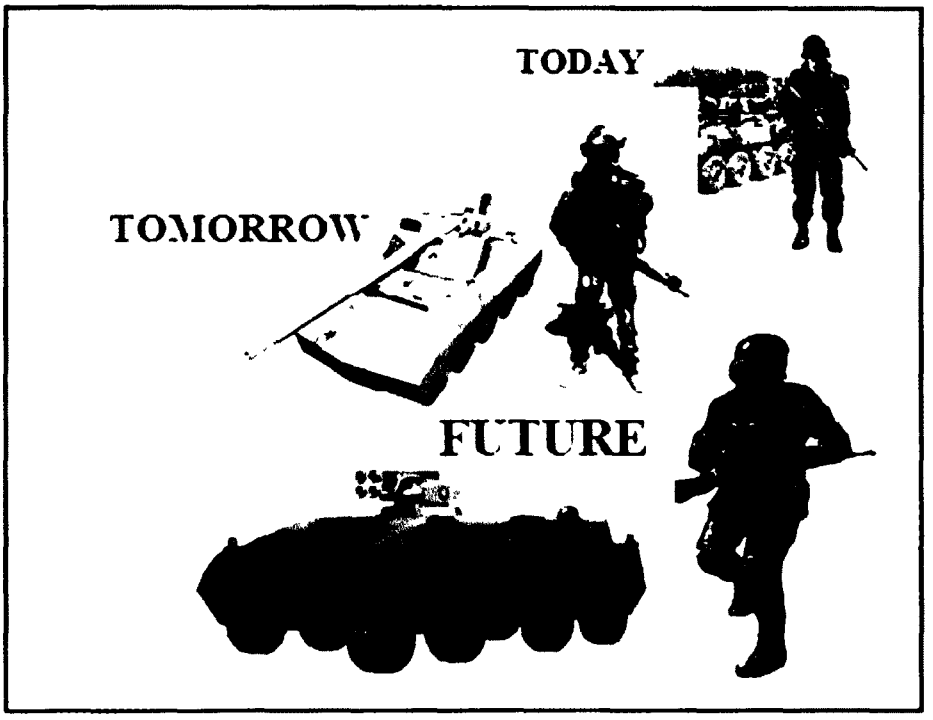
[186] Ibid., 24.
[187] Ibid., 36.
[188] Ibid., 36.
[189] Ibid., 36.
[190] Ibid., 36.
[191] Ibid., 36.
[192] Ibid, ii.

Figure 2-4: *Future Army Capabilities* graphic[193]



While land force capability development moved in the direction of the U.S. Army's Transformation plan, a shift started in the focus of the Canadian Forces from peacekeeping and peace enforcement to a low to medium intensity combat role. In the 2001-2002 Chief of the Defence Staff Annual Report, the first Canadian deployment to Afghanistan was noted as "the largest deployment of Canadian Forces into combat-international operations since the Korean War."[194] The report emphasizes that in these circumstances there is a pressing need to modernize military equipment and capabilities.

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[193] Ibid., 23. The vehicle next to the caption "Today" is a LAV-based vehicle. In the copy of the picture above, the front of the vehicle is cut off, making it difficult to identify. In a photocopied version of the document provided to the author, it is more clearly a LAV family vehicle. However, the photocopied version is of extremely low quality, so the above version from a digital copy of the document was used. Next to the caption "Tomorrow" is a speculative U.S. Future Combat System (FCS) graphic with five wheels per side, and "Future" appears to be a graphic of a wheeled vehicle with a compact missile-launcher "remote weapons station" mounted as a turret, similar to the TOW-Under-Armour turret mounted on a LAV-III chassis in case of the LAV-TUA vehicle.

[194] Department of National Defence, Chief of the Defence Staff, *At A Crossroads: Annual Report of the Chief of the Defence Staff* (2002), I-II.

RMA and interoperability are described as key components of such modernization, and land force Transformation is discussed in these terms.[195] Significantly, the land component is described as: "a medium-weight, information-age land force."[196] As will be seen, this description would be important in defining the need for LAV-based vehicles, rather than tanks, during the Transformation program started in 2003-2004.

2002-2003: The Final Set of Armoured Vehicle Studies Before The Direct Fire Unit

During 2002 and 2003, capability development studied organizations similar to those under development in the U.S. Army Transformation program. Despite an inherent bias towards lighter armoured vehicles, it continued to follow its mandate, and did not recommend mirroring the U.S. approach in the near term.

In May 2002 the Directorate Land System Concepts (DLSC) studied concerns about urban warfare and light armoured vehicles in *Future Army Experiment: Operations in the Urban Battlespace*. Structured as a seminar wargame, it involved over 130 personnel.[197] This experiment is representative of the themes running through this chapter. It shows how the land force continued to use allied personnel and studies, as well as its own training programs, to help capability development conceptualize armoured vehicle design. It also shows how a bias towards U.S. Army type Transformation entered the structure of Canadian war games. Finally, it illustrates how, despite this bias, capability development followed its mandate and did not recommend a

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[195] Ibid., p. 28.
[196] Ibid., p. 28.
[197] Department of National Defence, Directorate of Land Strategic Concepts and Fort Frontenac, *Future Army Experiment: Operations in the Urban Battlespace* (May 2002), 5.

new force structure, since the results of its experiments were inconclusive. These details are significant, because the drawbacks of the Direct Fire Unit (DFU) in urban areas would later be a source of organizational friction between capability development and the land force leadership's plan.[198]

Three brigade-sized "exercise force" (EXFOR) constructs were studied. Students graduating from the Transition Command and Staff Course at the Canadian Land Forces Command and Staff College served as the commanders and staff of the EXFORs.[199] U.S. Army, Marine Corps, Department of Defense, and RAND Corporation personnel also participated, as well as representatives from other allies and non-governmental organizations (NGOs). The exercise examined whether a force designed for high intensity combat in open terrain could be adapted equally well to conflict in urban terrain.[200] This was due to the proposition seen in *Army After Next* wargames that an opponent would try to occupy and fight in cities in order to degrade the advantages of Western forces.[201]

EXFOR A was labelled an "evolutionary design" but reflected the 1999 *Army After Next* designs which incorporated 25-40 ton armoured vehicles. It had 5200 men and three battlegroups using "future armoured vehicles."[202] These included two sub-units in each battleground using a Multi-Mission Effects Vehicle (MMEV) designed around a LAV chassis, and two-sub units using a "close effect vehicle" (CEV).[203] The MMEV incorporated characteristics that would later appear on both the Mobile Gun System

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[198] As will be shown in Chapters Three and Four.
[199] Department of National Defence, *Future Army Experiment.*, p. 5.
[200] Ibid., 4.
[201] Ibid., 2.
[202] Ibid., 6.
[203] Ibid., 6.

(MGS) and the Multi-Mission Effects Vehicle (MMEV) of the Direct Fire Unit plan. It had a 105mm main gun and low level air defence missiles for both anti-tank and short-range air defence, and was described as "the evolution of the tank."[204] The close effect vehicles (CEVs) resembled the existing LAV-IIIs then being acquired by the Canadian land force. They were designed as infantry carriers with a 25mm gun, general purpose machine guns, and grenade launchers,[205] and were also equipped with four low level air defence missiles each.[206] The construct force also had two flights of Griffon helicopters with reconnaissance, surveillance and target acquisition and attack functions, and artillery support from 155mm tube artillery and 120mm mortars which would fire precision guided rounds.[207]

The 4500 man exercise force (EXFOR) B was described as the "revolutionary design."[208] As in some *Army After Next* urban warfare scenarios, the experiment deliberately deleted a battlegroup to test whether the "revolutionary" design would require fewer personnel.[209] Vehicles were supposed to be smaller and lighter than those in EXFOR A and also to have greater endurance and range and better resolution in their sensing systems.[210] They were to be equipped with various small automated surveillance and combat vehicles systems, both Unmanned Ground Vehicles (UGVs) and Unmanned Aerial Vehicles (UAVs.)[211] The individual soldiers in EXFOR B were simulated to have various technologies built into their clothing in order to further network them together,

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[204] Ibid., 6.
[205] Ibid., 6. Compare LAV-III specifications: 25-mm turret mounted M242 chain gun, 7.62mm coazial machine gun, 5.56 or 7.62mm machine gun mounted atop the turret, and two clusters of four 76mm grenade launchers.
[206] Ibid., 6.
[207] Ibid., 6.
[208] Ibid., 7.
[209] Ibid., 7.
[210] Ibid., 7.
[211] Ibid., 7 and 11.

such as heads up displays in their helmets which would feed them real-time situational awareness data.[212] In addition, provision was made for multi launch rocket systems with a theoretical range of 100 kilometres, other artillery that fired precision munitions, and two flights of helicopters deemed to be able to process up to 200 targets at a time and to be able to kill T-90 main battle tanks at a range of eight kilometres.[213]

Exercise force (EXFOR) C was a baseline similar to a standard Canadian 2000/2001 brigade structure, with three infantry battalions, an armoured regiment, an artillery regiment, a field engineer regiment, and combat service support, and it was also assisted by an aviation squadron.[214] Although it had a data processing centre, the flow of information this centre provided, together with the brigade's other information processing capabilities, were deemed to be "less sophisticated" than those in the two other EXFORs.[215]

Those organizing *Operations in the Urban Battlespace* clearly took the approach that a force without new weapons platforms would also have less sophisticated information processing capabilities. It is significant that a force with mostly year 2000 equipment, but with *Army XXI* style digital appliqués,[216] was not tested. With Unmanned Aerial Vehicles (UAVs) and Unmanned Ground Vehicles (UGVs), such a force would likely have had a great deal of additional data collection and information processing capacity. As with the U.S. *Army After Next* and Transformation plans, Canadian planners were now assuming that light armoured vehicles and information superiority would work together in tandem.

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[212] Ibid., 7 and 13.
[213] Ibid., 7.
[214] Ibid., 7-8.
[215] Ibid., 8.
[216] See Chapter One, pages 66 to 78, for description of *Army XXI* digital appliqués.

After working through the seminar play, the experiment concluded that while technology would enhance individual and collective force capabilities, it would not replace the need for large numbers of soldiers in urban or other complex terrains.[217] All three variants lacked sufficient dismounted soldiers, although exercise force (EXFOR) B suffered most significantly from this problem.[218] It was found that EXFOR A would have benefited from replacing one sub-unit of Multi-Mission Effects Vehicle (MMEV) tank replacements in each of its battlegroups with an extra sub-unit of Close Effect Vehicle (CEV) infantry carrier/support type vehicles. EXFOR C predictably was found to suffer from a lack of situational awareness and information dominance.[219] The war game designers had introduced a bias towards lighter vehicles in the way that they had constructed the EXFORs. Nonetheless, they concluded that it is difficult to make "one size fits all" force structures, and suggested that creating a Future Army model optimized for complex terrain but adaptable to open terrain would be overly complicated.[220] In this case, dismounted operations, not lighter replacements for tanks, had been critical.

While the Directorate of Land System Concepts (DLSC) undertook seminar wargame experiments, the Directorate of Land Synthetic Environments (DLSE) Army Experimentation Centre continued with the "Army Experiment" series of studies. Army experiment 3 dealt with digital appliqué type concepts similar to the U.S. Army's early 1990s *Army XXI*.[221] Army Experiment 4 dealt with command and control alternatives in

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[217] Department of National Defence, *Future Army Experiment*, 17.
[218] Ibid., 12.
[219] Ibid., 18. The document uses the Canadian terminology of sustain, sense, command, act, shield. It states: "EXFOR C encountered sever shortcomings due to a lack of technological advances and resources, particularly in the *Command*, *Sense* and *Act* functions."
[220] Ibid., 19.
[221] Department of National Defence, *Five Years of Development of New Sources of Information for a Canadian Brigade*, 4. The document does not use the term appliqué, but it describes how prototype

a mechanized brigade, named Model A, Model B, and Model C.[222] Model A simply added a "more robust" intelligence staff to the existing brigade staff.[223] Model B had an "ISTAR [Intelligence, Surveillance, Target Acquisition and Reconnaissance] Coordination Centre" to collect, analyze and distribute information from sensors.[224] Model C had an ISTAR Coordination Centre with the additional authority to task and retask sensors without having to constantly request permission from the brigade operations staff.[225] Models B and C were found to detect enemy forces more efficiently and reduce the number of vehicles the brigade lost, and recommendations were created for improved scenarios for similar future experimentation.[226]

Army Experiment 5 studied the tactics, techniques and procedures (TTPs) to be used in mechanized battlegroups up to the brigade level using Leopard 1 C2s and LAV-III infantry carriers.[227] It used a combination of Modular Semi-Automated Forces simulation (ModSAF) and live trials.[228] Both quantitative and qualitative data were recorded, including numerical data during simulation, questionnaires, and verbal feedback from players during after action reviews.[229] This experiment included the Army Experimentation Centre work described by Paul Roman in September 2000. Army Experiment 6 included further work on Situational Awareness systems and the Land Force Command and Control Information System, and led to the creation of an Army

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software and hardware was mounted on ground combat vehicles to test the development of a new situational awareness system, which is similar to what the U.S. Army did between 1994 and 1997.

[222] Ibid., 5.
[223] Ibid., 5.
[224] Ibid., 5.
[225] Ibid., 5.
[226] Ibid., 5-6.
[227] Ibid., 6.
[228] Ibid., 6.
[229] Ibid., 6.

Digitization Office in Kingston, Ontario.[230] Like the U.S. Army Digitization Office established in 1994, the Canadian Army Digitization Office was given a broad mandate to ensure that networked systems, and new doctrine to efficiently utilize them, would be developed.[231]

At this time, officers on the Phase 4 armoured course at CFB Gagetown also experimented with how best to organize a combined force of LAV-III and Leopard 1 C2s.[232] Various interim doctrine pamphlets were produced as a result of this work. The October 14, 2003 *LAV Company Tactics (Interim)* states that, in order of priority, the main tasks of the LAV-III armoured personnel carrier are:

a. to provide protected transport for the infantry to get them as close as possible to the objective;
b. to provide fire and other mounted support to dismounted infantry; and
c. to kill enemy LAVs[233]

It also states that:

a. Tanks and mechanized infantry are complementary and normally operate together on the battlefield.
b. The LAV and its section form a total weapons system. Only when the section is dismounted is the full effectiveness of all the weapons realized.
c. The aggressive use of the LAV must be tempered with the knowledge that it does not have the firepower or protection of a tank.[234]

LAV Company Tactics (Interim) also highlights that it: "builds upon the previous work of the Infantry School's LAV Implementation Cell and also incorporates many lessons learned from the Mobile Automated Instrumentation Suite (MAIS) Trial

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[230] Ibid., 6-7.
[231] Ibid., 7.
[232] Interview with land force Captain Andrew Duncan.
[233] Department of National Defence, Chief of the Land Staff, *Land Force publication B-GL-321-007/FP-001, LAV Company Tactics (Interim) (English)* (2003), 1.
[234] Ibid., 1.

conducted in CFB Gagetown."[235] Its companion pamphlet, *Combat Team Operations (Interim)* states that:

> While the fielding, integration, training and level of experience with the LAV III and Leopard C2 continues across the field force, there are many issues yet to be resolved... Feedback on the information contained in these manuals is encouraged and it need not wait until the execution of the formal review process. In this regard, units are asked to submit observations to the Army Lessons Learned Centre or to the Directorate of Army Doctrine as appropriate...[236]

In addition, a presentation by Land Force Doctrine and Training System Operational Research Advisors in August 2002 discusses "LAV III uninstrumented and instrumented field trials."[237] It describes the vehicles as having "thermal and image intensification systems that provide the infantry battalions with sensor sophistication to which they have not previously had access."[238] It also discusses trials of the Mobile Automated Instrumentation Suite (MAIS) system, which had already been used at the U.S. Army's Operational Test Command at Fort Hood, Texas, in both the LAV III and Leopard 1 C2.[239] Finally, the American, British, Canadian and Australian armies undertook coalition interoperability experimentation in Kingston, Ontario in 2002.[240]

While capability development studied future armoured combat vehicle design and doctrine, the land force leadership conducted its own analysis through the office of the Director General Land Staff (DGLS) at National Defence Headquarters (NDHQ).[241] The

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[235] Ibid., p. iii.
[236] Department of National Defence, Chief of the Land Staff, *Land Force publication B-GL-321-006/FP-00, Combat Team Operations (Interim) (English)* (2004), iii-iv.
[237] Department of National Defence, *Five Years of Development of New Sources of Information for a Canadian Brigade*, 8.
[238] Ibid., 8.
[239] Ibid., 8.
[240] Ibid., 9.
[241] The Director General Land Staff (DGLS) is "in essence" the Chief of Staff of the land force. He is responsible to the Chief of Land Staff (CLS) for "coordinating and directing staff activity in order to provide the best advice and assistance in the development of policies, plans and procedures for the Army." Department of National Defence, Land Force Command, *Civilian Employee's Orientation Guide* (Ottawa: 2005), 8.

Director General Land Staff (DGLS) examined three alternatives for a wheeled Armoured Combat Vehicle (ACV) with a 105mm tank gun in November 1999. The first was to immediately replace both the six-wheeled LAV-I Cougar, which had a short turret-mounted 76mm gun,[242] and the Leopard 1 with the ACV.[243] The second was to delay ACV acquisition until between 2015 to 2020.[244] As in the Directorate of Land Strategic Concepts (DLSC) 1998 study, the third was to replace the Cougar in the near term with the ACV and replace the Leopard at a later date.[245]

The DGLS study found that immediate advantages of ACV acquisition would be improved operational mobility, lower in-theatre logistic burden, and near-term interoperability with the U.S. Army. However, it also found that the ACV would provide no significant improvement in tactical capability over the Leopard 1 C2, and that it would have little "growth potential."[246] As a result, given the CF's "limited" capital procurement budget, DGLS judged that if the land force spent funds in the short term to acquire the ACV, it would be locked into a system that would lead to long term interoperability problems with the U.S. Army.[247] As a result, it recommended that option two be pursued, as a way of spending limited funds on "high payoff" equipment,[248] and also as a way of further testing and refining ACV designs in the context of the future

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[242] The Canadian Forces land force equipment website describes the Cougar: http://www.army.forces.gc.ca/land-terre/equipment-equipement/item-eng.asp?product=57 (accessed September 17, 2010). It was part of the original set of orders for 6-wheeled MOWAG Piranha/LAV based vehicles in the 1970s described in Chapter One.

[243] Directorate of Army Doctrine (DAD) comments on the second draft of the Mobile Gun System Statement of Operational Requirements (MGS SOR), fall 2003. Accessed through the Canadian Access to Information and Privacy Act, file number A0109893.

[244] Ibid.

[245] Ibid.

[246] Ibid. For instance, the ACV would have little potential to mount improved communications, computing, command and control, intelligence, surveillance and reconnaissance (C4ISR) or weapons systems or improved armour.

[247] Ibid.

[248] The ACV was judged an improvement over the Cougar.

security environment. Like the capability development organization in Kingston, the National Defence Headquarters (NDHQ) staff office concluded that a long capability development process lay ahead before replacements for the Leopard 1 tanks could be identified.

As can be seen from the above studies, the exact tactical and operational roles of tanks and LAV-IIIs were not fully defined in 2002 and 2003, but tanks were still conceptualized as a necessary part of a force structure. Nonetheless, the senior leaders of both the land force and the Canadian Forces continued to emphasize a shift to lighter armoured vehicles as a part of Transformation during these two years.

In 2002, the land force produced a new capstone document, *Advancing With Purpose: The Army Strategy*. It describes its purpose as to "implement the Army role" in the Canadian Forces (CF) strategy adopted in *Strategy 2020*. *Advancing With Purpose* states that the most prominent allied force model for the land force to examine is the "more deployable" U.S. Interim Brigade Combat Team.[249] It is discussed in the context of having a "potential for achieving greater effects with smaller numbers of personnel" along with a level of "robustness required to operate effectively on increasingly complex missions."[250] To this *Advancing With Purpose* adds that: "The Army needs to be more agile and lethal."[251] The medium-weight land force concept seen in Chief of the Defence Staff Annual Reports from the previous two years is reiterated.[252] "Transform into a

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[249] Department of National Defence, Land Force, *Advancing With Purpose: The Army Strategy*, (2002), 11.
[250] Ibid., 11.
[251] Ibid., 12.
[252] Ibid., 13.

medium weight, information-age army" using the five operational functions of sense, act, command, shield and sustain is described as a ten year target.[253]

The 2002-2003 Annual Report of the Chief of the Defence Staff (CDS), *A Time For Transformation*, expressed an optimistic view that an $800 million per year funding increase for the forces would allow for extensive Transformation initiatives. It includes comments which reject the idea that the Canadian land force would continue to pursue acquisitions in a manner that could be described as trend innovation:

> Since the rise of industrial age armies, western militaries have emphasized tonnage and "mass" as the most important elements of a modern military force. Generally speaking, the industrial age logic was often, "the bigger, the better." This logic produced bigger and heavier guns, artillery, tanks and ships, and faster and more agile fighter planes. While the capabilities provided by these platforms remain relevant, the logic is obsolete. We are moving from an age of achieving military objectives through massed, heavy, ponderous forces, to an age of applying lethal force as precisely as possible through the use of nimble, mobile, and smarter forces. At the dawn of the information age, it is already clear that the scalpel is better than the bludgeon, quality is more important than quantity, fast is better than slow, and lethality is more important than tonnage.[254]

This statement clearly rejects the need for heavy passive protection. Rather, the view that information superiority and mobility would together characterize future land forces is evident.

Conclusion

The land force senior leadership initiated reorganization of the capability development system in 1997 to address an interrelated set of concerns. It wanted to establish how the RMA and the interpretation of the future security environment typically

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[253] Ibid., 20.

[254] Department of National Defence, Chief of the Defence Staff, *A Time For Transformation, Annual Report of the Chief of the Defence Staff 2002-2003* (2003), III.

tied to the RMA in U.S. analyses were relevant to Canadian concerns. It also wanted to identify how to maintain interoperability with the U.S. Army and other allies. In that context, it wanted to have a system that could identify relevant procurements and justify them within conditions of resource constraints, in order to replace worn out equipment.

As capability development reorganized, its initial future armoured vehicle studies suggested that while new light vehicles could fulfill potential new roles, tanks would likely not be redundant until after 2010. Following these studies, both capability development and the land force leadership fully adopted the U.S. views of the RMA and the future security environment. RMA was expected to create information superiority, reduce the need for passive protection, and drive a need for increased tactical mobility. The future security environment would also require greater tactical mobility and strategic deployability. Such views were further reinforced when the Canadian Forces (CF) as a whole endorsed RMA in *Strategy 2020.*

During 1999 to 2003, the land force had enough funding to modernize much of its infantry carrying armoured vehicle fleet as well as its intelligence and reconnaissance armoured vehicles. This process gave the land force a fleet of newer LAV-II and new LAV-III models. Both the leadership and capability development also reconfirmed their views of the future security environment, and concluded that it would lead to peace enforcement operations in which the land force would need greater mobility. Interoperability concerns with allies in the context of RMA were also repeatedly expressed at both levels.

The final set of armoured vehicle studies, with significant input from allies, had some bias towards light vehicles. However, as in the earlier studies, capability

development did not conclusively endorse the position that the RMA would make tanks redundant. While the studies produced justifications that the leadership could use for the Direct Fire Unit (DFU) program, the capability development process was still underway. However, leadership adopted the view that a Transformation program should be put in place based on the RMA, leading to a medium weight, "agile" force. It repeated the U.S. Army Transformation position that tanks were "industrial age" systems that would likely become irrelevant in the information age. In addition, increasing military budgets after the year 2000 offered the possibility that new equipment purchases could be pursued, provided that costs were kept as low as possible. The perceptions of the land force leaders would lead to the creation of the DFU program. The way in which the program was developed would conflict with the organizational logic of capability development, as well as the logic of the artillery, infantry and armoured arms, as seen in the following chapters.

Chapter Three
The Direct Fire Unit

Up to 2003, the leaderships of the U.S. Army and the Canadian land force had both adopted a model of the RMA that emphasized mobility and information superiority. This interpretation led to the U.S. Army's Stryker and Future Combat System programs. However, it generated criticism from those, such as MacGregor, who believed that the justification for it had not been proven through adequate experimentation.[1] In the Canadian case, capability development studies had included experimentation with American concepts, but the process of developing recommendations for new armoured vehicle procurements was incomplete. In 2003, the land force leadership decided to proceed with a Transformation program which included replacement of Leopard 1 C2 tanks with the Direct Fire Unit (DFU). It attempted to execute the DFU plan rapidly, shortening the standard steps in the Canadian procurement process. In this situation, the Canadian plan, like the American one, would generate resistance from those who believed that it was not based on adequate justification.

These events created the conditions for the DFU to generate bureaucratic disagreements and bargaining. The purpose of this chapter is to demonstrate how that process played out between the land force leadership, the artillery, and the infantry in the period of 2003 to 2006. At this point, the Liberal federal government also became a more direct actor. In a general sense, the federal government is always an actor, as it controls the military budgets, provides general strategic direction, and has to approve specific procurements. However, in this chapter it is shown that the land force leadership worked

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[1] See Chapter One, pages 108-109.

closely with the Liberal Minister of National Defence (MND) to take advantage of moderate funding increases in order to pursue the Direct Fire Unit (DFU). The interactions between these four historical actors took place in five distinct ways.

The first two interactions were driven by the land force leadership. Firstly, it chose a specific set of vehicles to comprise the DFU, estimating that funding was most likely to be obtained for those specific sub-programs. The other is that it anticipated that it would encounter resistance to the DFU from within the land force, and attempted to preempt it by developing a "communications strategy" to "sell" the DFU as part of Transformation. The communications strategy was additionally intended to present the land force as relevant and cutting edge to the general public and the government, in order to help ensure continued higher levels of funding.

The third interaction was that the project generated resistance from both the artillery and the infantry. In the case of the artillery, this was primarily because of the questioning of organizational logic about how ground based air defence should be used. In the case of the infantry, it was because of a transfer of a capability from that arm to the operational control of the DFU. The fourth interaction was between the Canadian land force and the U.S. Army. In a clash of organizational logic between the Canadian Mobile Gun System (MGS) project office and its American counterpart, the Canadians were unable to access even basic information. These initial acts of bargaining and clashes of organizational logic did not lead immediately to the cancellation of the program. Rather, they set the stage for continued disagreement.

The first section, "Creating a 'System of Systems,'" shows how the land force leadership's rationale for the Direct Fire Unit was an act of pragmatism and bargaining with the federal government shaped by the context of the RMA. Here it can also be seen that the leadership chose the general type of vehicles examined in 1998 to 2003 studies. The second section, "The Direct Fire Unit Communications Strategy," demonstrates how the leadership attempted to prevent organizational resistance to its plan. The announcement of the program, before the Statement of Operational Requirement (SOR) was completed, is included here. The third section, "Mobile Gun System: Operational Requirements," examines the SOR that was drafted during late 2003 and early 2004. It illustrates how the SOR was influenced by the arguments made in the communications strategy as much as by studies from the 1997 to 2003 period.

In the fourth section, "The Multi-Mission Effects Vehicle" it is shown that the artillery arm of the land force initially embraced the Direct Fire Unit (DFU), anticipating that the program would provide new capabilities and relevance for the artillery. However, when it became apparent that the Air Defence Anti-Tank System (ADATS) mounted on the Multi-Mission Effects Vehicle (MMEV) would no longer be under its operational control, but rather integrated with Armoured Corps and infantry units in the DFU, the artillery became resistant to the project. The concerns of these arms created difficulties for the land force leadership. R.D. Buck, at the time Vice Chief of the Defence Staff (VCDS), faulted Lieutenant General Hillier, at the time Chief of the Land Staff (CLS), for not addressing the potential drawbacks of the MMEV. The transfer of the LAV-TOW Under Armour (LAV-TUA) systems to the DFU also generated

opposition in the infantry arm, as shown in the fifth section, "The LAV TOW-Under Armour."

The final section of the chapter, "Initial Problems with the Mobile Gun System," shows how the Mobile Gun System (MGS) part of the Direct Fire Unit (DFU) project rapidly encountered problems because of reliance on the U.S. Army Stryker program. The land force leadership's intent to acquire the MGS at low cost did not take sufficient account of the potential difficulties in coordinating with the U.S. Army. The U.S. Army's own organizational logic created obstacles to allowing a foreign organization, even if it was an especially close ally, to have unlimited access to American development work.

Creating a "System of Systems"

The DFU was inherently an act of political bargaining by the land force senior leadership from its beginning. It was designed to gain rapid approval from the government by being part of a message that the land force would retain relevance in the 21st century security environment. In political and financial terms, it was also designed to hold down costs through reallocating existing assets and leveraging U.S. programs. In addition, the leadership arranged for additional bargaining during initial planning, which included discussion of the "communications strategy" for the project. The DFU was supposed to become a showpiece for Transformation, designed to arrest loss of morale and the perception amongst some in the land force that further reductions in capability

and strength would follow. According to these plans, the leadership intended to create "momentum" for change in the land force.

Between 1998 and 2003, studies by both the capability development organization in Kingston and the Director General Land Staff (DGLS) office in Ottawa had found that near term replacement of Leopard 1 main battle tanks was not justified. Nonetheless, the concept of a 105mm gun equipped light wheeled Armoured Combat Vehicle (ACV) continued to receive support from land force senior leaders. Ideas for various types of Multi-Mission Effects Vehicles (MMEVs) also remained significant for them. This is described in email discussions between Colonel M.D. Kampman, then Director Land Strategic Planning (DLSP) at National Defence Headquarters (NDHQ), and a number of other Canadian Forces personnel.[2] According to their accounts, the idea of incorporating a Mobile Gun System (MGS) into a Direct Fire Unit (DFU) alongside Tube launched, Optically tracked, Wire data link auto-guided missile (TOW) and Air Defence Anti-Tank Systems (ADATS) mounted on LAV chassis was first developed by the Chief of Land Staff (CLS) Lieutenant General Jeffery in 2002 together with Major-General Hillier[3] who was Assistant Chief of the Land Staff (ACLS) and promoted to Lieutenant General in December 2002.

According to Kampman: "the idea was to create a flexible, task-tailorable approach to grouping our medium direct fire assets (MGS, LAV TUA and MMEVv1) to support unit-level task forces."[4] At the smallest tactical unit level, the DFU was intended

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[2] As part of the Ottawa NDHQ bureaucracy, Kampman's positions appear to have been more closely aligned with the land force senior leadership than the capability development system in Kingston.

[3] M.D. Kampman, e-mail to other senior land force officers, Friday February 27, 2004. Accessed through the Canadian Access to Information and Privacy Act, file number A0109954. Hillier was promoted to Lieutenant-General on December 1, 2002. See: Rick Hillier, *A Soldier First* (Toronto: HarperCollins Publishers, 2009), 260.

[4] M.D. Kampman, e-mail Friday February 27, 2004.

to be based on sub-units, or troops,[5] composed of four Mobile Gun Systems (MGS), two LAV-TOW Under Armour (LAV-TUA), and two Multi-Mission Effects Vehicles (MMEVs).[6] An April 28, 2003 email from Hillier to Jeffery, as well as to then-Brigadier General P.J. Holt and to Kampman, supports the account of Hillier's and Jeffery's planning given by Kampman. In it Hillier states that he has had detailed discussions with the Minister of National Defence (MND) regarding developments designed to give wheeled vehicles protection at a heretofore unreachable level.[7] Hillier writes:

> Thus we really could replace the Leopard in the direct fire role with a veh [sic., abbreviation for vehicle] that is wheeled, can be carried in a Herc [sic., abbreviation for Hercules cargo aircraft] and that can deliver at least the same capability but, most importantly, deliver it in a theatre of operations where we cannot or don't want to get the Leo [sic., abbreviation for Leopard 1 C2].[8]

The email demonstrates that Hillier had confidence not only in the U.S. Stryker program, but also in the Future Combat System (FCS) follow-on being ready on the U.S. Army's original Transformation schedule by 2008. He suggests that a FCS vehicle could provide the basis for a new artillery vehicle by that year.[9]

Also during 2002 and early 2003, according to an account by former Assistant Deputy Minister (Materiel) Alan Williams, Liberal Minister of National Defence (MND)

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[5] The word "troop" is used to describe a small grouping of armoured vehicles in military terminology. Typically, a Canadian tank troop is composed of four tanks. A tank squadron, by establishment, has a headquarters group of three tanks and four troops of four tanks, for a total of nineteen tanks, plus a support echelon. By comparison, a reconnaissance (recce) troop has an establishment strength of eight vehicles. A reconnaissance squadron is composed of three troops and a headquarters group of two vehicles together with a support echelon. Jeffery's and Hillier's intention to create eight vehicle Direct Fire Unit (DFU) troops, with sub-groupings of four MGS in each, was therefore in keeping with traditional Armoured Corps organization. Two DFU troops, together with headquarters vehicles, could form a traditional 19 vehicle squadron, and three could form a reconnaissance squadron. Leopard tank crews, familiar with operating groups of four vehicles, would not have to alter their organizational principles greatly to fit their MGS sub-groups into a DFU troops alongside the MMEVS and LAV-TUAs.

[6] Kampman, e-mail Friday February 27, 2004.

[7] Rick Hillier, e-mail to Mike Jeffery, P.J. Holt, M.D. Kampman and others, Monday April 28, 2003. Accessed through the Canadian Access to Information and Privacy Act, file number A0032670.

[8] Ibid.

[9] Ibid.

John McCallum challenged General Jeffery to design a "well-structured and easily understood strategic plan" for the land force.[10] Jeffery apparently responded with a plan that gained McCallum's approval, and the Minister brought it forward in cabinet.[11] Williams suggests that at least the Mobile Gun System (MGS) portion of the Direct Fire Unit (DFU) was part of this plan.[12] Thus, the U.S. concept of Transformation fitted with political opportunity for the land force senior leadership. By regrouping its medium direct fire assets and pursuing a moderately expensive acquisition, it was able to portray itself as having merit both to the federal government and in terms of the Transformation programs of its allies.

Political and civilian management support for the Stryker as a model was also reflected in Department of National Defence (DND) planning in the spring of 2003. A U.S. Army Stryker and Stryker Brigade Combat Team "Fact Sheet" was prepared by David Beal at the office of the DND Director General Policy Planning (DG Pol Plan) within the Assistant Deputy Minister of Defence Policy group (ADM Pol) on April 3, 2003. This group is mandated to provide policy advice to the Minister of National Defence (MND) as well as the Chief of Defence Staff (CDS), illustrating that the political leadership had become interested in light armoured vehicles on its own account. While recognizing that the Stryker Brigade Combat Team (SBCT) is an interim model,[13] the ADM Pol document describes it in terms relevant to the force structure that the Canadian land force was proposing to establish. It is stated that the SBCT is a:

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[10] Alan S. Williams, *Reinventing Canadian Defence Procurement* (Montreal and Kingston: Breakout Educational Network in association with McGill-Queen's University Press, 2006), 10.
[11] Ibid., 10.
[12] Ibid., 10.
[13] Department of National Defence, Director General Policy Planning, *FACT SHEET: US Army Stryker and Stryker Brigade Combat Team* by David Beal (Ottawa: April 3, 2003), 2. Accessed through the Canadian Access to Information and Privacy Act, file number A0042346.

> ...rapidly deployable, medium-weight, combined-arms force created to fill gaps in the operational capability of the U.S. Army to conduct contingency operations in places like Afghanistan and Bosnia, or to engage a capable enemy before the arrival of heavier follow-on forces.[14]

The statement contains the arguments for the Stryker that emerged between 1999 and 2003, largely ignoring the criticisms of that approach by U.S. analysts such as MacGregor, who believed that insufficient experimentation had been done to justify the program.[15] Reacting to possible concerns about survivability, it states that the Stryker provides protection against common types of ammunition and that it can be fitted with additional ceramic armour to stop Rocket Propelled Grenades (RPGs).[16] However, it emphasizes that the combat teams will use "sophisticated sensor and communications capabilities" to enhance situational awareness,[17] implying that this will allow them to avoid anti-armour rounds. It goes on to argue that:

> The Stryker has attracted considerable interest in the Canadian defence community for two reasons. First, when the delivery of the new LAV IIIs is complete, the Canadian army will be close to having an all-wheeled mechanized force. The only vehicles that will remain tracked are the Leopard C2+ [sic.] tank and the life-extended M113, which will play a Combat Service Support role only. Second, some have suggested that the Leopard could be replaced as a direct support vehicle by the Stryker Mobile Gun System [MGS], which would continue to provide the army with firepower similar to what it has today, while increasing its mobility.[18]

In addition, the proposition that the Stryker is air transportable at both the strategic and operational levels is reiterated, although there is acknowledgment that the RAND corporation has questioned the feasibility of the U.S. Army's goal of transporting

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[14] Ibid., 1.
[15] As seen in Chapter 1, pages 108 to 110.
[16] Ibid., 2. Specifically, 7.62mm rifle and machine gun ammunition, 14.4mm heavy calibre armour piercing ammunition, and 152mm airburst ammunition are mentioned.
[17] Ibid., 2.
[18] Ibid., 2.

a combat-ready brigade anywhere in the world in 96 hours.[19] Further to the point of the Stryker Brigade Combat Team (SBCT) being an interim model, it is added that the Future Combat System (FCS) program will provide a "lightweight replacement" for the 70-ton Abrams main battle tank by 2010.[20] Other Director General Policy Planning (DG Pol Plan) documents at the time made similar points.[21]

In a related example, a Director of Policy Development (D Pol Dev) document from 2002 deals with equipping Canada's three brigades with the Stryker from a financial perspective. Discussing the debate on the Stryker in the U.S., it notes that the cost of three Stryker brigades was reported as $4.5 billion U.S. dollars.[22] It points out that the Canadian land force was in the process of acquiring 651 LAV IIIs for $2.227 billion Canadian dollars, and had purchased 203 Coyotes for approximately $882.8 million Canadian dollars.[23] Equivalents to these vehicles would represent the majority of the vehicles purchased for the Stryker brigades. Aside from some life-extended M113s operating in combat service support roles, the backgrounder states that:

> The only component of the current brigade structure that will remain heavy and tracked would be the Leopard C2+ tank (by definition it is actually a medium weight tank). All of Canada's wheeled vehicles are either LAV II or LAV III variants... To make the Canadian Army an all wheeled force, the minimum that would have to be done is to replace the current Direct Fire Support Vehicle (DFSV), the Leopard C2+.[24]

The terminology reflects the transition that proponents of the Direct Fire Unit (DFU) wanted to make. If the Leopard 1 C2 was to be described as a medium weight

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[19] Ibid., 1.
[20] Ibid., 2.
[21] See, for instance: Department of National Defence, Director General Policy Planning, *Information on Stryker Mobile Gun System and HALIFAX Class Frigate Mid-Life Update* by David Beal (Ottawa: April 9, 2003). Accessed through the Canadian Access to Information and Privacy Act, file number A0042351.
[22] Department of National Defence, Director of Policy Development, *Strykers for Canada?* (Ottawa: 2002). Accessed through the Canadian Access to Information and Privacy Act, file number A0042339, 1.
[23] Ibid., 1.
[24] Ibid., 1.

direct fire support vehicle lacking in mobility[25] and commonality with a mainly LAV-based fleet, transition to the Mobile Gun System (MGS) could be portrayed as an improvement. It is emphasized that the MGS 105mm main gun is very similar to the Leopard 1 105mm main gun.[26] Furthermore, the document argues that Canadian tank forces were already under strength. It states that while each Canadian brigade is supposed to have an armoured regiment of two Leopard 1 C2 squadrons, in practice the brigades were in 2002 operating with only one squadron each. Coyotes using the turret mounted 25mm chain gun were providing the other squadron of direct fire support.[27] Uncertainty in planning is discussed, but the basic point reiterated is that the land force could expect to retain three tank or tank equivalent squadrons.[28] As a result, a purchase of between 42 to 57 vehicles is considered, based again, as in the Director General Policy Planning (DG Pol Plan) documents, on tank squadrons of between fourteen to nineteen vehicles.[29]

By April 2003, the land force leadership was confident enough of political support to formalize the Direct Fire Unit (DFU) plan in the Chief of Land Staff (CLS) briefing *Implementing Army Transformation (Opportunities, Limitations & Risks)*. By this point Hillier had been promoted to the rank of Lieutenant General, but remained the Assistant Chief of the Land Staff (ACLS). The plan presented in the briefing shows a clear continuity with the planning that Generals Jeffery and Hillier had been doing since 2002, and with their earlier interest in the RMA dating back to the late 1990s.

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[25] In this case it was being described as lacking in mobility in terms of road speed. As seen in Chapter Two, the debate over whether tracked or wheeled vehicles had better mobility was ongoing.
[26] Ibid., 1.
[27] Ibid., 2.
[28] Ibid., 3-4.
[29] Ibid., 4.

The briefing contains a variant of the medium-weight force statement seen in the 2002 land force capstone document *Advancing With Purpose* and the Director General Policy Planning (DG Pol Plan) description of Stryker Brigade Combat Teams (SBCTs): "Our goal is a transformed information-based Army... [which is] strategically relevant, tactically decisive, agile, lethal, survivable... [and a] medium-weight force."[30] The briefing notes contrast this potential for positive change with concern about the loss of direct fire capability, as well as some artillery capability. Some planning documents from this time indicate that by the spring of 2003, the land force's "Interim Army" model called for the reduction of tank forces to three squadrons, which would have meant dropping from 114 Leopard 1 C2s to a total of between 43 to 57 vehicles.[31] This estimate was based on the fact that Canadian tank squadrons ranged in size from fourteen to nineteen vehicles.[32] Similarly, reduction or elimination of the land force's tracked 155mm M109 howitzers, a heavy platform with similar mobility to a main battle tank, was under discussion. The briefing notes state that the Chief of Land Staff (CLS) assessment is that "loss... or reduction" of "significant capability" in direct/indirect fire capacity will see an erosion of trust in leadership within the land force and a more general perception throughout Canada that the Army is "bearing the brunt of reductions and losing relevance as a multi-purpose combat capable force." Finally, the reductions would be perceived by allies as "another example" of Canada "not pulling its weight."[33]

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[30] Department of National Defence, Chief of Land Staff, *Implementing Army Transformation (Opportunities, Limitations & Risks)* (Ottawa: April 30, 2003). Accessed through the Canadian Access to Information and Privacy Act, file number A0042354, 1.
[31] Department of National Defence, *Information on Stryker Mobile Gun System and HALIFAX Class Frigate Mid-Life Update.*
[32] Ibid. As noted in footnote 5 above, an establishment (full-strength) squadron would have 19 vehicles.
[33] Department of National Defence, *Implementing Army Transformation*, 15.

Moving from general Transformation objectives to the specific platforms, the briefing outlines that:

> Building on our Command and ISTAR [Intelligence, Surveillance, Target Acquisition and Reconnaissance] programs, the elimination of our current Tank and Medium Artillery systems, combined with reinvestment in modern Mobile Gun and Precision Indirect Fire Systems is a realistic strategy for creating an army suitable for the emerging strategic environment.[34]

Despite the differences with Stryker, discussed above, the comment is made that: "This will give us a force comparable to the US Army's new Stryker Brigades, reinvigorating the army and making us credible internationally."[35] Various handwritten notes on the briefing document suggest the above concerns were reinforced during the meeting. These comments suggest that the Army saw a need to spend its resources on saving numbers of people, rather than spending it on equipment, in order to transform effectively.[36] Stryker is described as an opportunity, while there are notations made "not a Cold War Army" and "just in case to just in time."[37] These indicate a view of tanks as a Cold War military platform, being retained "just in case" the Canadian Forces would have to fight an opponent with tanks or other heavy weapons, as opposed to LAV based vehicles, which are seen as more deployable and therefore capable of arriving "just in time." Movement of troops west and land force reserve restructure are described as part of the effort to retain people rather than equipment. However, such a move also demonstrates a desire by at least part of the senior leadership at this meeting to retain the

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[34] Ibid., 16.
[35] Ibid., 16.
[36] Ibid., 1.
[37] Ibid., 1.

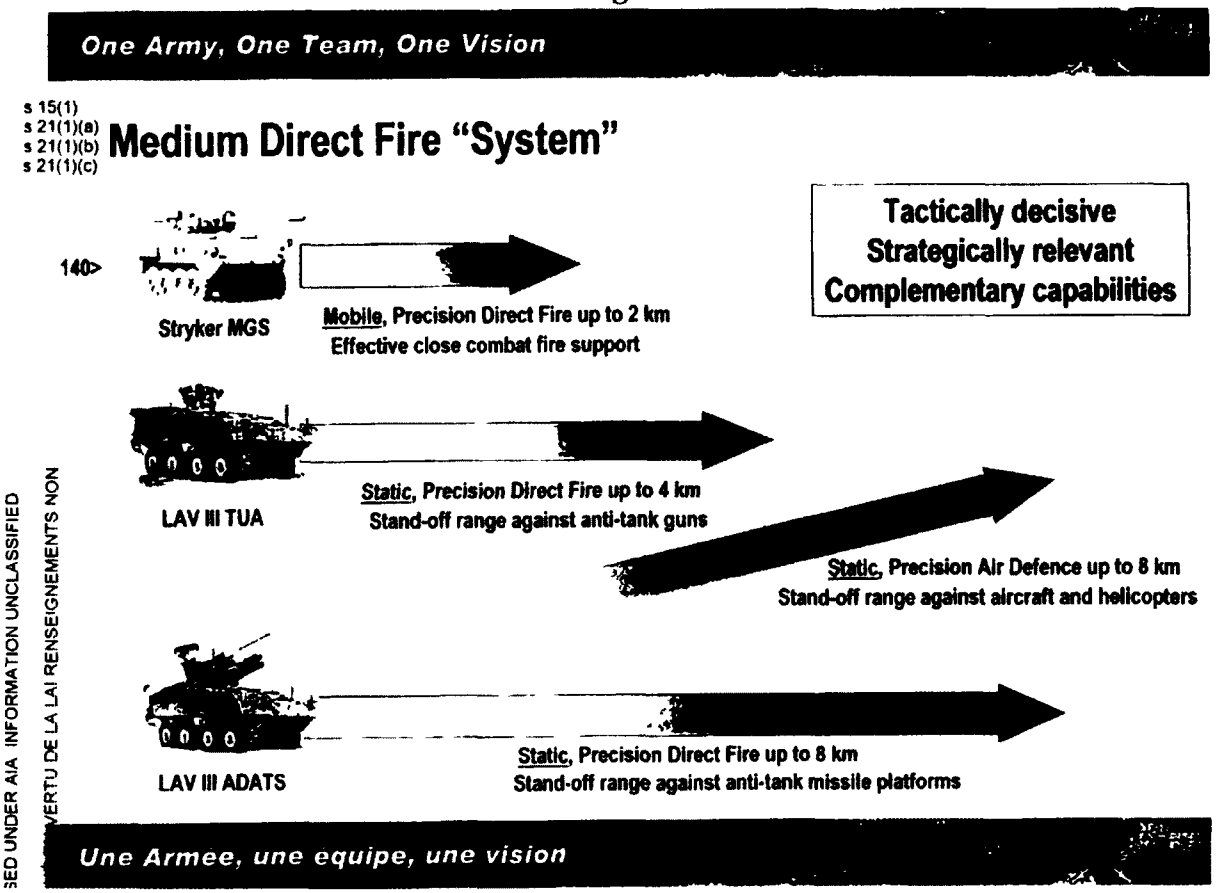
land force's traditional Armoured Corps focus in western Canada at the Edmonton and Wainwright bases.[38]

In terms of the direct fire technology, the traditional parameters of armoured vehicle design – firepower, mobility and protection – are still emphasized in the briefing slides.[39] However, information technology and the potential for information superiority/dominance are essentially added as a fourth parameter, with the comment: "Invest in fewer but more precise and effective Combat Capabilities."[40] What is described here as the "Medium Direct Fire 'System,'" and would often be called a "system of systems" in Canadian land force terminology, is introduced. As described in Chapter One, the overall concept behind the Direct Fire Unit (DFU) was that these three vehicle variants would operate as a single group by providing overlapping surveillance capabilities and ranges of precision fire.

The following images illustrate how the set of proposed interconnected capabilities could be made to appear compelling:

[38] Ibid., 1.
[39] Ibid., 2.
[40] Ibid., 2.

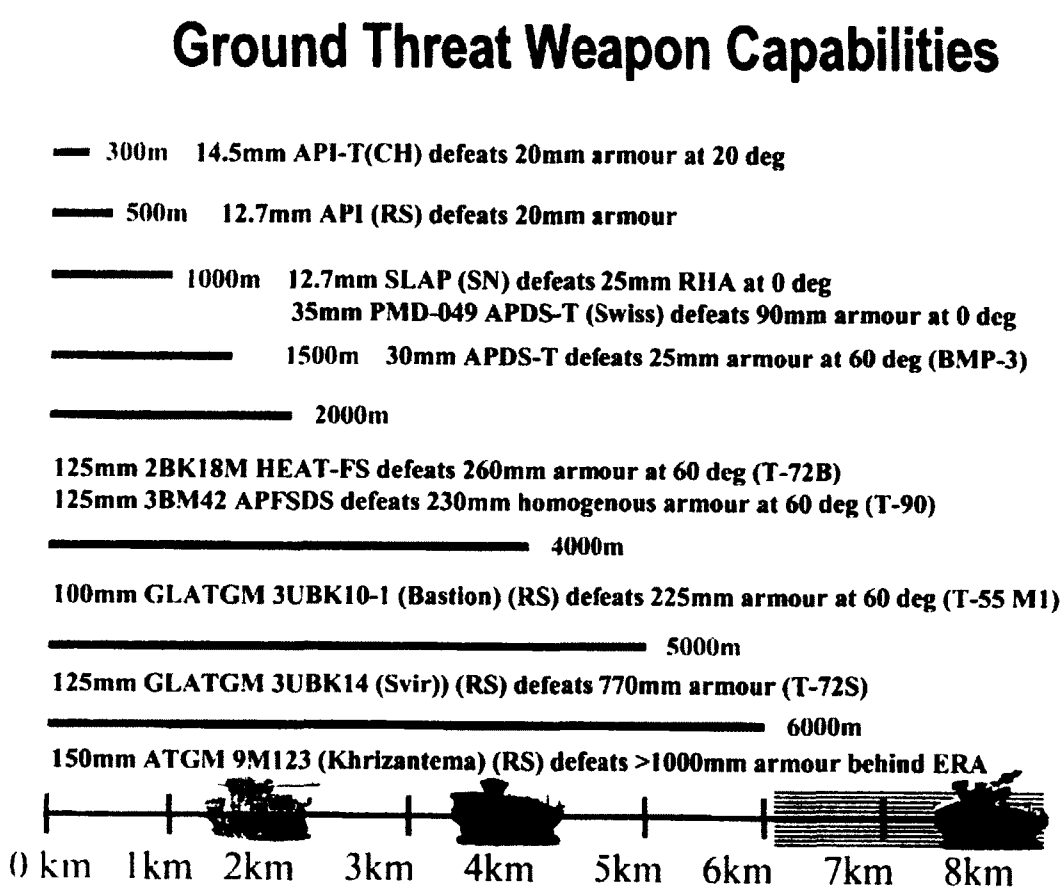
Figure 3-1: Illustration of Medium Direct Fire "System" in 2003 Chief of Land Staff Briefing[41]



In the above graphic, the Multi-Mission Effects Vehicle (MMEV) is shown as the "LAV III ADATS." Demonstrating the reliance that the land force leadership was placing on leveraging the U.S. Stryker program, the Mobile Gun System (MGS) is shown with its American name: "Stryker MGS." A related document, though not part of the briefing, shows how the above set of capabilities was intended to address various potential threat weapons:

[41] Ibid., 4.

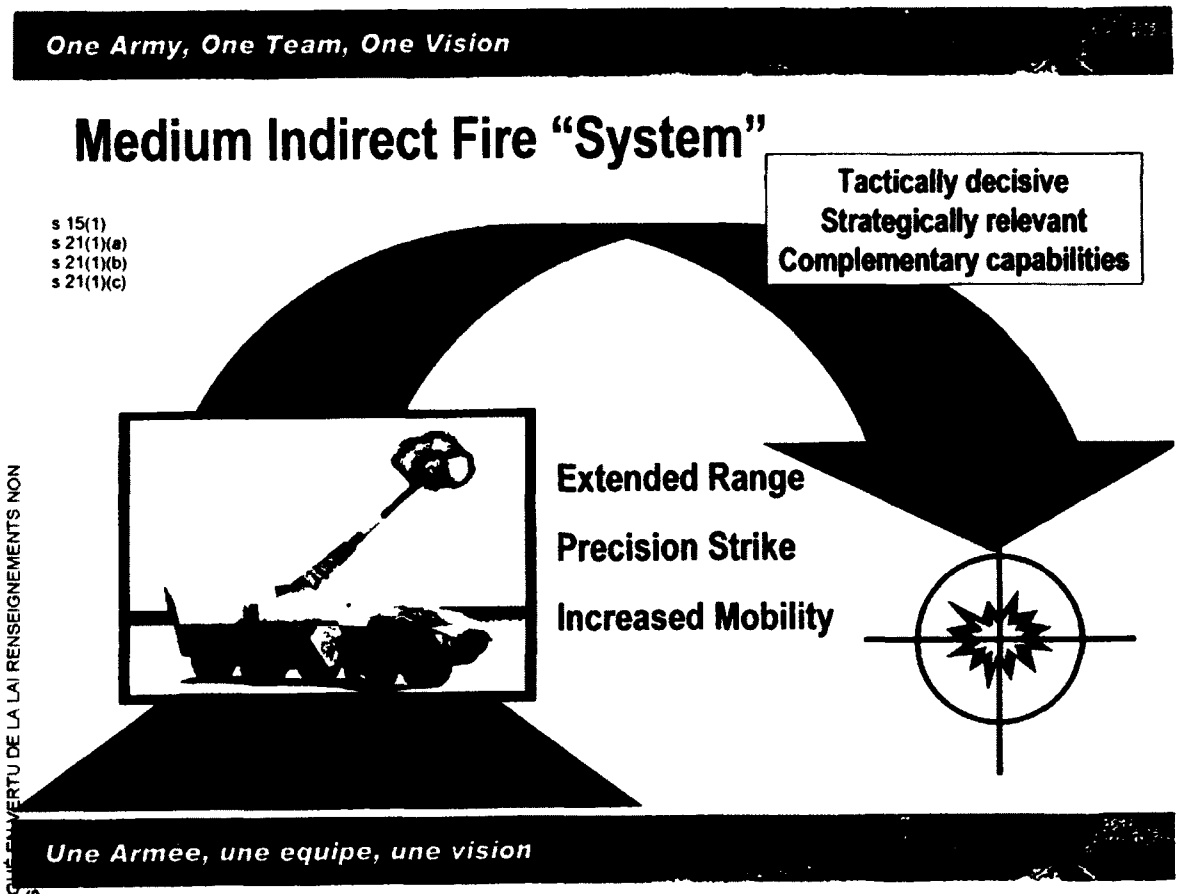
Figure 3-2: Illustration of the Overlapping Fields of Fire of the Direct Fire Unit in 2003 Ground Threat Weapon Capabilities Document[42]



Developing new artillery capability to complement the LAV-based force receives further detail in the Chief of Land Staff (CLS) briefing. As seen above, Hillier briefly discussed in email correspondence the possibility of acquiring new U.S. Future Combat System (FCS)-based artillery capability in the 2008 or slightly after timeframe. In the Chief of Land Staff (CLS) material, a wheeled artillery vehicle which appears to be based either on a LAV type chassis or on a speculative wheeled version of the Future Combat System (FCS) is shown:

[42] Department of National Defence, Land Force, *Ground Threat Weapon Capabilities*. Undated but evidently from the first part of the DFU planning process (2003 to early 2004). Accessed through the Canadian Access to Information and Privacy Act, file number A0110955.

Figure 3-3: Conceptual Wheeled Artillery Vehicle in 2003 Chief of Land Staff Document[43]



It should be noted that the Multi-Mission Effects Vehicle (MMEV) also blurred the lines between direct and indirect fire, as the Air Defence Anti-Tank System (ADATS) missiles were theoretically capable of non-line-of-sight ground-to-ground fire, rather than traditional direct fire, if accurate targeting information was provided. Insight into how land force leadership intended to avoid the appearance of reductions to land force strength and capabilities by reorganizing weapons systems and placing them on LAV-III platforms can be gained from this material. Although precise numbers are not certain in

[43] Department of National Defence, *Implementing Army Transformation*, 5.

documents from earlier in the planning process, as will be seen below, the planned force structure for the Direct Fire Unit (DFU) that emerged by 2004 consisted of 66 Mobile Gun System (MGS) vehicles, 33 LAV-TOW Under Armour (LAV-TUA) vehicles, and 33 MMEVs. This total of 132 vehicles in the new DFU would have exceeded the 114 Leopard 1 C2s which the Armoured Corps would have lost. It would also have reflected the original idea developed by Jeffery and Hillier for sub-units of 4 MGS, 2 LAV-TUA, and 2 MMEV. At the same time, troop, squadron and brigade level training and management of the TOW Under Armour and Air Defence Anti-Tank System (ADATS) systems would have been consolidated in the DFU, reducing demands on infantry and artillery resources.[44] It would therefore have represented an equipment rationalization and reduction in costs while maintaining the "significant capability" in direct/indirect fire capacity which was a central concern in the briefing.

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[44] For Transformation advocates such a combination of infantry, artillery and Armoured Corps personnel and systems could also have contributed to a desired aim of "breaking the phalanx" of distinct branch and regimental identities. The concept of "breaking the phalanx" emerged in the 1990s RMA discourse, and was popularized by MacGregor in his 1997 book *Breaking the Phalanx*. MacGregor's use of the term is derived from the battle between the Macedonian and Roman armies in 200 B.C.E. in Thessaly. He observes that: "Until the smaller, more agile Roman Legions... deployed in checkerboard formation destroyed it, the ancient world regarded the Macedonian Phalanx as invincible... Their tactic was simple and deadly: a perfectly aligned charge at a dead run against the enemy's weak point. But these tactics failed in action against the Roman Legions, which could maneuver more easily without fear of losing alignment and without the need for concern about gaps in the line – the gaps were built in!" From this observation he draws the analogy that the modern U.S. military must focus not just on new technology but, more importantly, on innovative combat organizations in order to prepare for future conflict and to defeat industrial age armies using information technology and greater mobility. See: Douglas A. Macgregor, *Breaking the Phalanx, A new Design for Landpower in the 21st Century* (Westport: Praeger Publishing, 1997), 1-4, and, more generally, the entire book. Although this approach may superficially seem to be at odds with MacGregor's later arguments in *Transformation Under Fire*, the key difference between the two books is that by 2003 he had become disillusioned with the U.S. Army's interpretation of the RMA and its approach to Transformation, not with the basic idea of the RMA. RMA advocates on occasion extended MacGregor's 1997 analogy to include the idea that existing Western military unit identities, rooted in industrial age warfare, would need to be broken in order to eliminate resistance to change. However, although the land force leadership was attempting to merge elements of the distinct combat arms into an "all-arms" brigade, as will be seen below, that brigade would have retained the traditional Armoured Corps regiment identity of the Lord Strathcona's Horse (Royal Canadians) [LdSH(RC)]. Furthermore, as seen in footnote 5 above, it would also have retained vehicle troop organization very similar to that of the Armoured Corps. Therefore, the organizational logic of the Armoured Corps with which Hillier and other senior leaders were familiar had as great an effect on their planning as their intention to effect "transformational" change.

The images above from the Chief of Land Staff (CLS) briefing and related documents illustrate how, by working as an interconnected system, groups of Direct Fire Unit (DFU) vehicles would engage targets that could be engaged by tanks while, in theory, avoiding being targeted and destroyed themselves. While this was an implementation of one of the core RMA-based concepts to emerge from the U.S. during the late 1990s, it was combined primarily with Canadian land force concerns about retaining a direct fire capability cost-effectively and retaining political relevance both within Canada and with allies. As coming from senior leadership, it appears that these military concerns dominated the planning process. There is relatively little concern expressed in the documentation about fostering domestic industry. The fact that LAV-IIIs were built in London, Ontario, and that modification of the Air Defence Anti-Tank System (ADATS) to fit on a LAV-III and take on more extensive ground fire roles would create jobs at the Oerlikon-Contraves branch in Quebec, appear to have been deemed secondary benefits after the initial plan emerged. Possibly, Lieutenant General Jeffery's plan presented to Minister of National Defence (MND) McCallum in late 2002 or early 2003 had been designed to take such industrial aspects into account and therefore gain rapid political approval.

Suggestions that this may have been so can be found in the details of some of the senior leadership planning documents. In the 2003 Chief of Land Staff (CLS) briefing there is a brief mention of Canadian industrial interests in terms of the Mobile Gun System (MGS): "MGS offers the only Canadian built non-Tank option for replacement for the Leopard for the foreseeable future."[45] The primacy of the land force leadership, rather than political influence, in initiating these projects can be seen elsewhere in the

[45] Department of National Defence, *Implementing Army Transformation*, 21.

briefing notes, with the comment regarding the Mobile Gun System (MGS) that: "If the Government wants this to happen and we can obtain the support of the US, which I think is realistically achievable, then we should be able to implement the project very quickly."[46]

Alongside this comment is the hint of a doubt about the effectiveness of the MGS, despite the "direct fire system" images seen above, with the comment: "Not a Tank – therefore some limitations but the best option for the foreseeable future – equivalent firepower, inferior protection."[47] In terms of the other Direct Fire Unit (DFU) vehicles, it is mentioned that mounting of Tube launched, Optically tracked, Wire data link auto-guided missile (TOW) systems on the LAV III chassis and upgrading them with new fire control systems is part of the current LAV III project, with the exact number of systems to be modified still under consideration.[48] Regarding the Air Defence Anti-Tank System (ADATS), the statement is made that: "Our LLAD [Low Level Air Defence] system is not sustainable as currently structured. It is intended to eliminate all but the ADATS."[49] However, an "increasing helicopter and UAV threat" is mentioned, as well as the perceived benefit of having a non-line of sight ground-to-ground capability in the DFU.[50]

The Chief of Land Staff (CLS) briefing also illustrates the development of an internal communications campaign to convince the rest of the land force of the benefits of the DFU plan. The comment is made that: "The loss of the Tank will result in commentary (especially with the events in IRAQ) but can be sold if STRYKER is

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[46] Ibid., 28.
[47] Ibid., 21.
[48] Ibid., 21.
[49] Ibid., 21. LLAD stands for Low Level Air Defence.
[50] Ibid., 21.

purchased."[51] However, immediately below this comment the view is reinforced that personnel, rather than equipment, must be retained:

> Given the current operational commitments and personnel re-investments, the loss of any personnel will not be credible. Many believe that Transformation is a synonym for reductions and will see any such measure as confirmation. Such a backlash would probably kill change within the army.[52]

As a result of these concerns, what was described as a "high profile" "Communications Approach" was developed.[53] It deliberately intended to link the Direct Fire Unit (DFU) to the overall Army Transformation plan, with announcement of the project by the Minister of National Defence (MND) at a large media event.[54] The plan stated that this communications strategy would then be sustained through more speeches, interviews, contract announcements and other unspecified "opportunities."[55] Demonstrating that the intention of the leadership was to pre-emptively prevent disagreement, the plan included the comment that: "Anticipated external – and internal – communications challenges will be mitigated through a proactive, sustained and comprehensive approach to communication."[56]

A month after the *Implementing Army Transformation* meeting, on May 30, 2003, Lieutenant General Hillier replaced Lieutenant General Jeffery as Chief of the Land Staff (CLS). As CLS and, later, Chief of Defence Staff (CDS), he would maintain his support

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[51] Ibid., 32. Events in Iraq very likely refers to the U.S. Army's tactically successful run into the centre of Baghdad during the 2003 Operation Iraqi Freedom using Abrams tanks and Bradley infantry fighting vehicles. As will be seen below, operational experience drawn from the U.S. and British armies in Iraq, as well as Afghanistan, would become an increasingly significant aspect of the debate over the DFU during the following years.
[52] Ibid., 32.
[53] The phrase used in the briefing notes. See ibid., 35.
[54] Ibid., 35.
[55] Ibid., 35.
[56] Ibid., 35.

of the Direct Fire Unit (DFU) plan that he and Jeffery had developed until disagreements, delays, and a change in federal government led to its cancellation in 2006.

The Direct Fire Unit Communications Strategy

The following series of papers, events, speeches, and, finally, a website illustrate that the land force leadership vigorously pursued its communications strategy over the following months. This section illustrates how the leadership of the land force organization went about creating a bargaining position to influence its subsidiary organizations and personnel, as well as the government and the public.

The process started with the development of draft background documents and position papers to provide discussion points for land force and political leaders. An early example was an October 2003 draft entitled *Army Acquires Mobile Gun System (MGS)*, likely intended to provide the basis for a press release or speech. It makes bold statements that:

> The CF will acquire an agile and rapid Mobile Gun System to serve as the Army's direct-fire system. The MGS can readily defeat hardened bunkers, tanks and other armoured vehicles. It will be used to accomplish Land Force objectives such as supporting assaulting infantry and protecting Canadian soldiers on missions ranging from peacekeeping to high-intensity conflict.[57]

Emphasized in the document is a system road speed of 100km/h, which is said to "enable it to move and manoeuvre rapidly with infantry soldiers mounted on LAV III and surveillance units mounted on Coyotes."[58] Commonality of parts between the different

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[57] Department of National Defence, Land Force, *Army Acquires Mobile Gun System (MGS)* (Ottawa, October 2003). Accessed through the Canadian Access to Information and Privacy Act, file number A0109898.
[58] Ibid.

vehicles is described as an important benefit in terms of logistics.[59] It is also highlighted that: "The MGS [Mobile Gun System] will roll off the assembly line with digital equipment installed,"[60] even though, as seen in above chapters, digitization of existing vehicles had been feasible for years, if not decades.

However, the document was still very much in the process of developing the communications strategy advocating the Direct Fire Unit (DFU). It lists eleven "questions we need to answer as we proceed forward."[61] These focus on whether the Stryker MGS or its Canadian variant are truly "transformational," why replacing tanks before 2010 should be seen as critical, and why $650 million should be spent on the MGS when the Leopard 1 had recently been upgraded.[62] Two patterns emerge. First is that the communications strategy for the DFU initially focused on the MGS. Second is that, due both to this initial focus and to the fact that the main armament of the MGS was a 105mm tank gun, the MGS was often portrayed as a direct replacement for tanks. Such a portrayal missed the key point of the DFU plan that the MGS, Multi-Mission Effects Vehicle (MMEV), and LAV-TOW Under Armour (LAV-TUA) were only a replacement for tanks when fielded together. This confusion was a result of the way in which the different sub projects of the DFU were put forward by the land force leadership one at a time in order to gain rapid approval. Although it was necessary to procure vehicles which were technically different separately, it would have made sense to create statements of operational requirements and gain government approval for both the

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[59] Ibid.
[60] Ibid.
[61] Ibid.
[62] Ibid. C-130 transportability is also noted: "The US see it [Stryker] as reducing airlift flow times. Do we have the same imperative?"

Mobile Gun System (MGS) and the Multi-Mission Effects Vehicle (MMEV) at the same time.[63]

A position paper likely produced slightly later than the draft background document provides more developed answers to potential criticism of the MGS. Entitled *Army Transformation and the Mobile Gun System (MGS)*, it contains, at least in basic form, all the arguments that would continue to be used to support the vehicle procurement. It cites government policy and military planning as mandating that global deployability, and "multi-purpose," "knowledge-based, all digital' forces are necessary.[64] On this basis it states that the land force must transform into an "all wheeled fleet, designed to replace sheer mass with leading-edge situational awareness, speed and manoeuvrability."[65] The claim that the MGS will be deployable aboard aircraft is reiterated.[66] It then turns to "possible points of contention," suggesting: "Any opposition to this purchase would come from those who still believe the Army should deploy tanks. They would favour the acquisition of a new Main Battle Tank such as the U.S. Abrams M1A1... In the meantime, they would favour use of the Leopard C2."[67]

In response to such potential criticism, a number of pre-emptive arguments are made. The first is that it is "not reasonable" to expect the Canadian government to

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[63] As will be seen in Chapter Four, this confusion would lead to significant frustration and lack of clarity in discussions between proponents of the DFU and proponents of tanks.

[64] Department of National Defence, Land Force, *Army Transformation and the Mobile Gun System (MGS)*, 1. The document is undated, but the historical contexts suggests that it was produced in early fall 2003 in preparation for announcement of the MGS, or else slightly after as an additional justification for the project. Accessed through the Canadian Access to Information and Privacy Act, file number A0109897. Documents such as *Strategy 2020* are specifically quoted to reinforce the claim that policy mandates this approach.

[65] Ibid., 1.

[66] Ibid., 1.

[67] Ibid., 2.

approve a "very expensive" purchase of new main battle tanks.[68] It also claims that the "tracks versus wheels" debate "common in U.S. Army circles" has been "resolved" in Canada, because the Army has already opted for a "medium-weight, agile, knowledge-based force."[69] Beyond financial constraints, the claim is that tanks are politically unacceptable at other levels, as heavy armour is seen as an escalation of force in peace support operations.[70] The logistical burdens of heavy vehicles, combined with the fact that Leopard 1s have no commonality in parts with other land force vehicles, are also described as drawbacks.[71] Because of the "reticence" to deploy tanks, "the Army is likely to get much greater utility, and therefore protection of Canadian soldiers, from the Mobile Gun System (MGS)."[72]

In dismissing the utility of Canada's existing tanks, *Army Transformation and the Mobile Gun System* states that the Leopard 1 is "not a main battle tank" and cannot "go one-on-one" with newer designs.[73] The document claims that the decision to upgrade the Leopard 1 to the C2 variant was a "stop-gap measure" because the vehicle has had heavy use, but implies that it is nonetheless reaching the end of its lifespan. The question of armoured protection is then addressed: "Opponents will compare MGS's relatively light armour to the protection of a Leopard. Initially, the MGSs will be armoured against shell fragments, heavy-calibre machine guns and light cannon. But their armour would not stop rounds from the LAV III's 25mm chain gun or tanks."[74]

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[68] Ibid., 2.
[69] Ibid., 2.
[70] Ibid., 2.
[71] Ibid., 2. The document notes that small numbers of Leopard 1s are occasionally deployed, as in Kosovo in 1999, but argues that the Canadian Forces cannot airlift them itself. It also states that tanks must be deployed with "a large number of heavy, bulky spare parts."
[72] Ibid., 2.
[73] Ibid., 3. The Abrams and British Challenger II tanks are listed as examples.
[74] Ibid., 3.

In response to this potential criticism, the first answer is that: "because of the lack of a turret, the MGS [Mobile Gun System] has a low profile and the entire crew is down in the hull, affording greater protection." This claim is partially accurate. Although to the casual observer the MGS has a "turret," the turret is a remote weapons station; it houses the gun, and autoloader, and sensor equipment. Unlike a tank, upper body parts of some of the crew members are not, in other words, in the turret. The second point, concerning profile, is refutable. Low profile has been an important aspect of tank design since the Second World War, since it was found that a lower vehicle is more easily able to fire from a "hull-down" position – taking advantage of terrain to protect itself from being seen by the enemy and from enemy fire if necessary. A vehicle with a low profile is able to use comparatively smaller geographical features, such as small hills or ridges, than a taller one. While the MGS might have a lower profile than some vehicles, it does not appear to have a lower profile than a typical late 20th century tank, as the image below demonstrates:

Figure 3-4: Profile of Mobile Gun System Versus Main Battle Tank[75]

[75] Photograph from: Department of National Defence, Directorate of Army Doctrine, *Directorate of Army Doctrine DF TTP Development Brief to LdSH (RC)* by Major Chris Rankin (Kingston, Ontario: September 1, 2004). Accessed through the Canadian Access to Information and Privacy Act, file number A0109851, p. 16.

The paper makes two additional points about the technology of the Mobile Gun System (MGS). One is that new developments in active and reactive armour, presumably of add-on varieties which could be bolted onto the MGS in theatre, would greatly improve the protection of the MGS "by the end of the decade."[76] The other is that, as seen in the April 30, 2003 Chief of Land Staff (CLS) briefing slides, the Multi-Mission Effects Vehicle (MMEV) and LAV-TOW Under Armour (LAV-TUA), rather than armour, would provide the MGS with protection.[77] Elsewhere it is explicitly claimed that the MGS will rely on information dominance, that the MMEV outranges any other anti-tank missile on the battlefield, and that the Tube launched, Optically tracked, Wire data link auto-guided missile (TOW) can outrange any tank gun on the battlefield.[78] The paper then takes the position that few Western armies are likely to replace their main battle tanks, as those vehicles have reached their practical weight limit at approximately 70 tonnes.[79] Finally, the financial and credibility arguments are reiterated:

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[76] Department of National Defence, *Army Transformation and the Mobile Gun System (MGS),* 3.

[77] Ibid., 3. At this time the office of the Director Land Strategic Plans (DLSP – the Director was then Colonel Kampman) was beginning to go to greater lengths to emphasize the "system of systems" approach to the DFU. In a September 2003 response to comments about the MGS by the Director Force Planning and Program Coordination (DFPPC – a subordinate to the Vice Chief of Defence Staff who is responsible for coordinating departmental strategic direction with the resources allocated to it within the Defence Services Program) Major A.J. Atherton of DLSP wrote that: "It must be stressed that the MGS is not a tank, nor is it simply 'putting a tank on wheels', as suggested by the author of the DFPPC Review of the Army Capital Programme. The MGS is a transformational project which is part of a 'system of systems' overall approach to direct fire. The emphasis being on precision and lethality rather than mass. The MGS will, with fewer systems, provide digitised direct fire support to the modern battlespace. When integrated with other direct fire assets the MGS will provide the ability to identify and destroy priority targets at greater standoff range than is currently provided by the Leopard C2." Department of National Defence, *Briefing Note For DLSP 3 – Subject: Review of DFPPC Comments on CLS Capital Programme* by Major A. J. Atherton (September 9, 2003). Accessed through the Canadian Access to Information and Privacy Act, file number A0110160. Description of the role of the Director Force Planning and Program Coordination is summarized from the Vice Chief of Defence Staff website: http://www.vcds-vcemd.forces.gc.ca/sites/page-eng.asp?page=5607 (Accessed September 20, 2010).

[78] Department of National Defence, *Army Transformation and the Mobile Gun System (MGS),* 4.

[79] Ibid., 4. The typical RMA/Transformation arguments about knowledge-based, agile forces with information superiority are then reiterated. It is stated that future direct fire capabilities will "have to be placed on platforms which rely on means other than just armour to protect the crew."

> Failure to acquire the MGS [Mobile Gun System] will cost the Army the opportunity to benefit from... development costs borne by the U.S. Army... (and) undermine credibility with both Canadian soldiers and allies. Army commanders are attempting to redress the deficiencies the Land Force now faces... The MGS is an important part of this transformation – without it the Army will fall further behind in its effort to field a knowledge-based force that can fulfill a broad range of missions and tasks. Those who see the Canadian Army as a dinosaur will intensify their criticism as the Army falls further behind allied forces.[80]

A third example of the documents which the land force used to prepare the communications strategy is *MGS – Key Army Messages*. It repeats, in some cases word for word, the comments seen in the other documents. In addition, it discusses presenting the MGS as a benefit to Canadian industry: "The Army will field a MGS designed for Canadian needs, fitted for the developing ISTAR [Intelligence, Surveillance, Target Acquisition and Reconnaissance] sensing and communication network and built by Canadian contractors and workers." The fact that MGS would be built in London, Ontario was easy to take advantage of. However, in contrast to the above statement, internal documents from the MGS project team the following year, 2004, state that "Canadianization" of the MGS should not be given emphasis.[81]

The MGS acquisition was announced on October 29, 2003, by Minister of National Defence (MND) John McCallum. The wording of his announcement reflects the arguments planned out above, as well as general Transformation concepts developed by the land force:

> The acquisition of a mobile gun system is an important project that will take Canada's Army further down the path of transformation... It is part of our commitment to modernize the Canadian Forces by re-investing in capital projects

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[80] Ibid., 5.

[81] See, for example: Department of National Defence, *Mobile Gun System Project Update* slideshow/Powerpoint presentation by Alain Brûlé (November 8, 2004). Accessed through the Canadian Access to Information and Privacy Act, file number A0104125, p. 7. Usually, such documents only note requirements for minor differences, such as connectivity to the Canadian tactical internet. While such connectivity technically qualifies as "fitted for [Canadian] ISTAR," the intention was nonetheless to use the American design as much as possible.

> that provide the capabilities Canada needs in the emerging international security environment.[82]

The same day, Lieutenant-General Hillier amplified further:

> Transformation is our means of implementing the Army Strategy and our soldiers will see concrete evidence that we are moving forward – with real, state of the art kit and real, positive change... A mobile gun system is the right vehicle for Canada's Army and will provide an excellent capability on Canadian Forces operations.[83]

The Chief of Land Staff (CLS) spoke further about Transformation and the Mobile Gun System (MGS) during a press conference, dwelling on the themes that Transformation would make the land force credible with allies and that tanks were obsolete in terms of 21st century military operations. He also argued that Transformation and new weapons systems would reduce risk to soldiers. In doing so, he was addressing the concern, seen in the April 2003 CLS meeting, that transformation not be seen as a synonym for reductions to the land force. Turning to weapons platforms and strategic and operational mobility, he said that "so-called conventional" threats of attacks by opponents using massed infantry and tanks were increasingly unlikely, and, "new and more flexible capabilities" were therefore needed.[84] He added that the MGS would be a direct fire platform which the Canadian land force could and would deploy. In his critique of tanks, he said that:

> The Leopard tank – which I love after serving for many years on it and I keep a picture in my office to remind folks that if I can change to the new reality, so can they – is a very capable but less relevant platform… The strong qualities of a Leopard tank parked in Valcartier or Edmonton or elsewhere are useless to our soldiers in Kabul, Eritrea, Bosnia or anywhere else that we deploy them and where we require direct fire. In some cases, we can't get it there because the only

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[82] Department of National Defence, "Minister of National Defence Announces Acquisition of a Mobile Gun System," Department of National Defence news release, October 29, 2003 http://www.mdn.ca/site/newsroom/view_news_e.asp?id=1238 (accessed March 21, 2008).
[83] Ibid.
[84] Ibid.

> aircraft that can fly in are C-130s and it's too heavy for that. In other places, it cannot manoeuvre and I give you the streets of Kabul, those little tiny narrow alleyways as an example of that. On most peace support operations, it would actually be destabilizing to deploy or employ it.[85]

Having critiqued the tank, he continued with comments about improved communications, information dominance, and "radical changes" in training, equipment management, and other areas.[86] By doing so, he was using the Mobile Gun System (MGS) as a centerpiece to underpin Transformation as planned earlier in the year. The argument for the Direct Fire Unit (DFU) flowed clearly from planning in 2002 by Jeffery and Hillier through the April 30, 2003 Chief of Land Staff (CLS) briefing to the MGS announcement at the end of October 2003.

The communications plan continued into 2004, after the announcement of the MGS acquisition. The Record of Decision from a November 3-4 Army Council meeting shows that Hillier highlighted the significance of the MGS announcement in terms of Army Transformation.[87] He also solicited the support of unit and directorate commanders: "in communicating to the army and those elements that support the army, the system of systems approach to Transformation."[88] Further, it was decided at the meeting that the "communication/education" plan was to be updated, including production of a short video emphasizing the system of systems approach.[89]

When McCallum was replaced by David Pratt as the new Liberal Minister of National Defence (MND) in early 2004, the land force leadership worked to ensure that Pratt would continue his predecessor's support for Transformation. A number of

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[85] Ibid.
[86] Ibid.
[87] Department of National Defence, Director General Land Staff and Army Council, *Record of Decisions (ROD) – Army Council 3-4 November 2003 – Army Officers' Mess Ottawa* (Ottawa: December 12, 2003). Accessed through the Canadian Access to Information and Privacy Act, file number A0283156, p. 17.
[88] Ibid., p. 17.
[89] Ibid., p. 17.

generals and colonels were involved in creating a presentation designed to make him 'understand the logic of transformation and the important issues related to the MGS [Mobile Gun System]."[90] Briefing notes prepared for him later in the year reinforced the concept of the "medium-weight, information age force" combined with the deployability of light wheeled vehicles.[91] Other notes continue the theme that the Leopard 1 C2 tanks are reaching the end of their logistical and operational usefulness.[92] One makes the point that the Department of National Defence (DND) has been criticized for not replacing old equipment "as soon as some would like" and for taking too long, at an average of seventeen years and six months, to deliver procurements.[93] The suggestion is that the MGS can be used by the Liberal government as an example of rapid and positive actions for political gain.

The Transformation communications strategy culminated with the website *A Soldier's Guide to Army Transformation*, which, despite the title, was a publicly accessible website aimed primarily at members of the land force but also, evidently,

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[90] Lieutenant Colonel Fleury, Colonel Gunn, Major General Caron and others, e-mails between January 29, 2004 to February 4, 2004. Accessed through the Canadian Access to Information and Privacy Act, file number A0109955.

[91] These examples are from: Department of National Defence, *Mobile Gun System (MGS) – 00000731* (Ottawa). No specific date, context of the document suggests that it was produced during 2004. Accessed through the Canadian Access to Information and Privacy Act, file number A0104118. Another example is: Department of National Defence, Director Land Requirements, *Briefing Note For The MND, Mobile Gun System Project Update* by J.J.L. Petit. (Ottawa: October 26, 2004). Accessed through the Canadian Access to Information and Privacy Act, file number A0188326. The document states that: "One of the aims of Army transformation is to modernize firepower. To achieve this, a key component is the acquisition of 66 MGS to replace the Leopard tank... The main gun, a stabilized 105mm with autoloader, will defeat hardened bunkers and armoured vehicles (up to T-72 Tank). The chassis is an 8x8 wheeled platform and the vehicle is C-130 Hercules aircraft transportable." Features from earlier documents can be seen here, including the simplification that the MGS, rather than the DFU as a whole, is a replacement for the tank.

[92] Department of National Defence, Director Armoured Vehicles Program Management (DAVPM), *Briefing Note For The Minister Subject: Mobile Gun System Project* (Ottawa: June 3, 2004). Accessed through the Canadian Access to Information and Privacy Act, file number A0095159.

[93] Department of National Defence, Director Force Planning and Program Coordination, *Briefing Note For The Minister Subject: Equipment Issues* (Ottawa: June 7, 2004). Accessed through the Canadian Access to Information and Privacy Act, file number A0095169.

interested members of the general public.[94] It had an introductory page and three parts, the first part having six sections, including "How to Transform" and "Building a Direct Fire Unit."[95] The introductory sections and "How to Transform" repeat standard statements about the RMA and Transformation. A plan to become "agile," "lethal" and "knowledge-based" is presented within this framework.[96] Transformation is to be conducted through what is called regeneration, with aspects of restructuring of armoured vehicle units being five of the eleven "main transformation activities" listed in chart form for the years 2004 to 2006.[97]

These activities illustrate how an Armoured Corps regiment was to provide the organizational structure for integrating different combat arms into the new Direct Fire Unit (DFU) brigade. The plan to transform this unit, the Lord Strathcona's Horse (Royal Canadians) [LdSH(RC)], is described on the "Building a Direct Fire Unit" subpage. The changes were intended to take place between 2004 and 2008.[98] In 2005, a LAV-TOW Under Armour (LAV-TUA) company was to take over both reconnaissance and some direct fire roles, while the reconnaissance squadron was to be changed into a pure

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[94] The author has been unable to find a record of when precisely the website was first posted online, but recalls that it was available by late 2004 or by 2005 at the latest. Its content reflects these dates. Parts of the copy used states that it was last updated on July 24, 2006; other parts were updated on January 5, 2007. At some point subsequently, the website was removed.

[95] Department of National Defence, Land Force, *A Soldier's Guide to Army Transformation*, update posted July 24, 2006 (accessed March 21, 2008).

[96] Ibid. In the Background or Introductory section, the standard RMA/Transformation concept is repeated that the traditional battlefield of the "last half" of the twentieth century has changed, and that: "Wars are no longer about massive armies fighting each other over a period of several years." As a result, it argues: "We must modernize our long-held ideas of how we train and fight." The "How to Transform" section carries these arguments further, and repeats standard positions, indicating that the army will change from a "post-WWII Force with a defined enemy" to an "agile, lethal, knowledge-based Force."

[97] Ibid., "How to Transform" section.

[98] Based on a number of briefings, it appears this plan was created shortly before the website. One example is: Department of National Defence, Land Force, *LRAAW/TUA Brief to A/CLS*, September 2, 2004. Accessed through the Canadian Access to Information and Privacy Act, file number A0110761.

surveillance squadron.[99] Meanwhile, the Armoured headquarters was to become an "armoured/infantry" headquarters unit.[100] In 2006, an Air Defence Anti-Tank System (ADATS) battery – mounted on the LAV-III as the Multi-Mission Effects Vehicle (MMEV) – was to join the organization, while one tank squadron was to be replaced with a Mobile Gun System (MGS) squadron.[101] Also, the headquarters unit was to be transformed into an "all arms" headquarters.[102] In 2007, MGS squadrons were to replace both the remaining tank squadron and the surveillance squadron, creating a final organization of three MGS squadrons, a LAV-TOW Under Armour (LAV-TUA) squadron, and a MMEV squadron.[103] Regarding these changes, the website states that:

> This system's approach ensures the best possible capability for the least amount of resources. It will be based on the same platform which will be more logistically efficient. No one weapon system does it all – so it is the best value for money and it's deployable.[104]

Also included is the comment that: "The elimination of our 114 Leopard Tanks and the integration of the MGS would provide an effective mobile Medium Direct Fire system that would meet our operational needs well into the 21st century," while adding the statement, seen in previous documents, that the MGS offers the only Canadian built non-tank option for replacement of the Leopard 1 C2's firepower for the foreseeable future.[105] The MMEV is once again justified as providing not only long range anti tank

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[99] Department of National Defence, *A Soldier's Guide*, "Building a Direct Fire Unit" section. This was fairly logical, since, as seen in the previous chapter, many of the Coyote reconnaissance vehicles acquired in the mid to late 1990s were optimized for surveillance with extensive Intelligence, Surveillance, Target Acquisition and Reconnaissance (ISTAR) equipment.
[100] Ibid., "Building a Direct Fire Unit" section.
[101] Ibid., "Building a Direct Fire Unit" section.
[102] Ibid., "Building a Direct Fire Unit" section.
[103] Ibid., "Building a Direct Fire Unit" section.
[104] Ibid., "Building a Direct Fire Unit" section.
[105] Ibid., "Building a Direct Fire Unit" section.

defence but also countering the "increasing" helicopter and Unmanned Aerial Vehicle (UAV) threat.[106] The Transformation approach presented in the website is easily criticized. For example, what enemy would be likely to use helicopters and UAVs, but not large numbers of tanks and infantry? Insurgents would be unlikely to have access to any types of heavy weapons. They would most likely attempt to ambush armoured vehicles with handheld weapons such as Rocket Propelled Grenades (RPGs). Similar questions were raised in internal land force debates, as will be seen in Chapter Four. The communications strategy to "sell" the Direct Fire Unit (DFU) to the rest of the land force, as well as the Canadian public, was not based on rigorous analysis. Rather, it was designed as a bargaining tool. Although the DFU was described as an "all arms" unit, the land force leadership was effectively justifying the retention of a force structure which it preferred through near-term acquisitions.[107]

Mobile Gun System: Operational Requirements

Drafting of a Statement of Operational Requirement (SOR) started in late 2003, at approximately the same time as the Mobile Gun System (MGS) was announced. The final version was approved in the spring of 2004.[108] Although the SOR was drafted by

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[106] Ibid., "Building a Direct Fire Unit" section.

[107] As seen above, the phrase "all arms" was used to describe various aspects of the DFU, as in the case of the website stating that it was intended to have an "all arms" headquarters.

[108] Department of National Defence, Land Force, *Statement of Operational Requirement Mobile Gun System* (Ottawa: 2004). The SOR was signed as approved by the Project Director, Major J.A. Atkins, and the Project Manager, Lieutenant Colonel P. Ohrt, on January 19, 2004. It was signed by the SRB Chair, Acting CLS, and Group Principal Major General JHPM Caron, on January 29, 2004. It was signed as approved by DGSP Development Review by Major General DL Dempster on February 2, 2004. It was signed by the Chair of the Joint Capability Review Board and VCDS, Lieutenant General GEC Macdonald, on April 16, 2004. Accessed through the Canadian Access to Information and Privacy Act, file numbers A0104130, A0104131, and A0104132.

middle rank officers, the influence of the land force leadership on it is clear. Many of the details in it reflect the land force leadership's communications strategy since, as seen in Chapter Two, capability development studies had not produced a clear justification for the program as part of a group of tank replacements.[109] The Statement of Operational Requirement (SOR) also has limitations in that it at times relies on the Multi-Mission Effects Vehicle (MMEV) procurement to make sense. However, due to the fact that the MMEV was treated as a separate procurement and was as yet unapproved, the risk associated with the Mobile Gun System (MGS) project was increased.

The SOR established a requirement to acquire 66 MGS vehicles with associated integrated logistics support (ILS) from the contractor.[110] It is stated that the MGS would provide mobile, precision direct fire capability capable of executing a variety of tasks, but most effective in Operations Other Than War (OOTW).[111] Discussing the LAV-TOW Under Armour (LAV-TUA) and MMEV, the SOR states that the MGS was to be an "operational vehicle" employed "within a system of systems."[112]

Outlining the capability deficiency that the MGS was intended to fill, the SOR reflects the land force leadership's intent to procure a system which would be politically acceptable to deploy on peacekeeping missions. It justifies this with the observation that arose in some studies that tanks are too large and heavy to operate in "constricted spaces" or "complex terrain."[113] Further to this point, it deems the MGS to have greater strategic

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[109] As seen, a number of studies had identified that a lightweight, wheeled armoured vehicle with a 105mm gun could be a useful replacement for the Cougar, but not for the Leopard 1.
[110] Department of National Defence, *Statement of Operational Requirement Mobile Gun System*, 1.
[111] Ibid., p. 1.
[112] Ibid., p. 1.
[113] Ibid., 1-2. The SOR lists "potential or perceived" negative impacts on local populations or the local military or political situation, and it restates the expectation that the MGS would provide a more valuable direct fire capability because it would be deployed, and would therefore be available in theatre if a peacekeeping or peace enforcement situation escalated to conflict.

and operational mobility than a tank due to its lighter weight. The phrase "agility" is repeated here.[114] The Statement of Operational Requirement (SOR) also uses another argument to recommend replacing tanks before, rather than after, 2010, as previous studies had suggested.[115] It states that since the German government was expected to cease providing logistics support for Leopard 1s in 2015, Canada would have to initiate a tank replacement project within five years anyway.[116] Combined with this point, it argues that the Mobile Gun System (MGS) would have common logistics with other LAV-based vehicles.[117]

The SOR then turns to capability requirements as laid out in the *1994 White Paper on Defence*.[118] It addresses these with fairly general statements. In terms of Defence of Canada, it suggests that the MGS will provide direct fire capability in a territorial defence role.[119] In terms of defence of North America, it indicates that: "Because of its mobility and firepower, the MGS will be well suited to contribute to continental defence operations."[120] Comments regarding contribution to international security are less vague:

> The inherent flexibility of the MGS will result in a superior capability for UN stand-by forces, peace support operations, and service-assisted evacuations. The MGS will be very effective in convoy escort, route security and patrolling of zones of separation of combatants. The MGS, because of its firepower and mobility, will provide a useful direct fire support capability in NATO and global contingency operations.[121]

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[114] Ibid., 2.
[115] See Chapter Two, in particular the DLCD study on page 125 and the DGLS study on page 174.
[116] Ibid., 2.
[117] Ibid., 2.
[118] The 1994 White Paper had not been updated for nearly a decade and in late 2003 still represented the main political guidance from the Canadian government to the Canadian Forces.
[119] Department of National Defence, *Statement of Operational Requirement Mobile Gun System,* 5.
[120] Ibid., p. 5. Under what circumstances the land force would be expected to fight a terrestrial opponent in North America is a curious question that the document leaves unanswered.
[121] Ibid., 5.

General claims concerning the Mobile Gun System's (MGS') capabilities would generate significant disagreement within the capability development system, as will be discussed in Chapter Four. The important point here is that the Statement of Operational Requirement (SOR) was relying on general arguments, rather than a specific capability gap, to make its point. Even in the case of the final draft of the SOR under discussion here, the caveat was added that the employment potential of the MGS could be limited:

> ...by the fact that its ability to operate effectively relies on its agility, enhanced situational awareness and employment within the direct fire system (LAV III, TUA, MMEVv1). In environments where its ability to leverage these strengths is reduced, its employment could become limited.[122]

On this basis, the SOR again turns to the Multi-Mission Effects Vehicle (MMEV) and other recent land force modernization projects as enabling the MGS to fulfill its role.[123] The tactical mobility concerns raised in war games such as *Quarré de Fer*[124] are partially addressed. The SOR admits that the retirement of mobility enabling systems such as the ploughs and rollers that could be mounted on the Leopard 1 fleet will present the LAV based force with a "significant challenge."[125] This, together with the reduction in armoured protection, is indicated to have "an impact" on how the land force would operate in urban environments during high intensity conflicts.[126] In response to this potential concern, the document uses the information superiority and "agility" argument again.[127]

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[122] Ibid., 5.
[123] Ibid. These include the typical set of projects designed to create information superiority: Intelligence, Surveillance, Target Acquisition and Reconnaissance (ISTAR) capabilities, command and control information systems, battlefield combat identification, and global positioning system equipment.
[124] *Quarré de Fer* is discussed above in Chapter Two.
[125] Department of National Defence, *Statement of Operational Requirement Mobile Gun System*, 8.
[126] Ibid., 8.
[127] Ibid., 8. The statement in this case is: "...operating in the expanded battlespace and with the anticipated increase in situational awareness which the MGS will possess, the land force will leverage its speed, agility

Much of the rest of the Statement of Operational Requirement (SOR) deals with technical specifications. It states that the Mobile Gun System (MGS) will have an autoloader for the main gun and will be operated by a three person crew, with the commander being primarily responsible for navigation, command and control, engagements and crew supervision.[128] To this specification, the document adds that crew tasks will be further defined during the Definition Phase analysis of the project, and by continued liaison with the Multi-Mission Effects Vehicle (MMEV) project and a Future Armoured Vehicle System project.[129]

Many of the technical specifications are made up of listings of "essential" and "desirable" requirements. Among the more significant, given that the MGS was supposed to be part of a system of systems instead of a direct tank replacement, are that it is essential for the main gun to penetrate frontal T-72 tank armour at 2000 metres, and preferable for it to penetrate T-80U tank armour at that distance.[130] It is considered essential that the MGS have the capability to destroy armoured personnel carriers such as Soviet/Russian BMP variants, soft skinned vehicles, field fortifications, personnel in the open, and helicopters that have landed or are hovering in a stationary position.[131] Additionally, it is desirable for it to destroy such targets at ranges up to 8000 metres using "semi-indirect" fire.[132]

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and knowledge dominance to defeat the enemy." As will be seen in Chapter Four, experimentation ultimately showed that such advantages would be nullified in urban environments.

[128] Ibid., 11. The gunner would also have responsibility for detecting and engaging targets, assisting the driver with navigation, and for "user level" maintenance. In addition, the gunner would learn from, or "understudy," the commander and be capable of replacing him or her.

[129] Ibid., 12.

[130] Ibid., 18.

[131] Ibid., 18-19.

[132] Ibid., 18-20. In this section specifications are also made for target acquisition times and distances, hit probabilities, engagement times, re-engagement times, replenishment times, weapons stabilization and so on.

Significant in terms of the repeated claims, seen above, concerning road speed and air transportability are that a maximum forward speed of 90km/h is specified as essential, while over 100km/h is desirable.[133] Essential cruising speed is defined as 80km/h, with 100km/h being desirable.[134] It is also specified that the vehicle be capable of ascending a 3.5% grade at 80km/h for five minutes on paved highways.[135] It is indicated as essential that the Mobile Gun System (MGS) weigh no more than 38,000 lbs and therefore be capable of being transported by a CC130 cargo aircraft for a distance of 1000 nautical miles (1852km).[136] These specifications appear tailored to the existing specifications of LAV-III vehicles and to the expected characteristics of the American Stryker MGS.[137]

The Statement of Operational Requirement (SOR) makes speculative comments about providing protection through stealth capabilities. Reference is made to infrared paints and coatings, positioning heat producing components as low as possible in the vehicle, venting hot air and exhaust downwards at the rear of the vehicle, and cooling the interior and providing insulation.[138] Electronic protection measures are also considered.[139] In addition to these, it is stated that since it is "not possible" to armour the MGS sufficiently to protect it from direct hits by enemy tanks or anti-tank guided missiles, "passive and active hit avoidance measures" must be taken.[140] It is suggested

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[133] Ibid., p. 26.
[134] Ibid., p. 26.
[135] Ibid., p. 26.
[136] Ibid., p. 26. Discussion also includes fording and obstacle crossing capabilities, braking, turning circle, traction on ice and snow, cross country speeds, obstacle crossing capabilities, run flat tires, and the ability to be transported in C141, C5 and C17 aircraft.
[137] See, for example, Chapter One, page 105, where U.S. TRADOC specifies that all interim combat vehicles must be C-130 transportable.
[138] Ibid., p. 41.
[139] Ibid., p. 41.
[140] Ibid., p. 42.

that commanders "at all levels" be encouraged to react quickly in order to gain the initiative, and that they be aided in this with information generated by vehicle subsystems and other information sources networked together.[141] Regarding the question of vehicle profile that appears in other documents, it is specified more precisely in the Statement of Operational Requirement (SOR) that using a three person crew and seating them below the turret ring, while providing the turret with an autoloader, would significantly reduce the frontal profile of the turret, creating a smaller target for the enemy from that angle.[142]

Nonetheless, further detail is given to passive protection. It is stated as essential that the Mobile Gun System (MGS) have over most of the arc of its hull high probabilities of no perforation by many types of ammunition.[143] The SOR places reliance on the development of add-on armour to provide protection against heavier fire, including rocket propelled grenades (RPGs).[144] It is also indicated that the MGS is expected to remain in service for at least twenty five years, and that as a result it must have the growth potential to handle a ten percent increase in combat weight in order to protect against new threats.[145]

In terms of vehicle design selection, the SOR states that the U.S. Army Stryker MGS is the preferred vehicle.[146] Even though this comment is placed under the heading

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[141] Ibid., p. 42.
[142] Ibid., p. 41. Vague additional comments are made about the possibility of further reducing the top profile by eliminating protruding equipment from the area around the turret on the top deck of the vehicle, such as raised cupolas, machine gun stations, hatches, sight heads, antennae and external stowage racks.
[143] Ibid., 44. It is stated that the MGS must have a ninety percent probability of no perforation from 7.62mm x 51 NATO ball ammunition fired from 30 metres away impacting at zero to thirty degrees from the horizontal plain.
[144] Ibid., 44. It is stated as essential that the add-on armour be designed to provide protection against 14.5mm x 114mm fire at 200 metres range, and 30mm cannon fire at a 500 metre range over the frontal arc. The add-on armour is also required to protect against shell fragments or blast from projectiles with a cone diameter of up to 85mm, such as the RPG 7.
[145] Ibid., A-1/6. Compare this specification to the DGLS study on page 174, which concluded that this type of vehicle would likely have little growth potential.
[146] Ibid., 17.

"in-service foreign vehicles," the document admits that: "This vehicle is currently undergoing test and development and the design is not finalized. It is possible that certain Canadian essential requirements will not be met in the US vehicle due to differences in how the nations employ the vehicle." Such requirements are discussed further in other sections of the Statement of Operational Requirement (SOR). In one place, there is a handwritten note – signed VCDS (Vice Chief of the Defence Staff) – stating that: "Amendments may be required as issues are clarified."[147] This was the first example of reservations about the Direct Fire Unit (DFU) expressed by the VCDS. As will be seen in the next section, he would also have concerns with the Multi-Mission Effects Vehicle (MMEV).

Along with the SOR, the *Project Charter Mobile Gun System (MGS)* was also prepared during late 2003 and early 2004, after project announcement. It defines the MGS project as overall low risk, since it is based on an existing vehicle design and tactical command, control and communications system.[148] It identifies only a small number of medium risk elements, including logistic support and life cycle costs for the vehicles.[149] It also notes a risk that some companies may object to the sole source contract for the MGS, but states that no other potential manufacturer has expressed interest in the project and that the sole source is the preferred Crown procurement strategy.[150] The argument that had been repeated through the DFU communications strategy is stated as a "key assumption:" "A mobile gun system will provide the Army

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[147] Ibid., 17.
[148] Department of National Defence, *Project Charter Mobile Gun System (MGS) 00000731* (Ottawa: January 7, 2004). Signed by Major A. Atkins, Project Director MGS, and listing the Chief of Land Staff as the Project Sponsor. CLS is listed as having approved the Charter on November 29, 2003. Accessed through the Canadian Access to Information and Privacy Act, file number A0095035 Ibid., 3-4.
[149] Ibid., 3-4.
[150] Ibid., 4.

with a direct-fire capability consistent with the vision to transform into a medium-weight, information age force as outlined in the Army Strategy."[151] The project charter places emphasis on interoperability of a Canadian Mobile Gun System (MGS) with the U.S. Army Stryker brigades and on the MGS having a three person crew and therefore being less personnel intensive than the Leopard 1 C2.[152] It states that functionality together with other land force systems, which are defined in the Statement of Operational Requirement (SOR) as necessary to enabling the MGS to fulfill its role, will be developed further into the definition phase of the project.[153]

Overall, the specifications for the MGS developed during late 2003 and early 2004 identify the need for greater definition in some aspects of the project, but still assume that once greater definition is achieved, the core Transformation concept of information superiority will largely eliminate the need for armoured protection. This was the military justification for the Direct Fire Unit (DFU) put forward by the land force leadership in its earlier communications approach. It was an assumption that would generate disagreement, first internally, then more publicly. The other developmental component of the DFU, the Multi-Mission Effects Vehicle (MMEV), would also generate disagreement. The reason was not the assumption inherent in Transformation, but rather a clash of organizational logic between what the artillery branch believed an air defence

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[151] Ibid., 5.

[152] Ibid., 2-3. This apparently obvious observation is, however, somewhat contradicted by the comment in the SOR that: "It is anticipated that the more complex command and control and sensor suite of the MGS will impose a greater workload on the Fire Control System technician and Land Communications and Information Technicians trades than the current Leopard C2. Overall, the smaller MGS fleet will likely require vehicle maintenance support resources similar to the current AFV fleets." Department of National Defence, *Statement of Operational Requirement Mobile Gun System*, 59.

[153] Department of National Defence, *Project Charter Mobile Gun System*, 6-7. These include the Multi-Mission Effects Vehicle (MMEV), Intelligence, Surveillance, Target Acquisition and Reconnaissance (ISTAR) capabilities, command and control systems, battlefield combat identification, and replacement Global Positioning System (GPS) systems.

system could do and what the land force leadership wanted it to do. Although resistance emerged first from the artillery, it came to also involve the capability development and Department of National Defence (DND) procurement processes. The next section describes the Multi-Mission Effects Vehicle (MMEV) in detail, and shows how this clash of logic was inherent in the project from the start.

The Multi-Mission Effects Vehicle

This section traces the clashes of organizational logic surrounding the MMEV from the early stages of the project to its official announcement in 2005. The focus here is on the specific organizational confrontation between the artillery and the land force leadership. Difficulty with incorporating it into existing air defence organizational concepts delayed this project behind the land force leadership's preferred schedule. These events also saw various sub-organizations of the capability development system make positive recommendations on the MMEV, but also highlight awareness of its drawbacks. The Vice Chief of Defence Staff (VCDS) would criticise the way that the project was handled by the land force leadership in terms of capability development and procurement.

At some point in 2002 or 2003, as the Direct Fire Unit (DFU) project gained momentum with the senior leadership, a Canadian artillery position paper was written[154] extolling the virtues of the MMEV but arguing that it should be manned by artillery personnel. Entitled *Air Defence Anti-Tank System (ADATS) In The Line of Sight*

[154] The paper is undated, but based on the context of the other documents examined here it was almost certainly written in 2002 or 2003.

Precision Guided Missile Role – Like A Hot Knife Through Butter, And More..., it endorses the Multi-Mission Effects Vehicle (MMEV) concept, but argues that the artillery should have operational control of this subsystem of the Direct Fire Unit (DFU), rather than it being incorporated into a new organization. From the tone of the paper, it seems likely that its writers believed that their combat arm was in a strong position to gain such control.

The paper describes that the primary role of the Air Defence Anti-Tank System (ADATS), acquired through a 1986 low level air defence (LLAD) project to meet the late Cold War threat in Germany and mounted on an M-113A3 tracked armoured personnel carrier chassis, was to provide short range air defence (SHORAD) to mobile troops and static installations in all weather conditions.[155] Threats to be guarded against included high speed aircraft, helicopters, drones or remotely piloted vehicles, and cruise missiles.[156] It then proceeds to enthusiastically state that:

> What has been not so well known is that the ADATS has an excellent anti-tank capability, which has until now been considered a largely self-defence capability within Canadian AD (Air Defence) doctrine. In fact, the ADATS is capable of destroying armoured ground targets with great precision out to 8 kilometres plus with a minimum engagement distance of 370 metres.[157]

The paper identifies the ADATS as using an active X-band air search radar and a passive electro-optic (EO) module using forward looking infrared (FLIR) and low light television (LLTV) for tracking and engagement of targets.[158] The FLIR and LLTV

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[155] Department of National Defence, (Land Force, presumably Artillery Brach, given statements in the paper) *Air Defence Anti-Tank System (ADATS) In The Line Of Sight Precision Guided Missile Role – Like A Hot Knife Through Butter, And More...* (Ottawa), 1-2. Undated, but from historical context appears to be written in 2002 or 2003. Accessed through the Canadian Access to Information and Privacy Act, file number A0109843.
[156] Ibid., 1.
[157] Ibid., 1.
[158] Ibid., 1-2. It states that the search radar has a range of up to 25 kilometres and the EO module a range of at least ten kilometres, depending on atmospheric conditions.

systems are described as "extremely effective" at line of sight detection of ground targets, although, being electro-optical devices, they can be limited by rain, mist, fog, smoke, and similar obscurants.[159] The effectiveness of the system's load of eight missiles, capable of airspeed in excess of Mach 3, is emphasized, along with the missiles' warheads being optimized for both air and ground targets.[160] The missiles have a range of 10 kilometres, which is touted by the paper as: "much longer than any direct fire weapon in the Land Force inventory."[161] It is further stated that since the missiles use rearward looking laser receivers to obtain guidance information from the Air Defence Anti-Tank System (ADATS), an enemy cannot jam them without physically blocking the line of sight between the missile and the launcher, which is described as an "impossible feat" due to missile speed.[162] System accuracy is also highlighted, with the claim that the laser system is accurate to 1.5 square metres at distances of up to eight kilometres.[163]

As a result of the described capabilities, it is argued in the paper that the ADATS is both an excellent precision-guided direct fire system against both air and ground targets, and also an excellent intelligence, surveillance, target acquisition and reconnaissance (ISTAR) and command, control, communications, computing and intelligence (C4I) platform which can feed targeting data to all the systems tied into the tactical internet.[164]

Having made a case for the system, the author(s) of the paper then seek to address its weaknesses. They admit that, since the ADATS does not have a feature such as gyro

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[159] Ibid., 2.
[160] Ibid., 2. This effectiveness is described as due to the missiles having a dual purpose blast/fragmentation charge. These characteristics are stated to enable the missile to penetrate up 1 metre of Rolled Homogenous Armour, and make it deadly within fifteen metres of an air target.
[161] Ibid., 2. By contrast, the indirect fire 105mm howitzer has an 11km range.
[162] Ibid., 2.
[163] Ibid., 2.
[164] Ibid., 3 and 7.

stabilization, it cannot acquire and fire on targets on the move.[165] However, they suggest that this is compensated for because the Air Defence Anti-Tank System (ADATS) is capable of moving "cross country" in stand-by mode, which allows it to fire a missile approximately one minute after it has stopped on a firm and level piece of ground.[166] The position paper also states that:

> ...it is no secret to the users of the system that a well placed small arms shot or the shrapnel from a mortar or larger projectile can easily damage the turret and render the ADATS electro-optically "blind". If the ADATS were to be used in the traditional manner of tanks and/or TOW under Armour, the turret would require protection to enable it to fight and survive in close contact with the enemy.[167]

In addition, the paper notes that the ADATS requires a generator to be run even while the vehicle it is mounted on is not moving, because its sensor capabilities consume a great deal of energy.[168] This drives up logistic requirements, and also means that the system produces significant noise and heat signatures.[169] However, this drawback is minimized with a short discussion of how "high tech" equipment requires a lot of resources and that the land force is finding that the LAV III and Coyote are demanding more maintenance than older systems as well.[170] The author(s) of the paper then come to the crux of their argument, presented as both a problem and an opportunity:

> ...it is easier to assume a less demanding role or task, than it is to amass the significant experience that makes one an expert in a complex trade. The AD [air defence] has the more technically complex of the two tasks. The ADATS gunners and Detachment Commanders routinely train in the engagement of ground targets in both the simulator and during live fire exercises. To assume a direct fire precision role requires no further training in the engagement sequence, only additional training in anti-armour tactics. They are already trained in manoeuvre on the tactical battlefield and simply require the leadership and planning of their

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[165] Ibid., 2.
[166] Ibid., 2.
[167] Ibid., 3.
[168] Ibid., 4.
[169] Ibid., 3-4.
[170] Ibid., 4.

> officers and Senior NCMs [Non Commissioned Members, a synonym for Non Commissioned Officers] in anti-armour tactics. The converse is not true. You cannot take an anti-armour squadron and employ it in the AD [Air Defence] role with the requisite Command and Control skills and equipment to integrate into the theatre AD plan without replicating years of experience and training. No arrogance intended, just fact... [Air Defence Anti-Tank System] should remain within the AD artillery in order to meet the broad range of missions which may be required...[171]

As can be seen in the paper, the Multi-Mission Effects Vehicle (MMEV) concept could be quite attractive when an arm of the land force believed it might acquire a more significant role through the system. The artillery would be less enthusiastic when it found that the plan was to transfer control of the MMEV to the new "all arms" Direct Fire Unit (DFU), an organization with a primary ground based direct fire role. According to its organizational logic, the artillery argued that it would require not only control of crew training for the MMEV, but also operational control of the system. The reticence of the artillery to relinquish direct control of a vehicle employing the ADATS was driven by the belief that a command structure which was familiar with and used existing standard operating procedures (SOPs) for employment of an AD system was needed. Nonetheless, the artillery arm authors of this paper had a significant point, which would recur and ultimately factor in undermining the MMEV plan: combining air defence and ground-to-ground fire, while impressive on paper, is difficult in practice due to the multiple skill sets that the operators have to learn and maintain.

Outside of the artillery, arguments for the MMEV proceeded apace. At this point in the DFU program, the land force's capability development system, as well as Department of National Defence (DND) operational research organizations, were providing some positive assessments of the MMEV. A briefing note for the Minister of

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[171] Ibid., 6-7.

National Defence (MND) dated January 19, 2004, identifies the "Army Requirement for a Multi-Mission Effects Vehicle." Prepared by the Directorate of Army Doctrine (DAD), it states that the land force has identified the potential benefit of acquiring a Multi-Mission Effects Vehicle (MMEV) as part of its Transformation process.[172] It is reported that Defence Research and Development Canada (DRDC) identified a capability to act in direct, indirect, and air-defence roles from a single platform as important during a Future Armoured Vehicle Systems technology demonstration project.[173] Subsequently, it is stated, war games organized by the Directorate of Land System Concepts (DLSC) showed that the MMEV concept was "tactically decisive" based upon "improved understanding" of the battlespace and extended range fires.[174]

It is emphasized in the note that these studies coincided with a Ground Based Air Defence (GBAD) capabilities review which suggested that the "potential" of the Air Defence Anti-Tank System (ADATS) should be "maximized" by increasing its capabilities in the direct and non line of sight fire roles.[175] The note states that the army will be "seeking authority to proceed with this project shortly after MGS [Mobile Gun System]."[176] It also advises that this will require "revisiting" the current Strategic Capabilities Investment Plan (SCIP) funding timelines to bring MMEV programming into line with Transformation plans, as: "the current SCIP timelines are too far out."[177]

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[172] Department of National Defence, Directorate of Army Doctrine, *Briefing Note For The MND Through DM/CLS – Army Requirement For A Multi-Mission Effects Vehicle* by R.C. Rankin (Kingston, Ontario: January 19, 20040. Accessed through the Canadian Access to Information and Privacy Act, file number A0283157.
[173] Ibid.
[174] Ibid.
[175] Ibid.
[176] Ibid.
[177] Ibid.

The note also reveals more clearly that the land force leadership and capability development were intending to leverage the current Multi-Mission Effects Vehicle (MMEV) project for future MMEV plans such as those seen in 1998-2003 studies. The MMEV design for which approval is sought is described as the "MMEV version 1" or "MMEVv1."[178] It is stated that this MMEV will address some of the "immediate needs" of the army through its firepower and sensor capabilities, but that it is also the "important first step" toward the "full development" of the MMEV "concept."[179]

However, the capability development system was also aware of the organizational difficulties raised by the artillery in creating a combined air defence and direct ground fire system. A May 2004 Land Force Doctrine and Training System capability development record of the MMEV shows a positive outlook for the potential of system, but notes that air defence systems must operate within a Joint Airspace Control Plan.[180] It is stated that if the MMEV is to retain any air defence capability, airspace control authority authorized command, control, communications and intelligence (C3I) will be required.[181] Future ground based air defence missile designs are also discussed with capabilities exceeding the "standard" Air Defence Anti-Tank System (ADATS) missile.[182] As with the Statement of Operational Requirement for the Mobile Gun System (MGS), space is also given to describing the perceived relevance and role of the MMEV in missions such as the defence of Canada, defence of North America,

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[178] Ibid.
[179] Ibid.
[180] Department of National Defence, Director General Land Combat Development, Land Force Doctrine and Training System, *Capability Development Record (MMEV)* (Kingston: May 2004), 5. The document information/tracking block notes that it was prepared by Major C.F. Leeming of the Directorate of Army Doctrine, but it is unclear whether he has authored or edited the document or re-edited it. Accessed through the Canadian Access to Information and Privacy Act, file numbers A0110349 and A0110355.
[181] Ibid., 5.
[182] Ibid., 31.

contributing to international security, and so on.[183] The overall argument is made that: "This future GBAD [Ground Based Air Defence] system embodies the flexibility; economy of effort and cooperation required in future operations. The GBAD functional adjustments create new resources and greatly enhance other Command, Act, and Sense combat functions."[184]

However, discussion between officers at the artillery, infantry and armoured schools in the spring of 2004 illustrates that the concern over how to staff and manage the Multi-Mission Effects Vehicle (MMEV) recurred. In an April 2, 2004 email, Major R. Lavoie of the Canadian Training Centre (CTC) Artillery School at Gagetown stated that after an Artillery Advisory Board discussion:

> ...for some reason, we believe we are absolutely not being listened to, although we have the experience with the kit and we are the only Combat Arms [sic.] with concerns and appreciation of the complexity of the third dimension of the battlefield...[185]

He writes that the air defence community and Royal Canadian Artillery have "totally accepted" that the Air Defence Anti-Tank System (ADATS) and MMEV role is now anti-tank first, although there has been resistance within the artillery corps.[186] However, concerning force generation of Direct Fire Unit (DFU) units, he reports that Artillery Council examined three options. The first was the standard and preferred DFU plan developed during 2002-2003 (as seen above), consisting of troops of four Mobile Gun System (MGS) vehicles, two LAV-TOW Under Armour (LAV-TUA) vehicles, and

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[183] Ibid., 8-11.
[184] Ibid., 3.
[185] Major R. Lavoie at the CTC Artillery School in Gagetown, Lieutenant Colonel S.J. Bowes at CTC Armoured School Gagetown, Lieutenant Colonel M.J. Pearson at CTC Infantry School Gagetown, Lieutenant Colonel I.R. Creighton at CTC headquarters, Gagetown, Colonel C.J.R. Davis at CTC headquarters Gagetown, and Major L.J. Hammond at CTC Artillery School Gagetown, e-mail correspondence. Subject line: MMEV Force Generation – Position Of The Royal Regiment Of Artillery. Accessed through the Canadian Access to Information and Privacy Act, file number A0109924.
[186] Ibid.

two Multi-Mission Effects Vehicles (MMEVs).[187] The second was a sub-unit under the Direct Fire Unit (DFU).[188] The third was an organization independent of the DFU, but co-located with it.[189] He states that the first option was:

> ...rejected immediately and reverently by Arty [Artillery] Council. We have experience in this matter and we know it would fail (or at least be inefficient and ineffective). We have made this mistake before and have lived a decade of nightmares and difficulties with a concept like this. We understand the problems of having many complex (weapon) systems under the same unit or org, the complexity of training management, postings, career, manpower, maintenance, simulator, etc.[190]

By contrast, he indicates that the second option has advantages and disadvantages, and that the artillery would prefer option three.[191] He also goes into detail that:

> The ADATS [Air Defence Anti-Tank System] is not a LAV, a tank or even an APC [Armoured Personnel Carrier]. It is slow, hard to manoeuvre and requires specific technical aspects of the firing position to be effective. To expect to use the ADATS as a Tank or even a LAV is not possible. We can certainly trial it, but we should manage our expectations... We should expect the same differences between MMEV and LAV as was the case with the M113 and ADATS; extremely top heavy and very slow moving... Trials will likely demonstrate that the skills required to manage such a system as the MMEV will demand a lot of training and generate a high risk of skill fade.[192]

The above positions, stated informally, were further outlined in an April 27 transition concept paper signed by Lieutenant-Colonel M. Lavoie, Commanding Officer of the 4th Air Defence Regiment, Royal Canadian Artillery (RCA) in Moncton, New Brunswick, sent to the Director Land Requirement/Director Artillery at National Defence Headquarters in Ottawa. In it, the perception emerges that the transition of the MMEV into part of a "system of systems" is the result of a period of being forced through

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[187] Ibid.
[188] Ibid.
[189] Ibid.
[190] Ibid.
[191] Ibid.
[192] Ibid.

"rationalization and realignment" of resources, equipment, and personnel.[193] It is suggested that all Air Defence Artillery personnel and equipment be centralized in Edmonton, with the Multi-Mission Effects Vehicle (MMEV) being located in close proximity to Lord Strathcona's Horse [LdSH(RC)].[194] The Air Defence Anti-Tank System (ADATS) operators are described as "the smallest yet most technically advanced combat arms trade," and it is emphasized that the skills and equipment currently exist within the ground based air defence profession to operate within the "system of systems."[195] The difference of a system mounted on the ADATS from other platforms is once again underscored:

> The MMEV primary role is anti-armour but contrary to the two other systems, we must retain Air Defence Artillery capability as a secondary role. The MMEV concept cannot be examined in isolation as an Air Defence Artillery system, nor be seen as a LAV TUA [LAV-TOW Under Armour] with extended range. Our experience with ADATS has clearly demonstrated that when employing ADATS it must be used as a minimum in a troop of four due to high maintenance and support requirements, mainly fuel.[196]

Another untitled internal Canadian Forces document provides additional detail concerning some of the points in the documents above. It states that switching a MMEV from air defence to a ground engagement task can be as simple as a "sniping gun"[197] scenario in which the vehicle would receive information about a target, rules of engagement, and proceed to engage.[198] Completely retasking an entire troop would be

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[193] No author, ADATS/MMEV – A Transition Concept. Moncton, New Brunswick: 4th Air Defence Regiment, RCA, April 27, 2004. Signed by Lieutenant-Colonel M. Lavoie, unit commanding officer. Accessed through the Canadian Access to Information and Privacy Act, file number A0109944, p. 1.
[194] Ibid., p. 1.
[195] Ibid., p. 1 and p. 5.
[196] Ibid., p. 4.
[197] The sniping gun is a concept used in artillery with British doctrinal influence, but not U.S. artillery.
[198] No author, untitled internal document (or possibly this information has been redacted) regarding the ability of an ADATS/MMEV detachment or troop to switch between direct fire ground task and air defence task. Ottawa: Canadian Forces, undated. Accessed through the Canadian Access to Information and Privacy Act, file number A0109842, p. 1.

more complex because additional information would have to be received and time taken by the troop to assimilate it.[199] Switching from ground to air defence would be the most complex transition, since it would likely require the vehicles to be repositioned, briefed on the air threat and rules of engagement, and load current identification friend or foe (IFF) data.[200] It is specified that any coalition Canada would likely be a part of would not allow the activation of an air defence umbrella without prior coordination at a formation level, and that if Multi Mission Effects Vehicles (MMEVs) were to activate their radars without prior warning they would likely be targeted by friendly anti-radiation missiles.[201] As a result, it concludes that:

> Although technology supports the simultaneous air/ground role MMEV concept, the procedures and human factors inherent in today's system and in the foreseeable near future (2010) limit the employment of ADATS[Air Defence Anti-Tank System]/MMEV to one or the other. It is easier to move from an air defence task to a ground task than in the opposite direction.[202]

Finally, the paper also notes that the Intelligence, Surveillance, Target Acquisition and Reconnaissance (ISTAR) and non-line-of-sight radio transmission tasks that the MMEV has been assigned may require additional discussion.[203] By contrast with the above discussions, some MMEV documentation simply emphasizes direct fire as the primary role. One MMEV briefing indicates the assumption that air supremacy would be a given in coalition operations, as a result of which there was expected to be no requirement for crews to operate the MMEV for twenty four hours a day, nor for the radar to be in constant use.[204]

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[199] Ibid., p. 1.
[200] Ibid., p. 1.
[201] Ibid., p. 1.
[202] Ibid., p. 2.
[203] Ibid., p. 2.
[204] Department of National Defence, *ADATS/MMEV Organization* briefing. (Ottawa). Accessed through the Canadian Access to Information and Privacy Act, file number A0114361.

Resistance in the artillery to the changing role of the Air Defence Anti-Tank System (ADATS) continued through the summer of 2004. The concerns seen above were raised at an August 20, 2004 discussion of the Direct Fire System Working Group. The meeting opened with Brigadier General Petras speaking about how the Direct Fire Unit (DFU) was "based and supported" by Army Transformation and the "new" capability development process.[205] Other senior officers spoke about how the transition to the DFU had already started.[206] However, Lieutenant Colonel Clarke of the 4th Air Defence Regiment reiterated concern over the intention to use four Mobile Gun System (MGS) vehicles, two LAV-TOW Under Armour (LAV-TUA) vehicles, and two Multi-Mission Effects Vehicles (MMEVs) in a troop.[207] He also expressed "deep concern" that the Army leadership did not understand the "full implication" of transitioning the ADATS to a primarily direct fire role.[208] However, he also discussed future developments which could improve ADATS direct fire capability, including using modified rockets and possibly launching Hellfire missiles[209] for indirect precision fire.[210]

Nonetheless, Exercise Perfect Kill was held in July 2004 to demonstrate ADATS capabilities for the MMEV.[211] Initial test results produced 88% aircraft kills and 31% kills against armoured fighting vehicles, but final test results produced 95% kills against

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[205] Department of National Defence, CFB Suffield, *Record Of Discussion – Direct Fire System Working Group (DFSWG) – 20 August 2004*, edited by S. Schreiber (Alberta: 2004), 1. Accessed through the Canadian Access to Information and Privacy Act, file number A0109910.
[206] Ibid., 1.
[207] Ibid., 2.
[208] Ibid., 3.
[209] Hellfire missiles are used by U.S. UAVs and other U.S. vehicles.
[210] Department of National Defence, *Record Of Discussion – Direct Fire System Working Group*, 3.
[211] The war game is dated to July 5, 2004 in: Department of National Defence, *Comments on Exercise Perfect Kill (EX PK)* by T.J. Grant (Alberta: September 2004). Accessed through the Canadian Access to Information and Privacy Act, file number A0109936, p. 1.

aircraft and 96% armoured fighting vehicle kills.[212] M113 based Air Defence Anti-Tank System (ADATS) limitations were found to be a limited field of view, a turret that was "locked in" while on the move, needing to engage with radar "up," the ADATS power unit exhaust being on the front of the vehicle and thereby creating a strong heat signature, and vehicle orientation limiting field of fire.[213] Logistics and a limited missile load were additional concerns.[214] Further development and refinement of tactics, training and procedures (TTPs) for the ADATS in the ground role was found to be necessary.[215]

In his comments on Exercise Perfect Kill (Ex PK), Colonel T.J. Grant, then the Commander of First Canadian Mechanized Brigade Group (1 CMBG) found many shortcomings in the implementation of the exercise, but commented that the soldiers and Non-Commissioned Officers (NCOs) "found solutions to problems that others had stated were insurmountable."[216] He added that:

> In spite of the shortcoming of Ex PK, I found the exercise to be an extremely important step towards DFS [Direct Fire System, variant of Direct Fire Unit] implementation. There is a much better understanding of the abilities and limitations of the ADATS by all members of the DFS WG [War Game]... In summary, I do not believe that Ex PK achieved its aim vis-à-vis the DFS Trial. In spite of this shortcoming, vital information was gained that will be of benefit to the Trial in the coming months. I am convinced that if the stand up of the DFS unit is to be successful, some small elements of the ADATS [Air Defence Anti-Tank System] community must be integrated into the LdSH (RC) [Lord Strathcona's Horse] as a matter of urgency.[217]

Gradually, the chain of command asserted itself and acceptance of the changing role of ADATS began to develop in the artillery. A directive written by Colonel Gunn,

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[212] Department of National Defence, 4th Air Defence Regiment, RCA, *Ex Perfect Kill 2004 Brief To Comd 1 CMBG*. (Moncton, New Brunswick: 2004). Accessed through the Canadian Access to Information and Privacy Act, file number A0109852, p. 5.
[213] Ibid., 10-11.
[214] Ibid., 11.
[215] Ibid., 17.
[216] Department of National Defence, *Comments On Exercise Perfect Kill*, 2.
[217] Ibid., 1.

Director of Artillery, stated that the arm: "...cannot blindly fight for the continued existence of 4th Air Defence (4 AD) Regiment as a unit based on past missions or roles. The organizational models of the future must be based on first principles and mission requirements."[218] He outlined a discussion with Colonel Kampman, the Director of Land Strategic Plans (DLSP) in Ottawa, in which it was decided that the Artillery needed to produce a position paper outlining proposals for organizations, roles, locations and other details pertaining to future (Air Defence Anti-Tank System) ADATS capabilities.[219] He reiterated that the primary role of the Multi-Mission Effects Vehicle (MMEV) would be ground engagement, and that the artillery had to develop a plan to surge up to three rotations of MMEV troops in order to support a tactically self sufficient unit.[220] He also clarified that Director Land Strategic Planning (DLSP) staff still envisioned a tactical organization of a six MMEV troop broken up into two per direct fire troop,[221] for a total of three Direct Fire Unit (DFU) troops deployed at a time.[222] He wanted proposals for alternatives to this organization with analysis on the best options.[223]

Despite Colonel Gunn's acceptance of Transformation plans, the Vice Chief of the Defence Staff (VCDS), at that time Vice-Admiral R.D. Buck, was not convinced by the MMEV plan. As seen in Chapter Two, while the land force capability development system has some flexibility in the order of capability development steps it can undertake, ultimately a capability requirement must pass through the regulatory and legislative

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[218] Department of National Defence, untitled directive by R.D. Gunn. Accessed through the Canadian Access to Information and Privacy Act, file number A0109852, p. 1.
[219] Department of National Defence, untitled directive by R.D. Gunn, 1.
[220] Ibid., 1.
[221] This would mean that each group of two MMEVs would deploy alongside four Mobile Gun System (MGS) vehicles and two LAV-TOW Under Armour vehicles (LAV-TUA).
[222] Department of National Defence, untitled directive by R.D. Gunn, 2.
[223] Ibid., 2. As seen above, Artillery Council made such proposals in the spring of 2004.

procurement framework. As shown by Figure 2-1, approval by the Joint Capability Requirement Board (JCRB) is necessary.[224]

In September 2004 the JCRB deferred approval of the Multi-Mission Effects Vehicle (MMEV), with an explanatory letter from Buck to the Chief of the Land Staff (CLS), Lieutenant General Hillier, explaining why.[225] He makes criticisms in four areas. In the first, he outlines how the MMEV project has identified capability deficiencies in Ground Based Air Defence (GBAD), long-range direct fire, and precision indirect fire.[226] He then comments that the proposed improvements will improve GBAD capability but that he is concerned about the apparent relegation of GBAD to a secondary role behind direct fire.[227] He asks:

> Does this change in focus adequately address a key joint capability? I would be reticent to endorse any plan that would lead to the erosion of this key joint GBAD capability. Of note, from the briefing material provided, the anticipated MMEV contribution to operations, in a CF [Canadian Forces] context, suggests that the principal role in fact remains GBAD-related.[228]

In his second set of criticisms, he discusses the Army's concept of a direct fire "system-of-systems," stating that the articulation of a precision indirect fire capability deficiency raises further questions.[229] He points out that a number of indirect fire projects were rolled into a Future Indirect Fire Capability (FIFC) project in May 2003, and that it has yet[230] to fully qualify a specific capability deficiency.[231] From this point

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[224] See page 122.
[225] R.D. Buck to Rick Hillier, *Joint Capability Requirement Board Deferral – Multi-Mission Effects Vehicle* Official explanatory letter, September 2004, Department of National Defence. Accessed through the Canadian Access to Information and Privacy Act, file number A0101639, 1.
[226] Ibid., 1.
[227] Ibid., 1.
[228] Ibid., 1.
[229] Ibid., 2.
[230] As of September 2004, the date of the document.
[231] R.D. Buck, *Joint Capability Requirement Board Deferral*, 2.

he argues that it is important to clearly develop broader, presumably joint, Canadian Forces (CF) indirect fire capability before investing "strategic resources" to address "a possible component" of an "undefined deficiency."[232]

His third main area of criticism is that, although the Multi-Mission Effects Vehicle (MMEV) Project only received Senior Review Board (SRB) endorsement to proceed with an options analysis phase in June 2004;

> ...the preferred solution to the capability deficiencies has already been identified, presented, and indeed, published for some time as the ADATS [Air Defence Anti-Tank System] turret on a LAV III chassis. I am concerned that the scrutiny of possible choices may not yet have been conducted with the degree of rigour necessary.[233]

His final concern has to do with the impact of Defence Force Structure reallocations which have the effect of reducing the overall Ground Based Air Defence (GBAD) personnel establishment by 169 people.[234] He states that: "Reinvestments to achieve the required GBAD structure must be substantiated with offsets identified."[235] Even more critically, he adds that: "I would ask you to note the implications for the CF when rumours of proposed infrastructure changes and significant personnel movement circulate without Ministerial approval."[236]

Clearly, Buck perceived the impetus for the MMEV project as coming from the land force senior leadership's intention to institute Transformation without sufficient experimentation and analysis first being done.[237] Although the land force capability

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[232] Ibid., 2.
[233] Ibid., 2.
[234] Ibid., 2.
[235] Ibid., 2.
[236] Ibid., 2.
[237] And furthermore, with land force planning being done without taking sufficient account of ongoing joint projects.

development system had proceeded with experimentation to justify the Direct Fire Unit (DFU), and the artillery had ultimately been forced to accept the judgement of the leadership, the organizational logic of the procurement system now delayed the Multi-Mission Effects Vehicle (MMEV).

Nonetheless, the MMEV was ultimately endorsed by the Joint Capability Requirements Board (JCRB) on March 10, 2005. On April 12, 2005, the Senior Project Advisory Committee approved procurement of the MMEV – through the modification and integration of the Air Defence Anti-Tank (ADATS) systems into LAV-III chassis – on a sole-source basis from Oerlikon-Contraves Canada.[238] National and regional interests came into play, with an industrial and regional benefit strategy developed to seek an industrial and regional benefit commitment of one hundred percent of the contract value.[239] An April 15, 2005 briefing note for the Minister of National Defence, Bill Graham, who had replaced Pratt as Defence Minister in the Paul Martin Liberal government, advised the Minister on responding to questions concerning the MMEV in a meeting with the Mayor of Saint-Jean-Sur Richelieu, in whose city Oerlikon-Contraves Canada was a major employer.[240] On the note is a handwritten comment, presumably that of either Lieutenant-General Caron, who was now the Chief of Land Staff (CLS), or

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[238] Department of National Defence, *Briefing Note For The Minister Multi-Mission Effects Vehicle (MMEV) Project Update* by P.V. Romeo (Ottawa: April 15 2005), 1. Accessed through the Canadian Access to Information and Privacy Act, file number A0283178. Modifications considered necessary are described in a memorandum dated January 11, 2005: "The introduction of the LAV III Chassis to the system cannot be done in isolation to the overall weapon. A number of planned upgrades (electric turret drives, zoom-projection optics enhancement, electronics component rehousing, and Primary Power Unit replacement) will have to take place in order to enhance the manoeuvre qualities of the system. Even so, the vehicle must provide guidance to the missile in flight and the vehicle will still need to engage from the halt. Future weapons system enhancements are intended to lead into a system based more upon Non Line of Site (NLS) weapons delivery than Direct Fire (DF)." J.J. Schamehorn, Captain, 4AD Regt, *Memorandum 11000-1 (Adjit)*. Accessed through the Canadian Access to Information and Privacy Act, file number A0109876.

[239] Department of National Defence, *Briefing Note For The Minister Multi-Mission Effects Vehicle (MMEV) Project Update*, 1.

[240] Ibid., 1.

General Hillier, who had now been promoted to the position of Chief of the Defence Staff (CDS), stating: "I'd like it clear that this is essential to getting rid of tank and employing MGS [Mobile Gun System] correctly."[241]

The Multi-Mission Effects Vehicle (MMEV) was officially announced on September 22, 2005. The official press release states that:

> The Canadian Forces are acquiring new, technologically advanced Multi-Mission Effects Vehicles... that will combine anti-tank and air-defence capabilities on one platform. Firing with its non line-of-sight weapons system, the MMEV will be able to engage targets that are hidden behind surrounding landscape features such as hills and buildings.[242]

The press release claims that the MMEV would improve situational awareness by providing around-the-clock surveillance and by sharing intelligence data between vehicles and command posts.[243] It explains that the Canadian Forces worked with Defence R&D Canada and Canadian industry on parts of the MMEV project, and that Oerlikon Contraves Canada was selected for the project because it owns the intellectual property rights to the Air Defence Anti-Tank System (ADATS).[244] Consequently; "There

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[241] Ibid., transmittal sheet. The underlines are in the original writing. The transmittal sheet on the briefing note states: "Sir, enclosed is a briefing note to the MND on MMEV for the CDS's info. This briefing note was requested by the MND Office because there is a possibility that the Major (sic. – likely means Mayor) of St Jean will bring up the subject of the MMEV project with the MND at the luncheon he will be attending in St Jean on 28 Apr. There are indications that there will be Oerlikon executives in attendance." There is a stamp on the transmittal sheet stating "RECEIVED APR 27 2005," with "CDS 2005-007746" filled in in handwriting within it. It is initialled illegibly, but one of the letters in the initial is possibly an "R." Near this is the handwritten comment, in similar writing, with a similar, though not identical, initial. Since the transmittal sheet is signed, it is possible that the handwritten comments were added by Hillier after he received it, indicating that he wanted to the land force to continue this approach in the future. However, the comment may have been added by Caron before the note was sent to Hillier and Graham, in order to reinforce that the land force leadership was still in favour of the DFU. Lieutenant-General Hillier was appointed Chief of Defence Staff on February 4, 2005. For Hillier's appointment as CDS see: Department of National Defense, "News Release Lieutenant-General Rick Hillier appointed new Chief of the Defence Staff," *Department of National Defence Newsroom*, January 14, 2005. http://www.mdn.ca/site/Newsroom/view_news_e.asp?id=1572 (accessed March 21, 2008)

[242] Department of National Defence, "Multi-Mission Effects Vehicle," *Canadian Forces News*, September 22, 2005. http://www.forces.gc.ca/site/news-nouvelles/news-nouvelles-eng.asp?cat=03&id=1767 (accessed September 10, 2010)

[243] Ibid.

[244] Ibid.

is no other missile system integrator in Canada, or abroad, with the requisite expertise."[245] This point illustrates that the land force leadership had been working with other government departments to establish an industrial regional benefits (IRB) rationale for the Multi-Mission Effects Vehicle (MMEV), despite the resistance to the program from the rest of the military capability development and procurement system.

Further details included were that the MMEV operate as part of the Direct Fire Unit (DFU), that the project was valued at up to $750 million, and that 33 MMEVs were to be acquired.[246] The $100 million first phase is stated to have government approval, with smaller contracts and sub-contracts to be announced later.[247] The first phase was expected to provide three prototypes and an initial fleet of six vehicles with interim logistics support, and full production of the MMEV was expected by 2010.[248]

As an approved procurement, the MMEV would be short lived, as the DFU would be effectively cancelled in 2006. However, the series of events from 2002 to 2005 described above were a significant episode in both the land force leadership's bargaining to implement the DFU, and the resistance to it, based primarily on organizational logic, of the artillery and the procurement system.

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[245] Ibid.
[246] Ibid.
[247] Ibid.
[248] Ibid.

The LAV-TOW Under Armour

The least controversial component of the Direct Fire Unit (DFU) was the LAV-TOW Under Armour (LAV-TUA), for two reasons. First, the project was not developmental. The idea of mounting anti-tank rockets on light armoured vehicles had been accepted by military forces for some time, and as seen in Chapter Two, a number of LAV-TUA vehicles had been acquired as part of Canada's original LAV-III purchase. There was no need to create a new capability requirement to acquire such vehicles or modify others with the Tube launched, Optically tracked, Wire data link auto-guided missile (TOW). Second, the infantry controlled the TOW. Although the internal organizational logic of that combat arm indicated to infantry leaders that this was a logical arrangement, it was not a core competence. Rather, the infantry's reaction was one of governmental politics rather than organizational behaviour. Infantry leaders resented transfer of a capability to the DFU. Although infantry personnel would have continued to staff LAV-TUA vehicles in at least the short term, a perceived loss of a capability could have a negative effect on the morale of their soldiers. They also questioned whether the capability development process had been adequately conducted in the DFU plan. However, as the artillery did in the case of the Multi-Mission Effects Vehicle (MMEV), they accepted the dictates of the chain of command.

In February 2004, Colonel David Barr, the Director of Infantry, expressed concern that his Corps had over the planned removal of the TOW-Under Armour (TUA) and the creation of a single LAV-III based TUA anti-armour company in the land

force.[249] He agreed that the infantry could see the logic behind "co-locating" the Mobile Gun System (MGS), Multi-Mission Effects Vehicle (MMEV) and LAV-TOW Under Armour (LAV-TUA) systems in 1 Canadian Mechanized Brigade Group (1 CMBG), but argued that the TOW-Under Armour (TUA) should continue to be manned and operated by infantry soldiers.[250] He stated that the loss of "yet another" support platoon, indicating the TUA capability, and its ramifications on senior Non Commissioned Officer (NCO) career development and opportunities for "varied employment" in infantry battalions would constitute a "serious professional and morale issue."[251] He added to this that there was still "considerable resentment" over elimination of Pioneer and mortar platoons in previous years.[252]

Barr's comments are another example of confusion surrounding the Direct Fire Unit (DFU) plan. Career development opportunities would have continued to exist as the infantry would have manned the LAV-TUA, but operational control and unit training would have been with the DFU. However, infantry leaders may have been suspicious that Armoured Corps personnel would ultimately replace infantry members in manning all DFU vehicles, despite the land force leadership's approach that the DFU was an all arms unit not based on a traditional division of combat roles.

In correspondence on April 8, 2004, Lieutenant-Colonel M.J. Pearson at the Canadian Training Centre (CTC) Infantry School in Gagetown complained that "the doctrine part" of MGS and LAV-TUA organizations: "seems to have been overtaken by

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[249] Colonel Barr, Major General J.H.P.M. Caron, Major General A.B. Leslie, and others, e-mail correspondence, February 18-20, 2004. Accessed through the Canadian Access to Information and Privacy Act, file number A0109908.
[250] Ibid.
[251] Ibid.
[252] Ibid.

events."[253] He adds: "Pity, because the Op [Operational] Research is just gearing up. Perhaps after the wargames in May the structures will be reorganized to include other options. Perhaps not."[254] He also questions whether any Mobile Gun System (MGS) training would remain in Gagetown.[255] Additionally: "it seems to me to be a case of where goeth the MGS, then there goeth the TUA [TOW Under Armour]."[256]

By June, confusion over TUA capability was becoming more widespread in the infantry. An email from an infantry Lieutenant Colonel to Colonel Kampman, the Director Land Strategic Planning (DLSP) on June 29, 2004, asks whether the Chief of Land Staff (CLS) had decided whether all TOW systems would be mounted on armoured vehicles.[257] In another case, a note in May of 2004 from Colonel Grant[258] wonders whether the CLS had given direction on the future of the systems yet.[259] He states that based on previous discussions he had been telling his personnel that a decision had not been made, but that rumours about the fate of the weapons were now becoming disruptive.[260] Apart from unit rivalries, there were planning difficulties relating to the

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[253] Lieutenant-Colonel M.J. Pearson, e-mail to several other Gagetown infantry school officers, and copied to a larger number of personnel both in and outside of Gagetown and both members of the infantry and of other arms, dated April 8, 2004. Accessed through the Canadian Access to Information and Privacy Act, file number A010992.
[254] Ibid.
[255] Ibid. In previous years Leopard 1 tanks had been used for training purposes both in Alberta and at bases in eastern Canada
[256] Ibid.
[257] Lieutenant-Colonel I.R. Creighton, e-mail to Colonel M.D. Kampman regarding the future of dismounted TOW systems, June 29, 2004. Accessed through the Canadian Access to Information and Privacy Act, file number A0109916.
[258] Colonel Grant was, as seen above, commander of 1 CMBG.
[259] Colonel T.J. Grant, e-mail to Colonel M.D. Kampman regarding the TUA, May 21, 2004. Accessed through the Canadian Access to Information and Privacy Act, file number A0109917.
[260] Ibid.

vehicle itself. A LAV-TOW Under Armour (LAV-TUA) logistics support study reported in August 2004 that LAV-TUA fuel consumption was still unknown.[261]

As of August 2004, Kampman was confirming that TOW-Under Armour (TUA) capabilities would be centralized to the Direct Fire Unit (DFU) in western Canada. He indicated that details, including reallocation of equipment, would be issued in December of that year.[262]

Some correspondence during the fall of 2004 indicates continuing uncertainty over whether infantry or armoured personnel would man the LAV-TUA, and what the best organization would be. An Armoured Corps lieutenant colonel, who spoke with technical personnel[263] about the possibility of rotating infantry in and out of Lord Strathcona's Horse [LdSH(RC)] to man the LAV-TUA, reports being told that the technical complexity and costs associated with achieving crew proficiency on the vehicles would "preclude" rapid crew turnover.[264] He also had a positive impression of the LAV-TUA during a live fire exercise.[265] Other discussions over how the role of the LAV-TUA soldier could be professionalized follow the same pattern as those discussed above.

The views of the infantry leaders on the LAV-TUA likely contributed to negative perceptions of the DFU throughout the land force. At best, the program did not garner

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[261] Department of National Defence, *DFS LAV III TUA COY Support Estimate* by R. Dundon (Ottawa: August 11 2004). Accessed through the Canadian Access to Information and Privacy Act, file number A0109912.
[262] Colonel M.D. Kampman, e-mail to Lieutenant Colonel Denne at Land Force Central Area headquarters in Toronto, and copied to others, regarding anti-armour capability, August 3 2004. Accessed through the Canadian Access to Information and Privacy Act, file number A0109915.
[263] Lieutenant-Colonel S.J. Bowes, Commandant Royal Canadian Armoured Corps (RCAC) School, e-mail to Colonel G.J. Maillet and copied to a number of others, November 10, 2004. Accessed through the Canadian Access to Information and Privacy Act, file number A0109919. The email indicates that the technical personnel were working on a LAV-TUA prototype.
[264] Ibid.
[265] Ibid.

any support from the branch. By contrast, the Mobile Gun System (MGS) would continue to be the cause of problems for the land force. The initial delays in the program are dealt with below.

Initial Problems With The Mobile Gun System

The first problems concerning the MGS began immediately after the project was announced and ran into the fall of 2004. The U.S. Army is treated as an indirect actor in this dissertation, but at this point in the series of events from 1992 to 2006 it had a direct clash of organizational logic with the Canadian land force. Ironically, while the indirect American influence had helped to inspire the land force leadership's Direct Fire Unit (DFU) plan, at this point it would actually delay the Canadian program. In addition, the events described in this section show that the U.S. Army's program was encountering unexpected setbacks and taking on the characteristics of trend innovation. Additional specifications were added to the system making it more complex, while originally anticipated benefits of the system, such as rapid global mobility aboard C-130 cargo planes, had become doubtful.

For some time after the acquisition was announced, Canadian planners were unable to obtain detailed information about the MGS from their American counterparts. Correspondence between the MGS Project Director, Major J.A. Atkins, and Canadian Forces (CF) representatives at the Canadian Embassy in Washington, D.C., demonstrates that although MGS acquisition was announced at the end of October 2003, as of February 2004 the U.S. Army had still been unforthcoming about the vehicle's design. As

described by Atkins, all requests for information, both verbal and by other means, had been denied by U.S. Tank-Automotive and Armaments Command (TACOM) and Mobile Gun System Program Management Office (MGS PMO) security advisors.[266] Obstacles were encountered with attempts to have access to operational and user testing.[267]

The Canadian Mobile Gun System (MGS) project team believed that the U.S. Army had initially indicated that it would not have to make formal requests for information, but could instead use existing agreements and accreditations to access material from the U.S. MGS PMO.[268] As outlined by Atkins, Canadian Brigadier General Holt, Director General Land Equipment Program Management, met with American Major General Thompson, the Commanding General Tank-Automotive and Armaments Command (TACOM), to discuss the situation during the winter.[269] As a result of that meeting technical manuals were identified as short term priority requirements.[270] However, Atkins and others came to the conclusion that a formal memorandum of understanding would be needed in order to access test and evaluation reports such as armour tests.[271]

As a result of these problems, Holt wrote a letter formally requesting U.S. Government information in support of the MGS project, dated February 4, 2004. It outlines that the U.S. Stryker MGS was currently undergoing test and development and was expected to enter low rate production in June 2004, and that Canada had approved a

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[266] Major J.A. Atkins, e-mail to Colonel J.L. Holsworth, Canadian Defence Liaison Staff Washington, dated February 6, 2004. Accessed through the Canadian Access to Information and Privacy Act, file number A0109889.
[267] Ibid. Atkins describes these obstacles as "daily issues."
[268] Department of National Defence, *Request For U.S. Government Information In Support Of The Mobile Gun System Project (MGS)* by P.J. Holt (Ottawa: February 4, 2004). Accessed through the Canadian Access to Information and Privacy Act, file number A0109891, p. 2.
[269] Major J.A. Atkins, e-mail to Colonel J.L. Holsworth, February 6, 2004.
[270] Ibid.
[271] Ibid.

procurement strategy to acquire the same vehicle from General Dynamics Land Systems – Canada (GDLS-C).[272] He expressed confidence that most of the technical information required by the Canadian project would become available through General Dynamics Land Systems (GDLS) once contract negotiations were underway and International Traffic in Arms Regulations (ITAR) releases had been obtained.[273] Despite this, he pointed out, the majority of test report and integrated logistics support (ILS) products, such as technical manuals and training material, are U.S. government intellectual property and would require U.S. Army release authority.[274] He also sought a mechanism by which the Canadian and U.S. project teams could discuss project related issues, such as engineering, ILS and operator interfaces.[275] As a result of these requirements and problems with access, he requested negotiation of a formal bilateral agreement for Canadian Army access to Stryker Mobile Gun System (MGS) related intellectual property.[276]

Setbacks continued into March 2004. In correspondence Major Atkins advised Colonel Kampman that requests for information had been refused by GDLS not only because of ITAR, but also because other information was U.S. Army proprietary.[277] This included not only training material and test reports but also pictures.[278] Although stating that "at no time" was GDLS intellectual property an issue, Atkins complains that: "GDLS

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[272] Department of National Defence, *Request For U.S. Government Information In Support Of The Mobile Gun System Project*, 1.
[273] Ibid., 2.
[274] Ibid., 2.
[275] Ibid., 3.
[276] Ibid., 2-3.
[277] Major J.A. Atkins, e-mail to Colonel MD. Kampman dated March 5, 2004. Accessed through the Canadian Access to Information and Privacy Act, file number A0109886.
[278] Ibid.

and the US Army have been playing us back and forth for some time now."[279] He also expressed the opinion that Canadian Treasury Board approval of the sole source contract was holding back progress, but once approval was obtained the Canadian Mobile Gun System (MGS) project would likely acquire greater credibility with the U.S. Army.[280]

Further into 2004, the U.S. MGS program itself encountered difficulty. In September 2004 it was still not ready for low rate initial production,[281] and some correspondence indicated that rumours were circulating that the program was in trouble and might fail.[282] Problems with the vehicle's main gun and questions regarding whether it would actually be C-130 transportable were also raised.[283] In one case, an email containing a U.S. *Inside The Army* article detailing these problems was circulated.[284] Reportedly, the main gun was expected to fire ninety rounds without a system failure, but instead fired fewer than twenty rounds between failures.[285] It had been decided that a clean slate design would be needed.[286] Also, modelling, simulation and infantry school war games had demonstrated that the vehicle had significant drawbacks as designed.[287] The U.S. Army had decided that the MGS required the ability to fire on the move, and that additional armour on the gun pod was needed.[288]

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[279] Ibid.
[280] Ibid.
[281] This was discussed in correspondence between Major L.P. Binette at Directorate of Land Strategic Plans in Ottawa, Major Vince Fagnan with the Canadian MGS project, and other Majors and Colonels in emails dated to October 20 and 21, 2004. Accessed through the Canadian Access to Information and Privacy Act, file number A0110728.
[282] Such rumours were discussed in an email from A. Bolster at the Assistant Deputy Minister (Materiel) Office in Ottawa-Hull to Colonel M.D. Kampman. Accessed through the Canadian Access to Information and Privacy Act, file number A0110812.
[283] Major L.P. Binette, Major Vince Fagnan and others, e-mail correspondence.
[284] Ibid.
[285] Ibid.
[286] Ibid.
[287] Ibid.
[288] Ibid.

These developmental difficulties slowed the Mobile Gun System (MGS) acquisition and demonstrated that the program was more complex than simply putting a tank gun on a LAV-III. However, taken alone they would not have necessarily invalidated the MGS and, more generally, the Direct Fire Unit (DFU) concept. Rather, they became elements in a wider range of concerns, which will be examined in the next chapter.

Conclusion

During 2002-2003, the Canadian land force senior leadership launched a Transformation program which, like that of the U.S., drew its conceptual basis from the RMA, and featured a shift to lighter armoured vehicles as one of its cornerstones. The belief that information superiority and precision weapons could eliminate the need for the passive protection of heavy armour was central in this process. However, U.S. concepts focused on leveraging information superiority which emerged in 1997, such as "dominant maneuver" and "precision engagement," emphasized joint operations. Information was to be passed rapidly between ground, air, space and sea platforms. Could a family of three ground vehicles have constituted a "system of systems" in the sense that *Joint Vision 2010* meant?

Imperatives other than the RMA also drove the senior leaders of the land force. To use Herbert Simon's term, the DFU plan was an example of 'satisficing.' It would have achieved force structure rationalization, by combining the existing Tube launched, Optically tracked, Wire data link auto-guided missile (TOW) and Air Defence Anti-Tank

System (ADATS) weapons systems and modifying them to operate on the LAV-III chassis. In addition, the Mobile Gun System (MGS) was intended to be acquired as inexpensively as possible by leveraging an American program. The land force leadership was also able to claim that the new family of light direct fire vehicles would be more suited to the Canadian context, because they would be politically acceptable to deploy on peacekeeping and peace enforcement missions. Finally, the plan could be used to portray the land force as becoming "agile" and relevant for the 21st century. The Liberal federal government was responsive to such plans and provided rapid approval, making the land force leadership's bargaining position a political success.

However, the attempt to leverage political opportunity to 'satisfice' quickly resulted in clashes of organizational logic with the combat arms and the capability development and procurement system. This was especially apparent in the case of the Multi-Mission Effects Vehicle (MMEV), which would have likely required very complex crew training, would have had difficulties performing its roles optimally, and would have had potential interoperability problems in coalition air defence. Such drawbacks also meant that the MMEV would likely have been a difficult system to develop. Similarly, in the months after the MGS was announced, it became apparent that it also would be a problematic developmental system.

Beyond these difficulties, the Canadian land force was pursuing a shift to lighter armoured vehicles at the same time as the U.S. Army was instead finding on the other side of the world that it was increasingly using heavy armoured vehicles to deal with complex terrain. The following chapter analyzes the Canadian abandonment of the information superiority and light armoured vehicle construct.

Chapter Four
Disassembling The Direct Fire Unit

This chapter shows how the rationale for the Direct Fire Unit (DFU) was increasingly questioned within the Canadian land force during 2004-2005, and ultimately abandoned in favour of a return to main battle tanks during 2006-2007. This took place through three sets of interactions between three of the historical actors, capability development, the land force leadership, and the Armoured Corps, and one of the indirect influences, the U.S. Army. First, capability development studies found that the Multi-Mission Effects Vehicle (MMEV), Mobile Gun System (MGS), and LAV-TOW Under Armour (LAV-TUA) did not truly fit together into a DFU "system of systems."[1] In the case of the MMEV variant, complexities in trying to adapt an air defence system to a combined air defence and ground fire role became a continually greater obstacle. At the same time, opposition to replacing tanks with lighter vehicles increased among Armoured Corps officers. Ultimately, capability development concluded that the DFU would not work as the land force leadership had anticipated, and reached the assessment that it had been developed outside of an appropriate process.[2]

Second, U.S. indirect influence changed. U.S. Army combat experience in Iraq and Afghanistan, and Canadian combat experience in Afghanistan, strengthened the position of tank proponents that the passive protection of heavy armour was neither outdated nor unnecessary. Technological innovations had not facilitated complete

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[1] See the sections "Defining the Technology in this Study" in Chapter One and "Creating a 'System of Systems'" in Chapter Three for detailed explanation of the relationship between the three vehicles in the DFU, and the intention to replace Leopard 1 tanks with the DFU.

[2] This assessment seems accurate and accords with Buck's criticism of the MMEV seen in Chapter Three, as well as with the contrast between the capability development process and the DFU procurement pointed out in this dissertation.

information superiority, and military forces still unexpectedly encountered enemy positions, ambushes and improvised explosive devices. As a result, advocates of tanks could effectively argue that LAV-III based vehicles lacked survivability as compared to heavy tracked vehicles.

Third, the federal Liberal government was replaced by a federal minority Conservative government. The resulting changing political conditions created the opportunity for the land force leadership to resolve the growing problems with the Direct Fire Unit (DFU) by 'satisficing' again, this time with a tank purchase. In 2006 Leopard 2 tanks had become available at a relatively low price, and provided a rapid resolution both to the internal conflict over the DFU in the land force and the new federal Conservative government's interest in maximizing use of existing funds to publicly support the military and address rising Canadian combat casualties in Afghanistan.

The first of the six sections in this chapter, "Criticism of the Mobile Gun System Statement of Operational Requirements," shows that capability development analysts were not unanimous in support of the DFU plan in late 2003 and early 2004. Rather, many pointed out that the studies in the late 1990s and early 2000s recommending replacement of tanks by lighter vehicles had been inconclusive. Divisions became apparent between tank proponents, advocates of the DFU, and those who believed that the land force should refocus investment on different platforms, such as Unmanned Aerial Vehicles (UAVs). The underlying organizational logic of the capability development system emerged, mandating that experimentation to identify a need for, and feasibility of, a new weapons system or set of weapons systems needed to come before the start of an acquisition program.

The second section of the chapter, "Tanks or the Mobile Gun System: The Emotional Debate," illustrates two points. One is growing resistance to the Direct Fire Unit (DFU) among Armoured Corps officers. The second is that the bureaucratic politics in the land force are not limited to a small number of capability development analysts and senior leaders. Rather, middle rank officers began to bargain on behalf of their organizations. In email exchanges and then in articles written for the *Canadian Army Journal*, a number of officers began to argue publicly for the retention of tanks. This demonstrates the pressure that subordinates or subsidiary organizations can effectively exert on leaders to change their bargaining positions. Despite the senior leadership's attempts to declare the "tracks versus wheels" debate "resolved,"[3] significant numbers of land force personnel refused to accept this position as final.

The third section, "Wargaming the Direct Fire Unit," traces further the conflict between the leadership's vision and capability development studies. Additional studies of the DFU during 2004 to 2006 demonstrated that it would likely not work as a "system of systems," but rather as three separate complementary capabilities. Further, as separate platforms the Mobile Gun System (MGS), Multi-Mission Effects Vehicle (MMEV), and LAV-TOW Under Armour (LAV-TUA) proved to have numerous drawbacks.

In the fourth section, "A Changing American Influence: Operation Iraqi Freedom and Operation Enduring Freedom," American tank proponents are seen becoming a new indirect actor in Canadian land force internal politics. Examples of the utility of tanks in U.S. military operations in the Middle East and Central Asia appeared to many in the U.S. Army to bear out the criticisms that the Stryker and Future Combat System (FCS)

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[3] See the section on the Direct Fire Unit Communications Strategy in Chapter Three.

programs were not based on sufficient experimentation made by U.S. analysts such as MacGregor.

The fifth section, "Cancellation of the Direct Fire Unit," shows how 'satisficing' had not worked. The difficulties articulated by the critics of the Direct Fire Unit (DFU) in the land force's combat arms and capability development organizations became increasingly greater impediments to the success of the program. Furthermore, the attempt to leverage the U.S. Stryker Mobile Gun System (MGS) program had generated unexpected costs instead of anticipated savings. As a result, the DFU acquisition began to take on more of the characteristics of typical trend innovation. It was becoming an increasingly expensive attempt to modify an existing weapons system, the LAV-III, for what more and more appeared to be diminishing returns.

The sixth section of the chapter demonstrates that faced with rising costs, delays, and resistance to the DFU within the land force, the senior leadership took the opportunity presented by a change of government to 'satisfice' with a different acquisition program. The minority Conservative government elected in the spring of 2006 was willing to proceed rapidly with new acquisition projects. Also, surplus German inventory of Leopard 2 tanks became available at this time at a price similar to the increasingly costly DFU program. Although the Leopard 2s were used vehicles, they were much newer and in better condition than the land force's Leopard 1s. In 2006 these tanks were the most cost effective solution for addressing the land force's near term concerns.

The final section of the chapter shows that, as of 2008, the debate was not conclusively over. The senior leadership considered plans for further heavy armoured

vehicle purchases. However, the argument that combat experience had proven that tanks were still necessary was not accepted by all in the land force. The idea that Unmanned Aerial Vehicles (UAVs), rather than new direct fire ground vehicles, could be a new critical capability, seen during 2004 to 2006 in some capability development criticisms of the Mobile Gun System (MGS), was still held by some officers. From this perspective, expenditure of large amounts of resources to maintain a fleet of at least 100 direct fire ground vehicles, whether heavy or light, is seen as a possible diversion of resources from this new capability. It is in these terms that both the Direct Fire Unit (DFU) and tanks can be seen as "trend innovation."

Criticism of the Mobile Gun System Statement of Operational Requirement

During late 2003 and early 2004, the MGS Statement of Operational Requirement (SOR) was reviewed by the various sub-organizations of the land force capability development system.[4] These reviews produced a variety of comments, including endorsements of the DFU, but negative assessments were also made. Some were extremely critical of the MGS and, more generally, the DFU. Even a number of approaches generally supportive of the RMA were critical of aspects of the MGS. This resulted from the land force leadership's decision to proceed with the DFU program coming into conflict with the organizational logic of capability development. From the point of view of many capability development personnel, the need for the MGS had not yet been demonstrated.

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[4] As seen in Chapter Two, and on Figure 2-1, these are at the overall level the Land Force Doctrine and Training System, which includes the subsidiary Directorate of Land Strategic Concepts (DLSC), Directorate of Army Doctrine (DAD), and Directorate of Army Training (DAT)

A positive review was produced by an unidentified member of the Director General Land Combat Development (DGLCD) staff, which is the head office of the Land Force Doctrine and Training System. The reviewer agreed with the arguments for the Direct Fire Unit (DFU), and sought more emphasis on the perceived improvements in strategic deployability of the Mobile Gun System (MGS) and linkages to other DFU projects such as the Multi Mission Effects Vehicle (MMEV).[5] Another reviewer, Major John T. Sheahan, of the Directorate of Land Strategic Concepts (DLSC), was fairly neutral. He focused on the Future Security Environment as the threat environment in which the MGS would likely be used, while suggesting that employment of the MGS in a domestic environment was improbable.[6] Lieutenant-Colonel M.B. Boswell with the Directorate of Army Doctrine (DAD) commented that the Future Security Environment would entail conflicts in complex terrain, including urban areas.[7] He felt that the Statement of Operational Requirements (SOR) did not address the "potentially extreme vulnerability" of the MGS to many weapons in complex terrain.[8]

Boswell went on to state that: "Trading off armour protection for high mobility does not work in areas where you do not have high mobility."[9] Regarding armour protection, he was also highly sceptical of an estimate in the SOR that the MGS had good

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[5] Department of National Defence, Director General Land Combat Development, *Combat Development Record Comments 2nd Draft MGS SOR Version 3.1* comments by an unidentified Director General Land Combat Development staff reviewer (Kingston, Ontario: September 2003), 11-12. Accessed through the Canadian Access to Information and Privacy Act, file number A0109893.
[6] John T. Sheahan's review comments in ibid., 1-2.
[7] M.B. Boswell's review comments in ibid., 2. Boswell was a member of the infantry branch of the land force, meaning that he had no direct organizational involvement with tanks, but the infantry is typically the branch that has the leading role in urban conflict. Department of National Defence, Directorate of Land Concepts and Designs, http://www.army.forces.gc.ca/DLCD-DCSFT/bios/staff9_e.asp (accessed February 1, 2011).
[8] Ibid., 2.
[9] Ibid., 2.

resistance to anti-tank mines. [10] He carried armour related criticisms further later in the document, by commenting that: "The word 'protection' is misleading. The MGS [Mobile Gun System] has no protection against the weapons systems that can/will be used against it. Suggest the word 'protection' be deleted."[11]

Turning from armour to views regarding the MGS's strategic and operational mobility, Boswell again made extensive criticisms. He argued that there would be no improvement in global deployability between Mobile Gun System (MGS) equipped units and current (as of 2003-2004) Canadian forces.[12] He commented that while it was factually correct that the MGS would have half the weight of a Leopard 1 C2, this difference did not address the design of aircraft (such as volume of cargo bay) that would be expected to lift it.[13] He was sceptical that half the weight meant that twice as many vehicles could be moved.[14] In addition: "The MGS cannot currently, nor is it expected to be able to, be lifted by CC-130."[15] Finally, he emphasized that in a "cross-country environment" the MGS definitely did not have better mobility than a tank.[16] Overall, he rejected the "very strong implication" in the document that the MGS would be more mobile than tanks.[17]

Despite these concerns he however accepted the Direct Fire Unit (DFU) organization in theory. Expressing his view that the author of the Statement of Operational Requirements (SOR) was having difficulty expressing his point, Boswell writes that: "The old adage that tanks are the best tank killers is, if not old hat, just plain

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[10] Ibid., 3.
[11] Ibid., 3.
[12] Ibid., 2.
[13] Ibid., 3.
[14] Ibid., 3.
[15] Ibid., 3.
[16] Ibid., 3.
[17] Ibid., 3.

wrong. We kill tanks with a lot of systems." He argues that there is "no requirement" to conduct a "symmetrical fight," meaning that Canadian forces do not have to fight enemy tanks with the Mobile Gun System (MGS).[18] Rather, he agrees with the rationale for the Direct Fire Unit (DFU) plan, stating that when opposing tanks attack in ones and twos, Canadian forces will destroy them with "a number of our own systems."[19] Among these he includes the MGS, but also the LAV-TOW Under Armour (LAV-TUA), the Multi-Mission Effects Vehicle (MMEV) and the coalition assets of allied forces.[20] He states that: "We need to express this better in the SOR [Statement of Operational Requirement]."[21]

Despite this marginal endorsement of the overall DFU concept, Boswell's critical approach dominates. He concludes with a reference to a U.S. document, *Stryker Brigades vs Reality of War*.[22] This is a highly politicized document, which demonstrates that the debate over tracked versus wheeled and heavy versus light armoured vehicles in the U.S. was continuing strongly, as seen in MacGregor's comments above at the end of Chapter One.[23] The reference to this document in Boswell's comments demonstrates that

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[18] Ibid., 3.
[19] Ibid., 3.
[20] Ibid., 3.
[21] Ibid., 3.
[22] Ibid., 4.
[23] *Stryker Brigades vs Reality of War* was a report written by defence critic and novelist Victor O'Reilly for U.S. Republican Congressman Jim Saxton in 2003. It severely criticizes LAV-III based vehicles on many counts, including those put forward by U.S. analysts such as MacGregor. O'Reilly states that LAVs are too lightly armoured and vulnerable to Rocket Propelled Grenade (RPG) and machine gun fire, that they are unable to shoot on the move, that they are too heavy to deploy in C-130s, that they are prone to roll-overs, have poor off-road performance, a turning circle too large for urban combat, and so on. In terms of the Mobile Gun System (MGS) specifically, he includes claims that the cannon is too powerful for the chassis and knocks it over, that it does not carry enough ammunition, that the auto loader jams and that the muzzle blast from firing can injure friendly troops. The document presents the somewhat oversimplified thesis that the Stryker was the vision of General Shinseki, who was supposedly too focused on peacekeeping operations, and did not incline toward a favourable view of vehicles more suited to warfighting after the U.S. declaration of the "War on Terror." See: Victor O'Reilly, *Stryker Brigades Versus The Reality of War* (August 22, 2003). The report has been republished online and is still hosted at Globalsecurity as of 2010:

despite the claim in some Canadian policy documents that the "tracks versus wheels" debate "common in U.S. Army circles" had been "resolved" in Canada, at least some Canadian land force personnel were drawn to the U.S. political debate when evaluating their own organization's policies.

Another unidentified Director of Land System Concepts (DLSC) reviewer of the Mobile Gun System (MGS) Statement of Operational Requirement (SOR) expresses concern that the vehicle appears to have "no capacity for improvement."[24] Since the MGS will "be with us for some time," the reviewer states that it must have the ability to be upgraded and also questions why the vehicle will carry only eighteen rounds of ammunition for the main gun, while the Leopard 1 C2 carries 52 rounds.[25] In addition, this person points out that Leopard tanks were deployed not only to Kosovo in the late 1990s but also to Bosnia on Rotation 0 of the Canadian contribution to the Implementation Force (IFOR) earlier in the decade, where the mine rollers that could be attached to the front of the vehicles proved to be a "road proofing" ability.[26] However, endorsing the Direct Fire Unit (DFU) construct, the reviewer criticizes statements suggesting that the MGS is replacing the tank, writing that: "We are transforming the Army. The MGS is a new and different capability. It should be able to stand on its own. We have to get out of the business of replacing combat systems one for one. This is a system of systems approach."[27]

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http://www.globalsecurity.org/military/library/congress/2003_rpt/stryker_reality_of_war.pdf (accessed September 25, 2010)

[24] Department of National Defence, Director General Land Combat Development, *Combat Development Record Comments 2nd Draft MGS SOR Version 3.1* comments by an unidentified DLSC reviewer, 5.

[25] Ibid., 6.

[26] Ibid., 5.

[27] Ibid., 5.

A reviewer, also unidentified, from the Director Land Personnel Strategy (DLPS) office states general agreement with Directorate of Land System Concepts (DLSC) and Directorate of Army Doctrine (DAD) approaches. This reviewer adds that existing force planning scenarios "now seem very dated in light of" Operations Enduring Freedom (OEF), Iraqi Freedom (OIF), and Operation Athena.[28] Taking a pro-Transformation approach, the reviewer complains that these scenarios "perpetuate" the idea that operations can be divided discretely along the spectrum of conflict.[29] Using the phrase popular in the Canadian land force at the time, this reviewer states that the above operations are all "three block wars" where both low intensity and high intensity fighting and humanitarian assistance take place simultaneously.[30]

Members of the Director General Land Combat Development (DGLCD) Operational Research (OR) Team produced one of the most critical reviews. It questions typical RMA/Transformation statements, such as that the Mobile Gun System (MGS) "must operate across the full spectrum of conflict," commenting that there are many weapons systems, such as the Tow-Under-Armour (TOW) systems, which have no clear role in humanitarian operations.[31] Then concern is expressed that wheeled vehicles do not have the same tactical mobility as tracked vehicles.[32] Offering an opposing view to the justification that the Direct Fire Unit (DFU) vehicles will be more compatible with LAVs, it states that: "In one important respect Leo complements LAV, the tracks provide

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[28] Department of National Defence, Director General Land Combat Development, *Combat Development Record Comments 2nd Draft MGS SOR Version 3.1*, comments by an unidentified Director Land Personnel Strategy reviewer, 7.
[29] Ibid., 7.
[30] Ibid., 7.
[31] Department of National Defence, Director General Land Combat Development, *Combat Development Record Comments 2nd Draft MGS SOR Version 3.1* comments by the Director General Land Combat Development Operational Research Team, 7.
[32] Ibid., 7.

greater cross-country mobility... the MGS [Mobile Gun System]... does not complement the LAV's [sic.] by making up for shortcomings."[33]

The argument is made that the MGS can reduce operational flexibility in other ways; it would be vulnerable to even non-"modern" main battle tanks, as well as to "well-armed foreign dissidents" with Rocket Propelled Grenades (RPGs), anti-tank mines and weapons as small as 30mm cannons.[34] This argument is carried further with the observation that over the expected lifetime of the vehicle, more capable threats than these are likely to emerge.[35]

Members of the Director General Land Combat Development (DGLCD) Operational Research (OR) Team express significant concern over the MGS's limitation to eighteen rounds for its main gun.[36] They state that studies of combat in urban environments suggest that numerous targets frequently have to be engaged before resupply is possible, so eighteen rounds "seems far too few for urban operations in particular, and potentially also for operations in open terrain."[37] The main gun's limitation to an elevation of fifteen degrees is also described as "far too unambitious" for urban combat.[38] These perceived shortcomings concern the OR team because: "Given that missile-based systems (e.g., TUA and ADATS [TOW-Under Armour and Air Defence Anti-Tank System]) seem to have limited roles in urban operations and would be kept outside the cities, the MGS may be the only direct fire weapon that could support our troops inside cities."[39]

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[33] Ibid., 7.
[34] Ibid., 8.
[35] Ibid., 8.
[36] Ibid., 8.
[37] Ibid., 8-9.
[38] Ibid., 8.
[39] Ibid., 8.

They sum up this set of criticisms with the comment that: "The material on threat warning seems to have been written without consideration of urban operations."[40] Apart from the above complaints, the OR Team comments that there are "considerable restrictions" in terms of transporting a Mobile Gun System (MGS), or any LAV based vehicle, on a CC-130, and that arguments about the age of the Leopard 1 C2 are not relevant to buying the MGS "now" because a Leopard replacement is not needed until 2015.[41]

Another reviewer from the Directorate of Army Doctrine (DAD), also unidentified, has a similar negative approach, stating that the MGS project "comes across" as "situating the estimate,"[42] meaning that it was trying to make reality fit a predetermined plan.[43] This DAD review suggests that there is a need to be "honest about the relative merits and pitfalls of both eliminating the Leopard C2 from service and introducing the MGS."[44] It recounts the history of Armoured Combat Vehicle (ACV) studies in 1999-2000,[45] emphasizing that it was found that a near-term ACV purchase would lock the Canadian land force into technologies with long term operational interoperability problems with the U.S. Army.[46] The DAD reviewer expresses skepticism that these factors had significantly changed by late 2003.[47] Apart from this historical perspective and commentary on interoperability problems, the review reiterates concerns

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[40] Ibid., 9.
[41] Ibid., 7. Additional comments about transportability on C-130s and other aircraft are made on p. 8.
[42] Department of National Defence, Director General Land Combat Development, *Combat Development Record Comments 2nd Draft MGS SOR Version 3.1*, unidentified Directorate of Army Doctrine reviewer's comments, 9.
[43] According to Canadian Army Captain Andrew Duncan, "situating the estimate" means "fitting the factors to a predetermined plan." Andrew Duncan, interview by author, Kingston, Ontario, 2010.
[44] Department of National Defence, *Combat Development Record Comments 2nd Draft MGS SOR*, comments by unidentified Directorate of Army Doctrine reviewer, 9.
[45] See Chapter Two, pages 166 to 176.
[46] Department of National Defence, *Combat Development Record Comments 2nd Draft MGS SOR*, comments by unidentified Directorate of Army Doctrine reviewer, 9.
[47] Ibid., 9.

about the Mobile Gun System (MGS) lacking armoured protection, carrying only eighteen rounds, lacking tactical mobility, and there being no reason to replace the Leopard 1 C2 at that time.[48] Additional detail on the question of tactical mobility includes the observation that off-road conditions include heavy snow and urban rubble,[49] potentially limiting operation of the MGS in cold climates and urban conflict.

The frequently cited benefit of common logistics requirements for LAV-IIIs and the MGS also comes under criticism in this Directorate of Army Doctrine (DAD) review. It notes that the two vehicles will have significantly different turrets and that the MGS chassis will likely have to be modified in other ways to support its turret, meaning that interchangeable parts will be limited and therefore logistic compatibility arguments may be overstated.[50] It acknowledges that the MGS may have greater operational mobility than a tank in some circumstances.[51] However, it points out that the Canadian Forces' then-current airlift capability consisted of two C-130s at any given time. It then makes a detailed argument that with these limited assets, it would take fifteen days to airlift an entire MGS company into a theatre of operations in Europe or the Middle East.[52] By comparison, it suggests, Leopards could be moved by ship from Montreal to a theatre in

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[48] Ibid., 9-10. The comments on the Leopard 1 C2 are especially interesting: "The fact that the C2 will need to be replaced by 2015 does not explain why it is being replaced now. An additional ten years of service by the C2 could be gained by a far more modest expenditure than that proposed for the MGS. This allows the introduction of a future direct fire replacement around the 2013 mark (allowing two years to introduce the new equipment prior to retiring the C2). Emerging technologies will have matured and the FSE (Future Security Environment) will be better defined. The C2 still has good growth potential and the A5 turret could be up gunned to a 120mmm. Technological advances in DAS, etc. could no doubt be added to the C2 as easily as the MGS. It has been suggested that the O&M cost of retaining the C2 represent a strain on the Army's limited funding. At $18M/FY with a fleet of 114 this cost should be compared in detail to the anticipated cost of running the MGS fleet." A similar comment is made by another unidentified DAD reviewer: "With $600 million for the MGS, $400 million for MMEV V1 (ADATS on LAV), and an unknown amount for TUA conversion we best do this right. After all the LS (land staff) was told last Sep that it only costs $18 million annually to maintain the Leopard fleet."
[49] Ibid., 9.
[50] Ibid., 10.
[51] Ibid., 9-10.
[52] Ibid., 10.

the same area in fifteen to eighteen days.[53] On this subject, the review comes to the conclusion that it is questionable how much more globally deployable the Mobile Gun System (MGS) is in the Canadian Forces' circumstances.[54]

Continuing to advocate for the tank, the Directorate of Army Doctrine (DAD) review discusses the results of simulation trials showing that the LAV-III and Leopard 1 C2 are a "viable operational team," capable of defeating opponents such as a force of BMP-2s and T-72s.[55] It reiterates the Director General Land Combat Development (DGLCD) Operational Research (OR) Team's position that the LAV-III and Leopard 1 C2 have complementary mobility capabilities at the tactical level: "LAV III has the speed, C2 the weight. Where LAV III can not go, C2 can."[56] It also discusses the *Quarré de Fer* wargame demonstrating the drawbacks in tactical mobility and armoured protection of a LAV-III type vehicle with a 105mm main gun.[57] Along with this, it states that: "The ability of the 'system of systems'... to effectively operate during warfighting has not yet been demonstrated."[58] Commenting further on tanks, the review argues that the Leopard 1 C2 deployment to Kosovo was successful and that the tank functioned well

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[53] Ibid., 10.
[54] Ibid., 10. The second unidentified Director General Land Combat Development Operational Research Team reviewer also adds comments on this subject: "In any case a study is needed to see if the limited number of C-130s could move the required vehicles... We cannot simply assume that such an airlift is possible just because the dimensions of the MGS allow it to fit into a C-130. Further, we have OR tools to quickly calculate the number of aircraft (CC130 or other) chalks required..." Department of National Defence, Director General Land Combat Development, *Combat Development Record Comments 2nd Draft MGS SOR Version 3.1* comments by second unidentified Directorate of Army Doctrine reviewer, 15.
[55] Department of National Defence, *Combat Development Record Comments 2nd Draft MGS SOR* comments by first unidentified Directorate of Army Doctrine reviewer, 10. See pages 170 to 173 of Chapter Two detailing those simulations.
[56] Ibid., 10.
[57] Ibid., 10-11. The *Quarré de Fer* wargame is also discussed above on pages 130 and 157 of Chapter Two. Included in this "system of systems" are the LAV-III infantry carrier, the COYOTE Intelligence, Surveillance, Target Acquisition and Reconnaissance (ISTAR) vehicle, the Mobile Gun System (MGS), the LAV-TOW Under Armour (LAV-TUA), and the Multi-Mission Effects Vehicle (MMEV), which it refers to as "MMEVv1" or version 1.
[58] Ibid., 10.

in that environment.[59] The document repeatedly points out that the spectrum of conflict runs in both directions, suggesting that the Mobile Gun System (MGS) is less appropriate for warfighting operations than the tank is for peace support operations.[60] The Directorate of Army Doctrine (DAD) review points out that Canada's "major allies" are revisiting the requirement for tanks after their experiences in Operation Iraqi Freedom.[61]

The DAD review concludes with the statement that the Canadian army has chosen operational mobility at the expense of tactical capability. It adds scathingly to this that:

> There is little point in commenting on the system requirements for this project as it is clearly "the" MGS project not "a" MGS project. This would have been far more valid if other, perhaps tracked options had been considered... This path has most likely been chosen to ensure near term interoperability and to make the deployment of the Army more politically acceptable and thus increase its relevance. What must be done in the process is to ensure that we recognize the impact... Don't use smoke and mirrors. Simply state up front why we have chosen this route...[62]

Three additional reviews, by other originators from the Directorate of Land System Concepts (DLSC), the Director General Land Combat Development (DGLCD) Operational Research (OR) Team, and the DAD follow. Their comments are along the lines of those seen in the last two reviews above. Comments include that C-130 transportability for the MGS is a "shell game" and a "chimera."[63] The results of the *Quarré de Fer* wargame are mentioned again, as are the trials which showed the Leopard

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[59] Ibid., 10.
[60] Ibid., 11.
[61] Ibid., 11. Specific details of this include information that the U.S. Army is considering retaining the Abrams M1A2 until 2025, and Australia is considering the purchase of a main battle tank.
[62] Ibid., 11.
[63] Department of National Defence, *Combat Development Record Comments 2nd Draft MGS SOR* comments by second unidentified Directorate of Army Doctrine reviewer; and Department of National Defence, Director General Land Combat Development, *Combat Development Record Comments 2nd Draft MGS SOR Version 3.1* comments by second Director General Land Combat Development Operational Research Team reviewer, 13-14.

1 C2 and the LAV-III to have complementary capabilities.[64] A comment in the draft of the Statement of Operational Requirements (SOR) that tanks have limited or no utility in "post Cold War" operations is called a "false statement" by the Directorate of Land System Concepts (DLSC) reviewer.[65] Discussing the spectrum of conflict and operations against asymmetric opponents, the reviewer states that: "one could argue that the tank's thicker armour makes it a safer platform for... missions against a View 2 [insurgent] type enemy" with Rocket Propelled Grenades (RPGs) and other hand held missiles.[66] The options analysis is said to be: "almost ridiculously thin and vague... reinforcing the image of a 'situated' estimate."[67] The Directorate of Army Doctrine (DAD) reviewer also accuses the Statement of Operational Requirement (SOR) of "situating the estimate."[68] Both the Director General Land Combat Development (DGLCD) Operational Research (OR) Team and DAD reviewers raise concerns that without the tank's ability to breach obstacles such as walls under fire, or the ploughs and rollers which can be mounted on a Leopard 1 C2, further tactical mobility restrictions will be imposed.[69] Apart from these additional details, the observation that the U.S., British and Australian armies are changing their views on main battle tanks is repeated.[70]

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[64] Department of National Defence, *Combat Development Record Comments 2nd Draft MGS SOR*, comments by second unidentified Directorate Land Strategic Concepts, second Director General Land Combat Development Operational Research Team reviewer, and second unidentified Directorate of Army Doctrine reviewer, 11-15.
[65] Department of National Defence, *Combat Development Record Comments 2nd Draft MGS SOR*, comments by second unidentified Directorate Land Strategic Concepts reviewer, p. 13.
[66] Ibid., 13. "View 2" refers to the NATO division of types of conflict in the Future Security Environment into View 1 and View 2. The Canadian land force used this terminology at times.
[67] Ibid., 13.
[68] Department of National Defence, *Combat Development Record Comments 2nd Draft MGS SOR*, comments by second unidentified Directorate of Army Doctrine reviewer, 15.
[69] Department of National Defence, *Combat Development Record Comments 2nd Draft MGS SOR*, comments by second unidentified Director General Land Combat Development Operational Research Team reviewer, and second unidentified Directorate of Army Doctrine reviewer, 14-15.
[70] Ibid., 14-15.

The manner in which arguments for the Direct Fire Unit (DFU) were borrowed from the U.S. Army approach to Transformation and used to develop a program that would 'satisfice' has been examined in Chapter Three. The reviews in the section above highlight ways in which the DFU model was considered weak, and contain almost entirely the range of arguments that would be used to undermine it. As can be seen, a number of these points involved the continued relevancy of the capabilities of tanks. Views for and against tanks came into conflict frequently, producing a sometimes emotional debate within the land force. An example of this debate is shown below which illustrates the extent of disagreement within the land force officer corps. It also shows that the criticisms of Mobile Gun System Statement of Operational Requirement (MGS SOR) gained wider circulation within the land force, and caused middle rank Armoured Corps officers to become involved in debate which likely affected the bureaucratic politics of their leaders.

Tanks or the Mobile Gun System: The Emotional Debate

A representative debate took place in March 2004, triggered by an article which proposed modifying the Leopard 1 C2 into a close assault tank designed specifically for urban combat. The article, by Matt Fisher,[71] was published on the Canadian-American Strategic Review website. The debate began when Captain Christopher Hunt sent a link

[71] The personnel discussing the subject found that they were unable to find any "direct information" about Matt Fisher, and the author has been equally unsuccessful. The original article is no longer available. He may be the CANWEST journalist Matthew Fisher, but this is unconfirmed.

to Fisher's article to a number of other land force officers.[72] He commented that he was unsure if the modifications to the vehicle proposed in the article were technically feasible, but that he felt that the tactical arguments for such a vehicle were strong.[73] Major Shane Schreiber, at that time with the Director General Land Combat Development (DGLCD) office and also the editor of the *Canadian Army Journal*, thought that it was relevant enough to warrant being republished in the journal.[74] He also asked whether the Leopard 1 C2 tanks were too worn out to be modified, or whether a chassis overhaul would allow them to be reused in such a role.[75]

To this Hunt responded that the land force still had 41 tanks with "thin hulls," seven in "marginal condition," and 66 in good condition.[76] He commented that this would allow for a large pool of spare parts if the army were to establish one squadron of close assault tanks.[77] He argued that a close assault tank would be complementary to the Mobile Gun System (MGS), since it would be able to provide mobile direct fire support to infantry at ranges of less than 1000 metres, a distance, he commented, at which LAV-III based vehicles are very vulnerable.[78] This, he wrote, would allow Canadian land

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[72] Christopher Hunt, e-mail to a number of other land force officers, March 1, 2004. Accessed through the Canadian Access to Information and Privacy Act, file number A0109885.
[73] Ibid.
[74] Shane Schreiber, e-mail to a number of other land force officers, March 1, 2004. Accessed through the Canadian Access to Information and Privacy Act, file number A0109885. (The emails covering this particular instance of the debate over the MGS and tanks is all contained in the same large file.)
[75] Ibid.
[76] Christopher Hunt, second e-mail to a number of other land force officers on March 1, 2004. Accessed through the Canadian Access to Information and Privacy Act, file number A0109885. "Thin hulls" likely refers to the concern in the Canadian land force that the underside or "belly" armour of many Canadian Leopard 1 tanks had been worn thin between the late 1970s and the early 2000s during training exercises and deployments, when it would be scraped over rough and uneven terrain that the vehicles were crossing. Former CDS Rick Hillier discusses this in his autobiography: "The Leopard tank was completing a significant upgrade program, but it remained an old tank, with belly armour that had been scraped over the ground until it was paper thin. We knew we faced major challenges just to keep those beasts running." Rick Hillier, *A Soldier First* (Toronto: HarperCollins Publishers, 2009), 262.
[77] Christopher Hunt, second e-mail on March 1, 2004.
[78] Ibid.

forces to retain the ability to fight through fortified positions defended by obstacle belts.[79] He added that it would not be a stretch of the imagination to envision a scenario in which Canadian troops could become isolated in an urban environment and would need well protected armoured vehicles with heavy firepower to help them break out.[80]

At this point Major D.J. Senft at CFB Wainwright in Alberta, which is an important armoured vehicle training area for the Canadian land force, added that he found the article "quite interesting."[81] He noted that his view was that Leopards should be retained to complement the Mobile Gun System (MGS) capability "with a view to maintaining the absolutely critical capability of crossing contested ground to close with and destroy the enemy (as opposed to "ISTAR"ing [Intelligence, Surveillance, Target Acquisition and Reconnaissance] him into submission!)"[82] He expressed skepticism that the MGS was optimized for fighting in urban terrain, mentioning perceived problems including weak armour, a large turning radius, a long main gun barrel, a problematic recoil effect with the main gun, poor situational visibility and situational awareness for its crew, and external machine guns which could not be fired from inside the vehicle.[83]

Senft also stated that he believed that the land force had a "large number" of Leopard 1A5 hulls in storage that were in good shape. On this point he mentioned that part of the upgrade of Canada's Leopard 1 tanks to the Leopard 1 C2 configuration had involved buying low mileage Leopard 1A5s, removing their turrets, and transferring them

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[79] Ibid.
[80] Ibid.
[81] D.J. Senft, e-mail to a number of other land force officers, March 1, 2004. Accessed through the Canadian Access to Information and Privacy Act, file number A0109885.
[82] Ibid.
[83] Ibid.

to the hulls of existing Canadian tanks.[84] He suggested that there were plenty of useable components with which to make new Leopard based combat vehicles.[85]

He compared the potential of Leopards with the Mobile Gun System (MGS). He claimed that the "birdcage" armour that the U.S. had added to its Strykers in Iraq to protect against Rocket Propelled Grenade (RPG) attacks weighed 5200lbs, meaning that an up-armoured MGS would weigh between 44 000 to 46 000lbs with a full combat load.[86] He implied that this was likely to cause chassis overload and suspension strain.[87] By contrast, he argued, during the deployment to Kosovo it had been proven that a Leopard 1 C2 was "far more capable" of handling the additional weight of add-on armour.[88] His conclusion included the comment that "there is certainly a tactical, operational and strategic role for the venerable Leopard," and referred to the MGS as "defect plagued."[89]

Captain T. Hughes with the Lord Strathcona's Horse [LdSH (RC)][90] largely endorsed Senft's comments, but suggested that it was likely inevitable that all the Leopards would be retired, and that it was necessary to focus on planning for the new Direct Fire Unit (DFU) platforms.[91] Senft responded with more criticism of the MGS, and skepticism about the rationale behind it.[92] He then quoted a number of the

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[84] Ibid.
[85] Ibid.
[86] Ibid.
[87] Ibid.
[88] Ibid.
[89] Ibid.
[90] A Canadian armoured regiment in Western Canada, meaning that Hughes was affiliated with the Armoured Corps.
[91] T. Hughes, e-mail to a number of other land force officers, March 2, 2004. Accessed through the Canadian Access to Information and Privacy Act, file number A0109885.
[92] D.J. Senft, e-mail to a number of other land force officers, March 2, 2004. Accessed through the Canadian Access to Information and Privacy Act, file number A0109885.

Directorate of Army Doctrine (DAD) criticisms of the Mobile Gun System (MGS) seen in the reviews of the MGS Statement of Operational Requirement (SOR) above.[93]

At this point Major Rankin identified himself as one of the DAD reviewers and quoted his own review at length, including the criticism that the MGS project was "situating the estimate."[94] He added that there could be a role for a vehicle like the MGS, but not necessarily "the" MGS.[95] He stated that: "In an ideal world we would have both a MGS like capability and a heavier one... each suited to accomplish particular mission parameters."[96]

Colonel F.A. Lewis with DAD then forwarded the discussion to Colonel Kampman, the Director Land Strategic Planning (DLSP) at National Defence Headquarters (NDHQ),[97] whose position in debates over the Direct Fire Unit (DFU) reflected those of the land force senior leadership headquartered at the same facility. Lewis commented that this type of discussion is healthy in a professional army, and added that: "Face it, in operations when we find something that works better we change our doctrine on the spot and big efforts are made to make sure the rest also know."[98] Kampman had joined in the discussion earlier, stating that he had read the article, and found it "narrow and ill-informed."[99] He argued that the U.S. Army was reporting "good survivability" of the Stryker against Rocket Propelled Grenade (RPG) attacks in Iraq,

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[93] Ibid.
[94] R.C. Rankin, e-mail to a number of other land force officers, March 2, 2004. Accessed through the Canadian Access to Information and Privacy Act, file number A0109885.
[95] Ibid.
[96] Ibid.
[97] F.A. Lewis, e-mail to a number of other land force officers, March 16, 2004. Accessed through the Canadian Access to Information and Privacy Act, file number A0109885. See pages 183 to 184, 231 and 239 to 240 in Chapter Three for more on Kampman.
[98] F.A. Lewis, e-mail March 16, 2004.
[99] M.D. Kampman, e-mail to a number of other land force officers, March 5, 2004. Accessed through the Canadian Access to Information and Privacy Act, file number A0109885.

when equipped with add-on birdcage armour.[100] He added that "even better protection" was planned for Canadian LAV-III based vehicles.[101] He then commented that the U.S. Army was planning to employ Stryker brigades in urban combat, based on the 2003 U.S. Army posture statement.[102] Illustrating the faith of some Transformation advocates in the approach developed by the U.S. Army, he questioned whether the Americans could really have gotten "it all wrong."[103] In a direct response to Lewis' email, Kampman stated that he was not troubled by professional debate, but was concerned that people did not have "all the facts."[104] He wrote that he still perceived: "a lot of 'old think' with respect to how and when we would employ Leopard C2. We should be talking about utility across the spectrum."[105]

Differing opinions concerning a close assault tank seen in personal correspondence above were part of a wider discussion which eventually included articles in the *The Army Doctrine and Training Bulletin.* An article by Senft, "The Medium Gun System is Coming!....Now What?" was published in the fall-winter 2003 edition of the journal. In his article he repeats many of the criticisms of the Mobile Gun System (MGS)[106] seen above, as well as commenting positively on the performance of the Leopard 1 in its Kosovo deployment.[107] He states that "political and strategic

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[100] Ibid.
[101] Ibid.
[102] Ibid.
[103] Ibid.
[104] M.D. Kampman, e-mail to a number of other land force officers, March 17, 2004. Accessed through the Canadian Access to Information and Privacy Act, file number A0109885.
[105] Ibid.
[106] As noted in the section "Defining the Technology in This Study" in Chapter One, the Mobile Gun System was occasionally referred to as the "Main Gun System" or the "Medium Gun System" in some documents, correspondence and articles, but there is no difference in meaning between these names.
[107] D.J. Senft, "The Medium Gun System is Coming!....Now What?" *The Army Doctrine and Training Bulletin*, fall-winter 2003, 26-32.

considerations" were driving the acquisition of the Mobile Gun System (MGS), rather than a practical need.[108] He also quotes an article in the U.S. military journal *Parameters* by a U.S. Colonel, which argues that U.S. operations in Iraq have demonstrated a continued need for heavily armoured direct fire vehicles to engage in close combat in urban areas.[109] The penetration of a U.S. Army armoured column, including large numbers of Abrams tanks and Bradley infantry fighting vehicles, into the centre of Baghdad during Operation Iraqi Freedom in the spring of 2003 is cited as proof that "heavy" forces are not operationally slow or irrelevant.[110] Senft goes on to argue that the Canadian land force's three brigades should retain ten Leopards each alongside thirty MGS vehicles each.[111] He expresses concern that moving to an all light force will render the Canadian army a "niche force" unable to operate across the full spectrum of conflict.[112]

In his article, Senft focuses on the idea that the: "MGS cannot replace a tank."[113] The *Canadian Army Journal*, which had just been renamed from *The Doctrine and Training Bulletin*, published a response by Major J.A. Atkins, the MGS Project Director, in its spring 2004 edition. Atkins focuses on this aspect of Senft's article, presenting the Direct Fire Unit (DFU) approach that the MGS by itself is not intended as a direct replacement for tanks, but rather as part of a system combined with the Multi-Mission Effects Vehicle (MMEV) and LAV-TOW Under Armour (LAV-TUA).[114] However, he

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[108] Ibid.
[109] Ibid.
[110] Ibid.
[111] Ibid.
[112] Ibid.
[113] Ibid.
[114] J.A. Atkins, "The Leopard C2 Is Not A Tank," *Canadian Army Journal*, spring 2004, 111-112.

also expresses frustration with the "mind-numbing" tracks versus wheels debate.[115] Going beyond a description of the role of the Mobile Gun System (MGS) as part of the DFU, Atkins' article is characterized by the argument that the Leopard 1 C2 is unsuited to future land force operations.[116] This is obvious in the title of the article, "The Leopard C2 Is Not A Tank." He writes: "Major Senft continues to perpetuate the myth that the Leopard C2 is capable of armour tasks on the modern battlefield."[117] In response, Atkins posits that the Leopard 1 C2 is as "deficient" in its capacity to engage enemy tanks as the MGS:

> A modern main battle tank is one that can effectively engage high-end threat tanks (e.g. T80/90 mounting a 125 mm gun). All western tanks in this category have a 120 mm gun and weigh more than 55 tonnes. The Leopard C2 is a medium weight vehicle effective in the role of direct fire weapons platforms.[118]

He argues that differences in firepower, survivability and mobility between the MGS and the Leopard 1 C2 are "insignificant."[119] In terms of firepower, he points out that the MGS and Leopard 1 C2 have "virtually the same" main gun.[120] This 105mm gun, he states, can defeat many tanks still used around the world, including the Soviet designed T55, T62 and early T72s, at what he calls "normal" combat ranges.[121] To this he adds that recently designed tanks, such as the T80 or T90, will be engaged by the LAV-TOW Under Armour (LAV-TUA) or the Multi-Mission Effects Vehicle (MMEV).[122] In terms of survivability, he claims that the MGS will have Rocket Propelled Grenade (RPG) protection armour when sent into the field which will provide a

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[115] Ibid.
[116] Ibid.
[117] Ibid.
[118] Ibid.
[119] Ibid.
[120] Ibid.
[121] Ibid.
[122] Ibid.

similar level of protection to the Leopard 1 C2.[123] He emphasizes that the three person crew of the Mobile Gun System (MGS) will put one less person at risk than the four person crew of the existing tank.[124] He also emphasizes the smaller, more compact turret design, the crew being placed lower in the vehicle, as also is the ammunition, as features improving survivability.[125]

Atkins goes into greater depth on the question of mobility. First, he admits that tracked vehicles have better mobility in what he calls "marginal terrain," and perhaps generally better tactical mobility, but he insists that wheeled vehicles have better operational mobility.[126] He states that: "I have not seen any evidence that the difference in mobility between wheeled or tracks is a decisive factor in the outcome of combat operations."[127] This, of course, would contradict some of the studies on future armoured vehicle design in the late 1990s and early 2000s, but Atkins addresses this, calling the *Quarré de Fer* wargame: "...the favourite reference of MGS bashers."[128] He argues that the main comparison in *Quarré de Fer* was between the M1A2 Abrams and a wheeled armoured combat vehicle with a 105mm gun.[129] He states that in one excursion, the wheeled vehicle was given relatively heavy add on armour (enough to stop a 125mm round fired at a range of over 1000m, which he indicates is higher than the level of protection on the Leopard 1 C2).[130] He also cites the finding that the improved armour on the wheeled vehicle was insignificant because it could still be defeated by more

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[123] Ibid.
[124] Ibid.
[125] Ibid.
[126] Ibid.
[127] Ibid.
[128] Ibid.
[129] Ibid.
[130] Ibid.

advanced anti-tank guided missiles, and that it was also still defeated by the T80.[131] His concluding comments are that the Leopard 1 C2 is an "outdated" weapons platform, unsuitable to the anti-armour role that it was originally bought for in the late 1970s, and only infrequently deployed since the end of the Cold War.[132] He reiterates the frequent claim of Direct Fire Unit (DFU) advocates that the Mobile Gun System (MGS) will be deployed more often, and therefore will be a more relevant weapons platform for the Canadian land force.[133]

The above examples illustrate, that despite attempts in the land force leadership's DFU "communications approach"[134] to declare the "wheels versus tracks" debate in Canada "resolved," an emotional debate over retaining tanks quickly surfaced. This debate illustrates that even in a military organization, where members are conditioned to obey a chain of command, public anger over a controversial position taken by the organizational leadership can not be hidden. Less senior leaders, those between the ranks of Lieutenant and Colonel, are not averse to voicing contradictory opinions in such venues as professional journals.

Naturally enough, the debate over the MGS was more intense when coming from members of the Armoured Corps, such as Major Senft, and capability development, doctrine development, and operational research personnel involved with the MGS or other aspects of the DFU project, such as Major Atkins. The debate demonstrates that members of the Canadian land force never necessarily accepted the concept that information superiority would make the passive protection of heavy armour irrelevant, or

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[131] Ibid.
[132] Ibid.
[133] Ibid.
[134] See Chapter 3, pages 195 to 208.

that a need for strategic and operational mobility in the post-Cold War security environment would outweigh the tactical mobility of tracked vehicles. While some may simply have had doubts, others rejected an exalted role for information superiority as much as did U.S. Army personnel, such as the by then retired Colonel Macgregor who, as seen at the end of Chapter Two, claimed that studies of the concept followed a pattern of: "First the verdict, then the trial!"

Wargaming the Direct Fire Unit

During May 3 to May 7, 2004, the Director General Land Combat Development held a wargame seminar in Kingston, Ontario, to simulate the Direct Fire Unit (DFU) and examine its structure and organization. This was followed by Army Experiment 8A, a computer based simulation conducted at the Army Experimentation Centre. These studies endorsed the general Transformation approach, but questioned the DFU organization that was developed during 2002-2003 by the land force leadership. In particular, much of this research suggested that the Mobile Gun System (MGS), LAV-TOW Under Armour (LAV-TUA) and Multi-Mission Effects Vehicle (MMEV) did not work as a "system of systems" as its proponents believed.

The Directorate of Army Doctrine (DAD) summary of the May 3-7 event was that the wargame illuminated many areas where the army "clearly" did not know enough.[135] The participants questioned many of the general catch-all concepts that were part of Canadian land force Transformation and the justification for the DFU. They asked what

[135] Department of National Defence, Director General Land Combat Development, May 3-7 Seminar War Game report/slide show briefing, 3. Accessed through the Canadian Access to Information and Privacy Act, file number A0109841.

does "optimized for urban terrain" mean?[136] How do you measure progress in effects-based operations?[137] More specifically, concerns were raised over whether the mobility, protection and firepower of the Mobile Gun System (MGS) were adequate, and whether it could support a "close fight."[138] Communications difficulties were also identified in urban terrain, because large buildings and other structures interfere with radio communications and block laser communications, such as the laser guided missiles used by the Multi-Mission Effects Vehicle (MMEV). This meant that an older "manoeuvre warfare" system of issuing mission orders, rather than remaining in constant direct contact, would have to be used.[139] This in turn undermined the idea that Direct Fire Unit (DFU) units would be part of a "system of systems" interlinked by constant data flow. Also, reliance on sensors to constantly identify the enemy at a distance was found to be imperfect; a "readily apparent" need for human intelligence was identified.[140]

However, the participants in the wargame were not necessarily critics of Transformation. Rather, they found that Transformation thinking had not progressed far enough. They felt that the land force was not planning to make the best use of "relatively inexpensive" unmanned robotic or sensors systems to scout ahead and look around corners and through doorways.[141] The MGS was criticized as a "legacy system" which "adds little to the battle in complex terrain.[142] Its range and mobility make it adequate for operation in open terrain but it is ill suited for ops in urban terrain where it lacks both

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[136] Ibid., 4.
[137] Ibid., 4.
[138] Ibid., 4. The "close fight" means such things as infantry fighting house-to-house in urban combat.
[139] Department of National Defence, May 3-7 Seminar War Game briefing,, 5. The phrase "urban canyon" is also used. Essentially, large buildings can create significant interference in terms of both line of sight and wireless communications.
[140] Ibid., 6-7.
[141] Ibid., 9.
[142] Ibid., 14.

protection and mobility."[143] The grudging conclusion was that the Direct Fire Unit (DFU) was not a "transformational change for the better," but the land force would make it work "because we have to."[144] The participants were essentially saying that soldiers have to follow the chain of command and this was the system that the senior leadership and politicians had decided on. The LAV-TOW Under Armour (LAV-TUA) was also criticized as a legacy system that adds little to battle in complex terrain.[145] It was suggested that the Multi-Mission Effects Vehicle (MMEV) had the potential to be able to perform the LAV-TUA's missions using precision indirect fire from a distance, which would entail less risk to the vehicle.[146] Precision direct and indirect fire were identified as the primary benefits of the MMEV, and the complaint was made that operation of the system was being "distracted" by what had become a "tertiary" air defence role.[147] The participants emphasized that: "We need to focus on what we want the system to do well," and it was suggested that perhaps MMEVs in a brigade should be divided between those dedicated to direct/indirect fire support, and those dedicated to air defence.[148]

The wargame report outlines further criticism of the DFU. It asks the question: "Is it a system or are they simply complementary capabilities? Do they need to be employed together?"[149] Additionally, consideration was given as to whether the preferred sub-unit mix of four Mobile Gun System vehicles (MGS), two LAV-TUA vehicles, and two MMEVs was appropriate.[150] The other drawbacks of the MMEV, seen

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[143] Ibid., 14.
[144] Ibid., 14.
[145] Ibid., 15.
[146] Ibid., 15.
[147] Ibid., 16.
[148] Ibid., 16.
[149] Ibid., 20.
[150] Ibid., 20.

in Chapter Three, were raised. Could it leave and rejoin an air defence network?[151] Also, could its crew be proficient in both roles?[152] The weaknesses of LAV-based vehicles in obstacle crossing and breaching were also discussed, with the suggestion that perhaps some Leopard chassis with plows and rollers, and a turret with a gun optimized for building demolition, should be retained.[153] Maintenance, and therefore logistical, problems were identified in terms of an all-wheeled fleet; manoeuvre over urban rubble could wear out rubber wheels quickly.[154] Within this criticism, however, is the suggestion that the Multi-Mission Effects Vehicle (MMEV) could become a "transformational, battle winning capability" if the potential of its precision indirect fire capability could be achieved.[155]

The combination of advanced sensors and an engagement range out to 8km[156] within the Direct Fire Unit (DFU), combined with a lack of long-range artillery or missile systems in Canadian brigades, came under criticism.[157] The wargame participants found that while the Canadian brigade structure being modelled with the DFU had the ability to identify and locate the enemy at long ranges, it was unable to engage an opponent under fire at an acceptable range.[158] A requirement for an "integral capability" to engage at ranges over 30km in open terrain was found to be needed.[159] The flip side of this was that, due to the problems identified above, in urban terrain there was "less ability to find

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[151] Ibid., 20.
[152] Ibid., 20.
[153] Ibid., 22.
[154] Ibid., 12.
[155] Ibid., 16 and 26. In the scenarios played out it accounted for one quarter to two thirds of enemy casualties.
[156] As seen in Chapter Three, 8km was the approximate range of the Air Defence Anti-Tank System (ADATS) missile mounted on the MMEV.
[157] May 3-7 Seminar War Game report/slide show briefing, 17-19.
[158] Ibid., 17.
[159] Ibid., 17.

the enemy and much less ability to kill him with precision at any range."[160] The summary of the wargame included the salient remark that: "We are *not* optimizing."[161] With this comment it had become clear that the organizational logic of capability development was then in direct conflict with the land force leadership's intent to obtain acquisition funding from the federal government through 'satisficing.'

Like the May wargame, Army Experiment 8A found that ideally the Multi-Mission Effects Vehicle (MMEV) would operate independently from the Mobile Gun System (MGS) and LAV-TOW-Under Armour (LAV-TUA).[162] It was found that its non-line of sight fire capability was a "transformational attribute," especially if laser designators could be provided throughout the battlefield to guide its missiles.[163] Three MMEV variants were studied: one using a relatively unmodified Air Defence Anti-Tank (ADATS) system, one with laser designation capability, and one with "fire and forget"[164] missiles.[165] The two latter versions were found to be "significantly" more effective, especially the fire-and-forget variant.[166] A Directorate of Army Doctrine (DAD) working group meeting from July 5 to July 9, 2004, came to the same conclusions, although it

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[160] Ibid., 17.
[161] Ibid., 17. Also, on p. 19 it is commented that: "Given the limitations of the DFS, the lack of ability to fully effect the close fight with integral systems, the complete inability to fight the deep battle with integral systems and the reduced size of our force it should be clearly articulated now that in a 'warfighting' scenario the capability that we are able to field at the Bde level is limited to economy of force task such as screening, flank security, rear security and constabulary in open terrain and limited ability to function in complex terrain."
[162] Department of National Defence, Army Experimentation Centre, *Report AEC-R 0401: Army Experiment 8A Multi-Mission Effects Vehicle In The Direct Fire System* by James S. Denford, John Steele, Roger L. Roy, Eugenia Kalantzis (Kingston, Ontario: December 2004).
[163] Ibid., see, for instance, the Abstract.
[164] Fire and forget missiles would be capable of proceeding to a target with precision without continued data feed from the MMEV.
[165] Department of National Defence, *Report AEC-R 0401*, p. i.
[166] Ibid., p. i.

emphasized that significant planning and skill would be needed to use the Multi-Mission Effects Vehicle (MMEV) correctly, operating it from a "considered position" and not exposing it to the enemy.[167]

Further capability development continued to reinforce the themes seen above. An August 20, 2004 DAD briefing on the Direct Fire Unit (DFU) stated that although the Mobile Gun System (MGS) would have an excellent fire control system, its mobility and protection characteristics were still unknown.[168] The LAV-TOW Under Armour (LAV-TUA) was found not well suited to complex terrain.[169] There was also concern that in its initial form as an Air Defence Anti-Tank System (ADATS) on a LAV-III chassis, before further evolution, the MMEV would not work well in complex terrain.[170] Further, doctrine developers saw a distinction between the missile based systems and the MGS, with its tank gun. It reported that DAD believed: "The system is not a system because the MGS complements but does not work closely with the TUA and ADATS."[171]

Similarly, at an Army Combat Development Board Executive Meeting on 6 July 2004 the Director General Land Combat Development (DGLCD) raised the possibility that the migration of the TOW-Under-Armour (TUA) systems from the M113 to the LAV chassis may have been "ill-advised."[172] At the meeting the possibility was

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[167] Department of National Defence, Directorate of Army Doctrine, *Memorandum 11000-1 (Adjit)* by J.J. Schamehorn, January 11, 2005. Accessed through the Canadian Access to Information and Privacy Act, file number A0109876.
[168] Department of National Defence, Directorate of Army Doctrine, *Doctrine For The DFS*, presentation by Lieutenant-Colonel Hunt to 1 CMBG DFS WG 20 Augus 2004. Accessed through the Canadian Access to Information and Privacy Act, file number A0109865, 10.
[169] Ibid., 11.
[170] Ibid., 12.
[171] Ibid., 14.
[172] Department of National Defence, Army Combat Development Board Executive Meeting, *Record of Decision*, July 6, 2004. Accessed through the Canadian Access to Information and Privacy Act, file number A0109840, 2.

considered that the land force might possess too many anti-armour systems.[173] Discussion of this position presumably arose because of the increasing focus on urban conflict.

By end of summer of 2004, the Directorate of Army Doctrine (DAD) had come to the conclusion that the Mobile Gun System (MGS), LAV-TOW Under Armour (LAV-TUA) and Multi-Mission Effects Vehicle (MMEV) did not form a coherent Direct Fire Unit (DFU). Rather, DAD suggested that its component vehicles would work best with other weapons systems in different ways. During a briefing on September 1, 2004, DAD presented the view that despite some overlap between the roles of the MGS and the LAV-TUA, the LAV-TUA and MMEV were primarily complementary to each other in terms of conducting stand-off missile engagements.[174] The MGS, with its 105mm direct fire cannon, and the infantry carrier/support LAV-III, with its 25mm chain gun, were complementary to each other for engaging in the "close fight" in support of the infantry.[175] It was recommended that the "system of systems paradigm" be changed in this manner.

As a result of concerns over the extent to which the three DFU weapons platforms would work together, the DAD conducted a survey in which different force structure options were analyzed. Amongst other considerations, it was stated that the DFU had originally been optimized at the subunit level to take advantage of the different ranges of

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[173] Ibid., 2.
[174] Department of National Defence, Directorate of Army Doctrine, *DF TTP Development Brief to LdSH (RC)* by Chris Rankin, Kingston, Ontario, September 1, 2004, 57 and 63-71. Accessed through the Canadian Access to Information and Privacy Act, file number A0109851.
[175] Ibid., 57 and 63-71.

the available weapons systems against enemy armoured vehicles, but that enemy armour was no longer necessarily the greatest threat.[176]

The first option had an integrated subunit of twelve Mobile Gun System (MGS) vehicles, six LAV-TOW Under Armour (LAV-TUA) vehicles, and six Multi-Mission Effects Vehicles (MMEVs).[177] This was broken down into the originally preferred model of three squadrons of four MGS, two LAV-TUA, and two MMEV each.[178] It was stated that this organization was best from a perspective of logistical sustainment and organization of the maintenance and repair technicians who would keep the vehicles running.[179] However, it was also specified that this would overstretch command and control systems in combat, limiting the vehicles in terms of making the best use of their capabilities, and that it would also not allow for optimal groupings of LAV-TUAs or MMEVs.[180] Option two grouped the vehicles by weapons type: cannon or missile.[181] There would be three squadrons of four MGS each and one squadron of six LAV-TUA and six MMEV.[182] This organization was indicated to have good command and control coordination, but it did not allow for the MMEV to perform any air defence role, and it did not maximize efficiency in other ways.[183] The third option organized the vehicles by capability.[184] In this model there were three squadrons of four MGS vehicles each, one squadron of six LAV-TUA vehicles, and one squadron of six MMEVs.[185] It was

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[176] Department of National Defence, Directorate of Army Doctrine Direct Fire survey, 1. Accessed through the Canadian Access to Information and Privacy Act, file number A0109870.
[177] Ibid., 3.
[178] Ibid., 3.
[179] Ibid., 3.
[180] Ibid., 3.
[181] Ibid., 4.
[182] Ibid., 4.
[183] Ibid., 4.
[184] Ibid., 5.
[185] Ibid., 5.

specified that this organization optimized capabilities and command and control, but required two or three separate echelons rather than working together closely.[186]

The survey results are not available, but the organizational models presented, along with the positive and negative considerations attached to each, illustrate the extent to which the Direct Fire Unit (DFU) construct developed during 2002-2003 by the land force senior leadership was breaking down in 2004-2005.

A Changing American Influence: Operation Iraqi Freedom and Operation Enduring Freedom

While still endorsing Canadian land force Transformation with the comment that: "We must stop defaulting to what we know well,"[187] the August 20, 2004 Directorate of Army Doctrine (DAD) briefing states that the organization was studying Operation Iraqi Freedom (OIF) and Operation Enduring Freedom (OEF) for "some of the answers."[188] It goes on to state that: "What is going on in Iraq right now is a good example of the Contemporary Operating Environment (COE) in terms of the threat (insurgent tactics), environment (urban third world) and culture (religion is a major factor)."[189] Similarly, a report on direct fire field trials states that: "It must be assumed that the Threat will be one that has observed and learned from both past (Gulf War, Kosovo) and ongoing (OEF, OIF) operations. Threat forces will be comprised of both conventional and irregular forces that may work separately or in combination."[190]

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[186] Ibid., 5.
[187] Department of National Defence, *Doctrine For The DFS*, 7.
[188] Ibid., 8.
[189] Ibid., 8.
[190] Department of National Defence, Directorate of Army Doctrine, *Draft 1 DF Field Trials TTP*, 2-1. Accessed through the Canadian Access to Information and Privacy Act, file number A0109858.

These statements explain that enemy tanks were no longer necessarily the primary threat to Canadian armoured vehicles. They also explain the increasing concerns about armoured vehicle performance in the urban "close fight." However, as seen in Chapter Two, it was the U.S. Army that first adopted the idea that information superiority would eliminate the need for heavy armour. What was changing in the American experience? From 2003 on, the U.S. Army's use of heavily armoured vehicles increased, and many studies and journal articles appeared advocating for the continued utility of main battle tanks and heavy armoured personnel carriers.[191]

As mentioned above, a U.S. heavy armoured column led the U.S. Army attack into the centre of Baghdad in what the U.S. military called a "thunder run."[192] One article, based on interviews with American and British soldiers and officers involved in operations in Iraq in 2003, indicated that Abrams and the similar British Challenger II tanks were highly resistant to fire, including Rocket Propelled Grenade (RPG)-7s.[193] Infantry fighting vehicles such as the Bradley were somewhat more vulnerable, but seldom were completely destroyed, with their crews mostly surviving.[194] These forces led attacks into other urban areas as well, with groups of infantry fighting vehicles providing close range fire from their 20-30mm guns when opposing forces got underneath the field of fire of the large guns on the tanks.[195] Furthermore, the tanks successfully conducted their missions of demolishing bunkers, and buildings, and

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[191] Significant examples include: John Gordon IV and Bruce R. Pirnie, "Everybody Wanted Tanks," *Joint Force Quarterly* 39 (October 2005), 84-90; Kendall D. Gott, *Breaking the Mold – Tanks in the Cities* (Kansas: Combat Studies Institute Press, 2006); *Armor* CXVII, no. 5 (September-October 2008) Special Counterinsurgency Selected Works issue.
[192] John Gordon IV and Bruce R. Pirnie, "Everybody Wanted Tanks."
[193] Ibid.
[194] Ibid.
[195] Ibid.

breaching walls so that infantry could enter structures or compounds.[196] The very qualities of the tank that were previously criticized as destabilizing in peace support operations became useful, frequently causing opponents to choose to run rather than remain in the fight.[197]

It was reported that those interviewed used phrases such as "tanks got respect" and "everybody wanted tanks."[198] The logistical demands of tanks turned out to be less problematic than advocates of light armoured vehicles had suggested. The U.S. 3rd Infantry Division reported that, even though the Abrams could still be considered a "fuel hog," its tanks used less fuel than expected.[199] In their article on the subject, retired U.S. Colonel John Gordon IV and senior RAND military researcher Bruce R. Pirnie stated that: "Until recently, the Army envisioned equipping all its forces with medium-weight combat systems. That concept now appears premature... Trying to prevail with one force type would be difficult and unwise."[200] They commented that experience in Iraq showed that situational awareness enabled by digitization did not work as perfectly as expected, especially in urban areas, and that forces with heavy passive protection were still needed.[201] The article states:

> Situational awareness at the tactical level will continue to improve as land forces acquire new systems, such as unmanned aerial vehicles, to reconnoiter before contact. But for the foreseeable future, especially against irregular forces, land forces will still need protection against enemies who go unseen until they detonate a device or open fire.[202]

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[196] Ibid.
[197] Ibid.
[198] Ibid.
[199] Ibid.
[200] Ibid.
[201] Ibid.
[202] Ibid.

This comment accords with the limitations of the RMA and Transformation as suggested by U.S. analysts such as MacGregor The U.S. 3rd Infantry Division itself states in its After Action Report:

> This war was won in large measure because the enemy could not achieve decisive effects against our armoured fighting vehicles. While many contributing factors helped shape the battlespace (air interdiction, close air support, artillery), ultimately war demands closure with the enemy force within the minimum safe distance of artillery. Our armored systems enabled us to close with and destroy the heavily armed and fanatically determined enemy force often within urban terrain with impunity. No other ground combat system currently in our arsenal could have delivered similar mission success without accepting enormous casualties, particularly in urban terrain....Decisive combat power is essential, and only heavily armored forces provide this capability.[203]

As extremely heavy counterinsurgency combat in Iraq continued, the U.S. deployed its tanks into urban battles, including the violent battle in Fallujah in November 2004. In that battle, tanks operated in pairs, covering each other while others remained close behind to provide additional support.[204] Bradley vehicles used similar tactics.[205] Resistance to weapons such as the Rocket Propelled Grenade (RPG)-7 was again noted.[206] Such tactics allowed U.S. armour to avoid the type of defeat inflicted on Russian armoured columns in Grozny in the 1990s, and, in turn, spurred studies on the successful use of tanks in cities during battles from World War II through Vietnam to the 2000s.[207] By 2008, the U.S. Army/U.S. Marine Corps Counterinsurgency Center at Fort Leavenworth, Kansas, was working with the U.S. *Armor* magazine to publish an entire

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[203] Quoted in ibid.
[204] Kendall D. Gott, *Breaking the Mold*, 105-106.
[205] Ibid., 105-106.
[206] Ibid., 105-106.
[207] See ibid.

issue devoted to the use of tanks and other heavy vehicles in counterinsurgency warfare.[208]

From the representative examples cited above, the pattern is clear. After 2003, both the U.S. Army and the academic community with which it regularly interacted, including the RAND Corporation and the Army's various professional and academic journals, were emphasizing the effectiveness of existing heavy armoured vehicle designs. The inspiration for this was from unfolding events during Operation Iraqi Freedom and other U.S. Operations, which in turn influenced Canadian land force doctrine and capability development.

Cancellation of the Direct Fire Unit

The initial problems with the Mobile Gun System (MGS) project in 2003-2004, outlined in Chapter Three,[209] were succeeded by other issues. Internal Canadian land force correspondence indicates that the initial strategy to procure 16 MGS to establish an initial operational capacity, followed by a further 50 slightly more "Canadianized" variants, proved "impractical" as one officer close to events phrased it.[210] The strategy had evolved into one of acquiring all 66 vehicles in one production run.[211] Time pressures were also starting to mount, with concern that if Canada missed the American production run window, the cost of the MGS project could increase by up to $150

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[208] *Armor* CXVII, no. 5.
[209] See Chapter Three, pages 239-243.
[210] Major L.J. Hammond to a number of other land force officers, undated (from the context it is obviously late 2004 or 2005). Accessed through the Canadian Access to Information and Privacy Act, file number A0283192.
[211] Ibid.

million.[212] This was not the only potential cost increase. While the project's funding at this point was at $693 million, various additional survivability enhancements had been identified as necessary which would drive up costs significantly.[213] The cost of Canadianized command data terminals in the vehicles was also found to be more than expected.[214] In addition, the cost of bilingual electronic manuals, which had not been considered previously, now appeared as significant.[215] It was stated that providing bilingual electronics would cost in the range of $50 million alone, since engineering costs were $200 per hour, making it "very expensive" to change even "a few lines of code."[216] These unanticipated problems were reported as having the potential to drive the project cost up to $1.2 billion.[217]

While the Mobile Gun System (MGS) project's problems continued, uncertainty still clouded progress with the Multi-Mission Effects Vehicle (MMEV). On January 20, 2005, Major-General Marc Caron[218] was promoted to Lieutenant-General, and on February 3rd of that year he replaced Lieutenant-General Hillier as Chief of Land Staff (CLS). Hillier was at that time appointed to the position of Chief of Defence Staff (CDS).[219] A letter from Caron to the Vice Chief of Defence Staff (VCDS), dated March 8, 2006, explained that he was halting the movement of elements of the 4th Air Defence

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[212] Ibid.
[213] Ibid.
[214] Ibid.
[215] Ibid.
[216] Ibid.
[217] Ibid.
[218] Caron's earlier career had been as an infantry officer with the Royal 22e Regiment. See: Department of National Defence, "From a young platoon commander to head of the Army," *DND/CF Army News* website, press release February 4 2005 http://www.army.forces.gc.ca/land-terre/news-nouvelles/story-reportage-eng.asp?id=407 (accessed September 23, 2010).
[219] Department of National Defence, Land Force, "New Army commander appointed," Canadian Land Force news site, press release, January 21, 2005. http://www.army.dnd.ca/land-terre/news-nouvelles/story-reportage-eng.asp?id=392&sortOrder=desc (accessed September 23, 2010).

Regiment to the Direct Fire Unit (DFU).[220] Referencing a meeting with the Director General Land Combat Development (DGLCD) on February 20, 2006, and a meeting with the Chief of Defence Staff (CDS) Hillier and the Vice Chief of Defence Staff (VCDS) Buck on March 3, 2006, the Chief of Land Staff (CLS) Caron indicated that the decision had been made to re-orient Canadian Forces ground based air defence capability "towards a less costly and more appropriate solution to meet present and future air defence requirements."[221] Caron further indicated that during the meeting Hillier accepted that the Army should conduct an "in-depth review" of the Multi-Mission Effects Vehicle (MMEV) project from a cost/performance basis.[222] Disentangled from the DFU, the 4th Air Defence Regiment would "continue to generate the essential Air Space Co-ordination Centres (ASCC) for expeditionary operations."[223]

The Canadian land force's changing perceptions of Transformation requirements were driving this shift. Caron requested that Buck advise the Assistant Deputy Minister (Materiel) of these decisions and provide direction on the "most suitable way forward."[224] Caron stated that the need for discussions with the Minister of National Defence and his staff would be "essential," due to "potential political ramifications." He wrote that: "I trust you will manage this issue on our behalf."[225] These comments indicate that the land force leadership was aware of the potentially serious political ramifications of cancelling the MMEV contract with Oerlikon-Contraves Canada, but had determined to proceed

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[220] J.H.P.M. Caron, "Multi-Mission Effects Vehicle (MMEV) And Ground Based Air Defence (GBAD)," letter from the Chief of Land Staff to the Vice Chief of Defence Staff, also distributed to the Chief of Defence Staff and Director General Strategic Planning, March 8, 2006, Department of National Defence. Accessed through the Canadian Access to Information and Privacy Act, file number A0283179.
[221] Ibid.
[222] Ibid.
[223] Ibid.
[224] Ibid.
[225] Ibid.

anyway based on its own studies. The political leadership would have to be brought around to the army's way of thinking. The Direct Fire Unit (DFU) had been created, and subsequently was being cancelled, primarily due to military imperatives.

In a related official letter to Hillier, dated February 20, 2006, Caron summarized the position that had developed regarding the Multi-Mission Effects Vehicle (MMEV). Despite the 2004 wargames (seen above) that established the capabilities of the MMEV as potentially the most transformational, Caron wrote that:

> Since the establishment of the DFU concept, the Army has conducted a number of trials and experiments aimed at refining this potential transformational capability. In concert, a full PRICIE analysis examined the practical implications associated with establishing the unit. These studies revealed that the force structure changes that placed the Light Armoured Vehicle (LAV) Tow Under Armour (TUA) sub-unit within the DFU were sound and they are proving to be very successful. Regrettably the same cannot be said for the... MMEV.[226]

Caron went on to state that the PRICIE[227] analysis had established that the movement of ground based air defence capability to Edmonton would be approximately $40 million, which he called "extremely costly."[228] He also wrote that analysis had revealed that the movement would be "impractical if not impossible" in the short term, since the operational, training and support components of air defence capability were interdependent and would need to be moved at the same time.[229] Infrastructure related work to successfully move the capability in this time frame was expected to take in the

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[226] J.H.P.M. Caron, "Future Of The MMEV And The Direct Fire Unit (DFU)," letter from the Chief of Land Staff to the Chief of the Defence Staff, also distributed to the Vice Chief of the Defence Staff and the Assistant Chief of Land Staff, February 20, 2006, Department of National Defence. Accessed through the Canadian Access to Information and Privacy Act, file number A0283179 (Contained in same file as the previous letter).

[227] PRICIE is an acronym for: Personnel, Research & Development, Infrastructure and Organization, Concepts, Doctrine and Collective Training, Information Management, and Equipment, Supplies and Services. As described by the Canadian Forces Warfare Centre, it is: "a construct employed by the CF Capability-Based Force Development process." http://www.cfd-cdf.forces.gc.ca/sites/page-eng.asp?page=89 (accessed September 27, 2010). Also see Chapter 2, pages 119 to 124.

[228] J.H.P.M. Caron, "Future Of The MMEV And The Direct Fire Unit (DFU)."

[229] Ibid.

range of five years.[230] Caron emphasized that it was his view that the Multi-Mission Effects Vehicle (MMEV) component of the Direct Fire Unit (DFU) was problematic and that "any eventual move must be carefully considered, as the costs are extremely high."[231] These conclusions reflect the complaints raised by the artillery concerning the transfer of Air Defence Anti-Tank System (ADATS) to the DFU seen in Chapter Three.

During winter-spring 2006, two important changes took place which altered the context of planning for the Canadian land force. First, the Canadian government agreed to redeploy the land force's brigade-sized force in Afghanistan from Kabul to Kandahar in the south of the country, where the Taliban insurgency was strongest. The force's task groups went into action in February 2006, placing Canadian troops in a direct counterinsurgency combat role. The result was a rapid rise in casualties. On non-continuous deployments between April 2002 and November 2005, a total of eight Canadian military personnel were killed in Afghanistan.[232] Between March 2006 and May 2006, another eight died.[233] The need to protect Canadian soldiers from improvised explosive devices (IEDs) and other weapons used by insurgents made the continuing analysis of U.S. operations in Iraq appear increasingly relevant to the land force leadership. Second, as a result of a general election, the Canadian Liberal government – which had been in power since 1994, first under Jean Chretien and then under Paul Martin, in the final stages as a minority government – was defeated. A minority Conservative government took over, with Stephen Harper sworn in as Prime Minister on

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[230] Ibid.
[231] Ibid.
[232] Statistics compiled by CBC: Canadian Broadcasting Corporation, "In the line of duty: Canada's casualties," http://www.cbc.ca/news/background/afghanistan/casualties/list.html (accessed September 25, 2010).
[233] Ibid.

February 6, 2006.[234] Liberal Defence Minister Bill Graham was replaced by the Conservative Gordon O'Connor. As a result, there was also a change in political defence priorities.

In his autobiography, Hillier details how additional increases to the defence budget had been made. In 2005-2006, funding had been allocated for a number of projects that the military considered high priority, including replacement of the C-130 Hercules transport aircraft fleet, heavy lift helicopters, a new fleet of transport trucks, and new naval replenishment ships.[235] However, he describes being highly frustrated as a result of a meeting in which he laid out plans to proceed with the purchases but was faced with an indecisive Liberal Cabinet.[236] Concerns were raised about such things as the appearances of spending large sums of money and appearing to be sole-sourcing contracts.[237] This situation, Hillier believes, provided the Conservatives with an opportunity to demonstrate their support of the military without having to find additional money in the federal budget.[238] $13 billion had been allocated to defence, but it had not been spent.[239] He states that: "The Conservatives, on election, were presented with this plum, organized themselves to spend it and branded themselves as the party to support the CF."[240]

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[234] Canadian Broadcasting Corporation, "Harper sworn in as 22nd prime minister," http://www.cbc.ca/story/canadavotes2006/national/2006/02/06/harper-ottawa060206.html (accessed September 25, 2010).
[235] Rick Hillier, *A Soldier First*, 348.
[236] Ibid., 348-349.
[237] Ibid., 349.
[238] Another important component of the federal Conservative political strategy was to brand themselves as the most fiscally responsible party.
[239] Rick Hillier, *A Soldier First*, 349-350.
[240] Ibid., 350.

Hillier recounts that in the spring of 2006 Caron asked him if he was "wedded" to the Mobile Gun System (MGS). He writes that his reply was: "Marc, absolutely not. I'm not wedded to anything."[241] He explains his position on the MGS as the following:

> We had thought that the MGS could deliver an effect nearly identical to a tank if the technology of mounting the cannon on a relatively light vehicle could be made to work. It turned out that it couldn't; we would have had a lightly armoured, wheeled (as opposed to tracked) vehicle with limited mobility, limited armour protection and limited accuracy with its gun.[242]

He simplified his memoirs of the complicated chain of events, but his account shows that in the spring of 2006, as Chief of Defence Staff (CDS), he abandoned the position in favour of the Direct Fire Unit (DFU) that he had held since 2002.[243]

While problems with the MGS were gradually being resolved, the cost of the project, as seen above, was escalating rapidly. At the same time, the problems with the Multi-Mission Effects Vehicle (MMEV) had proven virtually irresolvable. Wargames and doctrine studies had already been undermining the idea that the MGS, LAV-TOW Under Armour (LAV-TUA) and MMEV would effectively work together as a "system of systems." The perceived imminent demise of the MMEV essentially removed the remaining justification for the MGS. The concept that information superiority would eliminate the need for the passive protection of heavy armour was unravelling, and the escalating cost of the DFU projects meant that it might be possible to purchase main battle tanks for a similar amount of money.

The fact that there was unallocated money in the defence budget, and that the Conservatives were already – to paraphrase Hillier – "organizing themselves to spend it," meant that a reversal on armoured vehicle acquisition policy was becoming politically

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[241] Ibid., 408.
[242] Ibid., 408.
[243] The development of Hillier's position in favour of the DFU is described in Chapter Three, 180-182.

easier. The Department of National Defence's share of the federal budget would not have to increase, and the tanks could be portrayed as a necessary purchase for the immediate safety of Canadian soldiers in Afghanistan. The changing perception of the U.S. Army concerning the security environment, the concerns about the Direct Fire Unit (DFU) within a number of capability development organizations, and resistance to the DFU within the land force's combat arms combined with the political shift as the core set of reasons for the reversal.

Email correspondence dated April 21, 2006, originating with Major Vince J. Fagnan, who had replaced Atkins as the Mobile Gun System (MGS) Project Director, reflects the project team's consternation that MGS "misinformation" was being spread in the media as a "test balloon" to gauge public reaction to cancellation.[244] Fagnan complained of one of the reports that: "I am not sure where the article gets its technical information about 'instability and durability problems.'"[245] He claimed that the vehicle had performed well in tests which the MGS Project Management Office had witnessed.[246] He rejected the criticisms that the vehicle could not fire on the move, that it would flip over when it fired over its side, that its armour was too weak, and that it lacked tactical off-road mobility.[247] Just as there had been a communications strategy to sell the DFU to the land force and the public during 2003-2004, perhaps there was now a communications strategy to cancel it.

While the MGS project team still believed in the merits of its vehicle, a Director General Land Combat Development (DGLCD) briefing by Colonel Jim Simms

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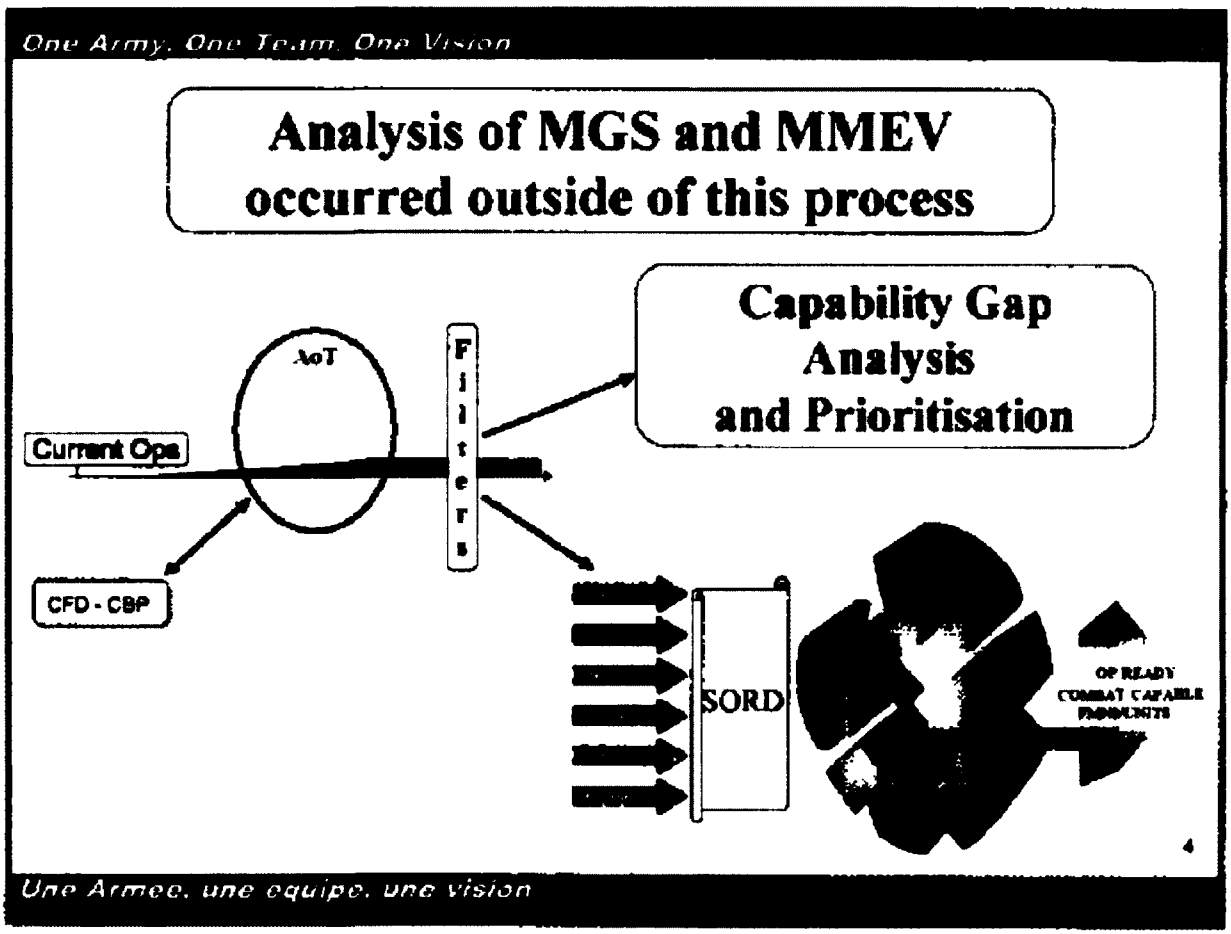
[244] Vince J. Fagnan, e-mail to a number of other land force officers, forwarded by R.T. Steward, April 21, 2006. Accessed through the Canadian Access to Information and Privacy Act, file number A0283201.
[245] Ibid.
[246] Ibid.
[247] Ibid.

recommended the cancellation of the Mobile Gun System (MGS) and the Multi-Mission Effects Vehicle (MMEV). It indicates that analysis of the MGS and MMEV occurred outside of the proper capability development process of identifying a needed future capability to fill a "capability gap" and then planning for procurement accordingly:

Figure 4-1: Analysis of the MGS and MMEV occurred outside of a regular Capability Development Planning Process[248]



[248] Department of National Defence, Director General Land Combat Development, *Recommendations to Cancel MGS and MMEV* by Jim Simms (Kingston, Ontario: undated but from the context must have been produced during the spring of 2006), 4. Accessed through the Canadian Access to Information and Privacy Act, file number A0283169. Higher quality image not available. Compare the graphic to figure 2-1 in Chapter Two: it is in keeping with organizational process established for capability development after 1997 and, more generally, with the Department of National Defence (DND) procurement process illustrated in Figure 2-2.

The image above is another indication that the land force senior leadership's Direct Fire Unit (DFU) plan ultimately conflicted with the sense of organizational logic in a number of capability development organizations. The briefing states that air and sealift initiatives had now eliminated the problem of strategic mobility,[249] implying that if heavy armoured vehicles were to be purchased, they could be transported by whatever means were available, whether sea or air in a contingency. The document demonstrates the changing influence of the U.S. Army with the point that: "Allies have learned that the protection and shock action of a tank is necessary in urban centres."[250] To this is added the comment: "Low tech enemies can escape modern sensors – you need to lead with protection."[251] This changed perception of the extent to which information superiority could be achieved is combined with a changing perception of the Canadian government's political will in conflict: "Kandahar/Fallujah require a different capability set and indications are that Canada will deploy what is necessary."[252]

The briefing claims that Caron, as Chief of Land Staff (CLS), had "overturned" the Multi-Mission Effects Vehicle (MMEV) plan on December 13, 2005,[253] although his letters describing that action were, as seen above, dated February and March 2006. This further demonstrates that the main drive to change DFU plans was coming from within the land force, rather than from government, as the decision was taken before the general election and the implementation of Conservative defence priorities. The briefing reiterates the perceived problems of the MMEV project, that the direct fire construct was not appropriate for the command and control capabilities of the Air Defence Anti-Tank

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[249] Ibid., 8.
[250] Ibid. 8.
[251] Ibid., 8.
[252] Ibid., 8.
[253] Ibid., 10.

System (ADATS) and was ultimately not endorsed.[254] It adds that a precision indirect fire capability could be achieved with another system.[255] On the subject of the Multi-Mission Effects Vehicle (MMEV) the briefing concludes that: "Multi-mission platforms remain a viable concept, but there is significant work that must be completed before they can be employed effectively."[256] The Canadian land force's long interest in MMEVs, dating back to the pre-Air Defence Anti-Tank System (ADATS) versions studied in the late 1990s,[257] was therefore not outright rejected. However, it was lowered significantly in terms of priorities.

Regarding the Mobile Gun System (MGS), it is stated in the briefing that the focus of Canadian land force Transformation had been framed around peace support operations with the Bosnia deployment as an example, and that the MMEV had been intended to offset the limitations of the MGS, but that these factors no longer held true.[258] Instead the position was taken that the Leopard 1 C2 would be the land force's interim direct fire platform, and that work would proceed to determine the "most appropriate solution" for replacing it.[259] The brief concludes with: "Our choices of weapons to meet these critical capability areas will be informed by our evolving understanding of the COE [Contemporary Operating Environment]."[260]

A June 6, 2006 official letter from Caron, as Chief of the Land Staff (CLS), to Buck, as Vice Chief of the Defence Staff (VCDS), recommended cancellation of the

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[254] Ibid., 11.
[255] Ibid., 11. The briefing was possibly referring to the 155mm M777 howitzer, which has a digital fire control system and the capability to use GPS guided ammunition, and which was by this point being purchased by the land force.
[256] Ibid., 12.
[257] These studies of earlier MMEV variants are seen in Chapter Two.
[258] Department of National Defence, *Recommendations to Cancel MGS and MMEV*, 8.
[259] Ibid., 13.
[260] Ibid., 13.

Mobile Gun System (MGS) project. It reiterated the reasons seen above, primarily that advanced intelligence, surveillance and reconnaissance systems could not detect opponents below a certain threshold, and that heavy armoured vehicles were needed in order to survive close engagements against such enemies.[261] Caron stated that the MGS had an "inherent lack of protection and survivability" for operations in complex terrain.[262] He added that: "Frankly, I have more pressing programme demands for the limited capital funds available at this time and recommend against the risk in proceeding with the MGS project."[263] Buck requested that expenditures on the MGS and Multi-Mission Effects Vehicle (MMEV) projects be halted on June 28, 2006.[264] Only one element of the Direct Fire Unit (DFU) survived, although not in the originally envisioned structure of incorporating elements of different combat arms into a new organization. An Army Council briefing dated November 30, 2006 recommended transfer of TOW-Under-Armour systems from the Infantry to the Armoured Corps.[265]

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[261] J.H.P.M. Caron, "Termination of Mobile Gun System (MGS) Project" letter from the Chief of Land Staff to the Vice Chief of Defence Staff, also distributed to the Assistant Deputy Minister (Materiel) and the Director General Strategic Planning, June 6, 2006, Department of National Defence, 1. Accessed through the Canadian Access to Information and Privacy Act, file number A0217434.
[262] Ibid., 1.
[263] Ibid., 2.
[264] R.D. Buck, "Suspension Of Expenditures Related To The Mobile Gun System And Multi-Mission Effects Vehicle Projects And The Air Defence Anti Tank System" letter from the Vice Chief of Defence Staff to Assistant Deputy Minister (Materiel) and distributed to the Chief of Land Staff and a number of other offices, Department of National Defence. Accessed through the Canadian Access to Information and Privacy Act, file number A0283180.
[265] Department of National Defence, Land Force, *AC Decision Brief Force Restructuring – Leo C2 and TUA*. By Colonel Tremblay (no first name provided; possibly Alain Tremblay) (Ottawa: November 30, 2006). Accessed through the Canadian Access to Information and Privacy Act, file number A0283175.

Acquisition of the Leopard 2

In June 2006, Major-General Andrew Leslie[266] was promoted to the rank of Lieutenant-General and replaced Caron as Chief of the Land Staff (CLS).[267] In an email sent to Hillier and a number of other senior officers on August 22, 2006, Leslie recommended deploying Leopard 1 C2 main battle tanks and associated armoured recovery vehicles and armoured engineer vehicles to Afghanistan.[268] He indicated that the office of the Assistant Deputy Minister (Materiel) had been doing "excellent work."[269] Based on this, he stated that: "We have to do something to try and reduce the casualties to our soldiers... we appear to have some of the heavy equipment in our existing inventories that may help save Canadian lives. Let's think about using it."[270] He wrote that a troop[271] of four tanks could likely be ready for deployment by the end of October or early November of 2006.[272] During the fall of 2006 tanks and crews of B

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[266] Andrew Leslie started his military career in the artillery. He then had a succession of field tours with mechanized and airborne units in Germany, Cyprus and Canada. After that, he became Commander of 1 Canadian Mechanized Brigade Group (1CMBG) in Western Canada. As seen in this work, the Armoured Corps was traditionally concentrated in Western Canada, and the Lord Strathcona's Horse [LdSH(RC)] armoured regiment is part of 1 CMBG. As a result, Leslie would also have had familiarity with the organizational logic of armoured units. Department of National Defence, Canadian Forces, "Senior Office Biography Lieutenant-General Leslie A.B., CMM, MSC, MSM, CD," *Chief Military Personnel* website. http://www.cmp-cpm.forces.gc.ca/dsa-dns/sa-ns/ab/soby-vbos-eng.asp?mAction=View&mBiographyID=62 (accessed September 27, 2010).

[267] Ibid.

[268] Andrew Leslie, e-mail to a number of other Land Force senior officers, August 22, 2006. Accessed through the Canadian Access to Information and Privacy Act, file number A0199396.

[269] Ibid.

[270] Ibid.

[271] As noted in Chapter Three, the word "troop" is used to describe a small grouping of armoured vehicles in military terminology.

[272] Leslie, e-mail August 22, 2006.

Squadron, Lord Strathcona's Horse [LdSH (RC)] underwent training preparation for deployment to Afghanistan.[273]

According to Hillier, after the Canadian land force had reassessed the situation regarding direct fire armoured vehicles, Gordon O'Connor, the Defence Minister, asked him if he would support acquiring Leopard 2 tanks, as these vehicles were becoming available as excess inventory as a result of force reductions by various European land forces.[274] On March 30, 2007 a Leopard 2 acquisition scoping meeting took place,[275] and in May of that year a Tank Replacement Project Management Office was set up.[276] On April 30, 2007, O'Connor wrote to the German Federal Minister of Defence with respect to arranging the loan of twenty Leopard 2A6M tanks and two associated armoured recovery vehicles from the German government for operations in Afghanistan.[277] According to the letter, this was based on preceding discussions between the Canadian and German defence ministries. O'Connor wrote that the: "Loan is urgently required by July 2007 as our current tank fleet will not be able to fully function in the upcoming hot summer conditions."

A June, 2007 a fragmentary order marked Secret and distributed to Canadian Expeditionary Force Command, Canadian Operational Support Command, various National Defence Headquarters Offices, as well as other staffs, gave direction regarding

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[273] Department of National Defence, Land Force Western Area, "Lord Strathcona's Horse (Royal Canadians) Train With Leopard C2 Tanks for Afghanistan," by Mike Van den Broek, http://www.army.forces.gc.ca/lfwa/photos_Leopard_tanks.asp (accessed September 28, 2010).
[274] Rick Hillier, *A Soldier First*, 408.
[275] Major Feuerherm, e-mail to a number of other land force officers, March 30, 2007. Accessed through the Canadian Access to Information and Privacy Act, file number A0213134.
[276] Letter from the Vice Chief of the Defence Staff, Lieutenant-General W.J. Natynczyk, to the Assistant Deputy Minister (Materiel), also distributed to the Chief of Land Staff, May 1, 2007, Department of National Defence. Accessed through the Canadian Access to Information and Privacy Act, file number A0283181.
[277] Letter from The Honourable Gordon O'Connor, Canadian Minister of National Defence, to Dr. Franz Josef Jung, German Federal Minister of Defence, April 3, 2007, Department of National Defence. Accessed through the Canadian Access to Information and Privacy Act, file number A0213219.

the deployment of the borrowed Leopard 2 tanks. Under the heading "Situation," it was stated that:

> The Leo C2 has performed well in the current operating environment but it is showing the strain of operating in these conditions. This Frag O will outline the introduction of Leo 2 tanks to reduce the burden on the Leo C2 fleet and to provide enhanced mine blast protection and state of the art precision fires.[278]

Elsewhere in the document it was specified that:

> The safety and protection of CF personnel is an overriding priority for this government and the senior CF leadership. The Leo I has performed well but required more robust crew protection. The Leo 2 with its enhanced armour protection provides close direct fire support and helps mitigate the threat of mines and IEDs and continue (sic.) to ensure that risks of collateral damage are reduced.[279]

These instructions clearly show that the procedure of using heavy passive armour to protect a direct fire vehicle had been fully reasserted, and the RMA inspired Transformation approach of lightly armoured direct fire vehicles, using information superiority to protect themselves, had been fully abandoned.[280]

While plans for acquiring a Leopard 2 fleet proceeded, Mobile Gun System (MGS) long lead items, such as 105mm cannon and breech mechanisms, laser range finders and compact modular sights were declared surplus to requirements.[281] The parts

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[278] Department of National Defence, *FRAG O 010 TO CDS OP O 800 (010/2005) – JTF-AFG LEOPARD 2 INTEGRATION*, by Lieutenant-Colonel P.N. Kelly, J3 Land, and Lieutenant-General J.C.M. Gauthier, 3. Accessed through the Canadian Access to Information and Privacy Act, file number A0214625. A fragmentary order is intended to make changes to existing orders still in effect, indicating changes in the situation, mission and so on.

[279] Ibid., 9.

[280] Essentially, 'hard won' operational lessons had shown that a direct fire ground vehicle still required extensive passive protection. As will be discussed on pages 304-307 below, agreement was not universal. Some believed that entirely different platforms could replace direct fire ground vehicles. Nonetheless, if this category of vehicle continued to be employed, operational experience at this point suggested that it would need to be well armoured.

[281] Department of National Defence, *Briefing Note For ADM(Mat) MGS Long Lead Items – Surplus To Requirements* by Steve McNutt (Ottawa: June 20, 2007). Accessed through the Canadian Access to Information and Privacy Act, file number A0217429.

were to be traded, sold or, if necessary, scrapped.[282] A briefing note for the Assistant Deputy Minister (Materiel) outlining the cancellation stated that under the Conservative "Canada First Vision" for defence:

> ...plans to acquire a lighter weight Mobile Gun System [MGS] as part of the replacement of the direct fire capabilities was cancelled due to the inadequate survivability and mobility of the platform in today's operating environment.[283]

An advice note for the Defence Minister dated May 11, 2007, suggested that if pressed about MGS cancellation the Minister should focus on the key points that: "The nature of security operations is constantly evolving. This demands that strategies and capabilities be constantly assessed and adjusted to meet emerging and future security environments."[284] It advised that the MGS should be described as "simply not affordable" when balanced against other priorities, and that it should be emphasized that the vehicle no longer fitted with Canadian requirements.[285] The note further suggested that, while it could be acknowledged that the MGS was a "capable platform," it should be stated that it would be "irresponsible" to move ahead with the project due to the reasons stated.[286] Regarding the Multi-Mission Effects Vehicle (MMEV), despite the decisions made during 2006, the note provided the explanation that:

> The Multi-Mission Effects Vehicle project is currently under review to ensure that it is in line with our "Canada First" defence strategy. A decision on this particular project has not been made at this time. This government is committed to ensuring that the Canadian Forces have the right mix of equipment to support them in both domestic activities and international operations.[287]

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[282] Ibid., 1.
[283] Ibid., 1.
[284] Department of National Defence, *Advice For The Minister* by Debbie McCosham (Ottawa: May 11, 2007). Accessed through the Canadian Access to Information and Privacy Act, file number A0217430, p. 1.
[285] Ibid., 1.
[286] Ibid., 1.
[287] Ibid., 1.

As the events described above were unfolding, the Canadian government announced the purchase of 100 surplus Leopard 2 tanks from the Netherlands.[288] The announcement on April 12, 2007 noted that two squadrons of approximately twenty tanks each were intended for deployment; while one would operate, the other would be ready for rotation into theatre to allow for the first to undergo repair in depot.[289] Two additional squadrons of twenty each would be used for individual and collective training in Canada.[290] The final twenty vehicles would include recovery, engineer and bridge-laying variants.[291] It was also announced that Canadian industry would have the opportunity to make modifications and upgrades to the vehicles, as well as to bid for long-term service support of the fleet.[292] The terminology of Transformation was not abandoned. The announcement included the statement that: "This acquisition is a further demonstration of Canada's New Government's commitment to renew and transform the Canadian Forces."[293] However, Transformation at this point was no longer based on the RMA inspired idea that emerged in 1997, that information superiority would radically alter the nature of weapons systems such as armoured vehicles. It was instead based on a new opportunity to 'satisfice,' and so fulfill the land force senior leadership's bargaining goals for retention of a direct fire capability.

According to some reports, the purchase of the surplus Leopard 2 tanks cost approximately $650 million, with a further $650 million required for a twenty years

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[288] Department of National Defence, Canadian Forces, "Renewing the Canadian Forces' Tank Capability," http://www.forces.gc.ca/site/news-nouvelles/news-nouvelles-eng.asp?cat=00&id=2252 (accessed September 28, 2010). See also: Department of National Defence, Canadian Forces, "Protection the top priority with tank acquisition, posted April 12, 2007. http://www.admpa.forces.gc.ca/site/news-nouvelles/news-nouvelles-eng.asp?cat=00&id=2251 (accessed September 28, 2010).
[289] Department of National Defence, "Renewing the Canadian Forces' Tank Capability."
[290] Ibid.
[291] Ibid.
[292] Ibid.
[293] Ibid.

service contract to repair and maintain the vehicles.[294] These figures placed the cost of the new main battle tanks in the same range as the estimated $693 million to $1.2 billion cost range that the Mobile Gun System (MGS) program had eventually reached. Furthermore, unlike the cost of the Leopard 2 purchase, the expected cost of the MGS program at this point did not include lifetime support, meaning that the final program cost would have been higher. In the context described by Hillier in which money had been allocated to the defence budget but not actually committed to specific projects, the switch from MGS to Leopard 2 acquisition did not require significant new allocations.

After 2008: The Debate Continues

During the late 1990s and 2000s, in U.S. Transformation, Canadian capability development studies, and the Canadian land force leadership's plans, the future of direct fire support was always framed in terms of armoured vehicles, whether heavy or light. However, as seen in the above sections, some capability development analysts and wargame participants had advocated the development of "relatively inexpensive" unmanned robotic or sensors systems, such as new types of Unmanned Aerial Vehicle (UAV). Such approaches had found that light vehicles such as the MGS were "legacy systems."

The land force leadership continued to work within the armoured vehicle framework. After the pragmatic reallocation of funds to acquire Leopard 2s, the Canadian land force initiated a Close Combat Vehicle (CCV) project, focused on the

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[294] Canadian Press, "Cost of battle tanks double initial estimate, O'Connor reveals," reposted by the Canadian Broadcasting Corporation, http://www.cbc.ca/canada/story/2007/05/17/tanks.html (accessed September 28, 2010).

possibility of acquiring between 108-138 infantry carrier and support vehicles in the 25 to 45 ton range.[295] Although this range overlaps with LAV-III based vehicles at the low end, it opens the possibility of using much heavier vehicles. The 40-45 ton range is equivalent to the Leopard 1, although short of the 60-70 ton range of the Leopard 2. The official justification for the Close Combat Vehicle (CCV) project is that:

> The experience of the CF and that of other nations in operations in Afghanistan, Iraq, Lebanon and other operational theatre (sic.) demonstrates the requirement for a new highly survivable medium-weight... armoured CCV. The threats of mines, Improvised Explosive Devices (IEDs), Explosively Formed Projectiles (EFPs) and anti-armour weapons have proliferated and are likely to be faced in most medium to high-threat missions. A more robust vehicle with both passive and active protection appropriate to the mission will likely be required frequently in the future.[296]

Media reports in late 2008 suggested that one of the platforms examined was the Swedish BAE Systems tracked CV90 vehicle.[297] As of 2011 it was unclear whether this project would proceed. However, it is indicative that the tracks versus wheels, light versus heavy debate, declared as being resolved in the Canadian land force by 2003, had instead come full circle to favouring heavy armoured vehicles over light by 2008.

However, the debate continues. Proponents of light vehicles, heavy vehicles and alternatives to ground based direct fire continue to advocate their views. In an interview with the author, Lieutenant-Colonel Ian Hope expressed continued concern that heavy vehicles would lack the operational mobility – especially the speed and logistical range – of LAV-III based vehicles.[298] Hope, who commanded one of the task forces of the Canadian force deployed to Kandahar in the first half of 2006, Task Force Orion, found

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[295] Department of National Defence, Canadian Forces, "Close Combat Vehicle (CCV) Project," http://www.forces.gc.ca/aete/closecombatvehicleccvproject-projetdesvehiculesdecombatrapprochevcr-eng.asp (accessed September 28, 2010).
[296] Ibid.
[297] David Pugliese, "Canadian Forces Looks At CV90 For New Close Combat Vehicle," *Ottawa Citizen*, November 17, 2008.
[298] Ian Hope, interview by author, Kingston, Ontario, May 2010.

that the rapid road speed of his LAV-III mounted force was a critical factor in conducting effective operations.[299] He found the survivability of the vehicles to be entirely adequate, referencing the accounts in his book, *Dancing with the Dushman*, of LAV-IIIs sustaining heavy enemy fire and improvised explosive blasts and successfully protecting their crews, even when the vehicles became heavily damaged.[300] He felt that money spent on tanks might have been better spent on other projects, such as acquisition of a substantial Unmanned Aerial Vehicle (UAV) fleet which could perform reconnaissance and also provide fire support to rapidly moving ground forces using weapons such as hellfire missiles.[301]

In some respects, Hope's comments reflect some of the observations made regarding the Mobile Gun System (MGS) Statement of Operational Requirement (SOR) in late 2003. One of the Directorate Land System Concepts (DLSC) reviewers commented that in terms of option analysis, what he considered the "situated estimate" for the MGS had failed to consider alternative platforms "whether aerial or vehicle (manned or autonomous)."[302] This illustrates that some members of the Canadian land force have for some time questioned emphasis on direct fire land vehicles, both MGS and tank.

Other views were in the section on the MGS versus tanks debate. As seen there, Major Rankin, one of the Directorate of Army Doctrine (DAD) reviewers of the MGS SOR, commented in early 2004 that ideally the land force would have both a light and a

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[299] Ibid.
[300] See: Ian Hope, *Dancing with the Dushman* (Kingston, Ontario: Canadian Defence Academy Press, 2008).
[301] Ian Hope, interview by author.
[302] Department of National Defence, *Combat Development Record Comments 2nd Draft MGS SOR*, comments by second unidentified Directorate Land Strategic Concepts reviewer, 13.

heavy vehicle mounting a tank gun or weapon of similar firepower.[303] Given the Canadian land force's structure it would be feasible, for instance, to have 1 Canadian Mechanized Brigade Group become a heavy force equipped with Leopard 2 main battle tanks and CV90 tracked infantry vehicles, while 2 CMBG could become a force equipped with LAV-IIIs and Mobile Gun System (MGS) vehicles. However, assuming that the federal government would not allocate funds to maintain two differently equipped brigades, are there other options?

One is seen earlier in this chapter in the comments of the Director General Land Combat Development (DGLCD) Operational Research (OR) Team and one of the Directorate of Army Doctrine (DAD) reviewers on the draft of the MGS Statement of Operational Requirement (SOR). In reference to early 2000s trials they make mention of the LAV-III infantry carrier and Leopard 1 C2 tank being treated as a complementary team at the tactical level. This was based on LAV-III vehicles moving quickly on many surfaces to gain tactical advantage, while tanks would more effectively cross broken terrain with little or no fear of exposure to enemy fire.[304] Both this option, and the one proposed by Rankin, are alternatives to a force based on just one vehicle platform or type.

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[303] R.C. Rankin, e-mail March 2, 2004.

[304] See: Department of National Defence, *Combat Development Record Comments 2nd Draft MGS SOR*, comments by unidentified Directorate of Army Doctrine reviewer, 10. Also see pages 161-162 and 169-174 of Chapter Two detailing those simulations.

Conclusion

A core point from the comments at the end of this chapter is that the LAV-III based Direct Fire Unit (DFU) family of the Mobile Gun System (MGS), LAV-TOW Under Armour (LAV-TUA) and the Multi-Mission Effects Vehicle (MMEV) was not a technologically determined necessity. Neither was a heavy force composed of Leopard 2 main battle tanks and CV90s, although it was based more closely on operational experience than the DFU had been. Rather, both were the result of the governmental politics of the land force senior leadership and the organizational logic of the capability development organizations.

In 2003, for the leadership the DFU was the best near-term option with which to replace existing equipment. As seen in Chapter Three, the leadership at that time saw the DFU as both easily deployable, and more politically acceptable than tanks for peacekeeping missions. Consequently the strategic relevance of the land force would be enhanced both with the Canadian government and public as well as among Canada's allies. In 2006, Leopard 2 tanks were the best near-term option. Allies were now reaffirming that tanks were still important weapons systems in the 21st century, and there was a political need to be seen to be doing something to reduce Canadian casualties in Afghanistan.

For the capability development organizations between 1997 and 2003, then current U.S. Army ideas about the RMA and Transformation were a core concern. Information superiority and a more uncertain Future Security Environment were supposed to drive a need for lighter vehicles with greater mobility. The studies during

that period focusing on lighter future armoured vehicles were a result of the mandate given to the capability development organizations in 1997-98 to make their planning processes more relevant to the concerns of the day. However, when the land force leadership proceeded with the Direct Fire Unit (DFU) acquisition, much of its plan was still notional. The capability development process was not complete when the program was announced. As capability development performed its organizational function of evaluating it, many problems were uncovered with the plan.

The DFU also created discontent within the land force's combat arms. Conflicts between artillery, armoured and infantry officers about who should control what capabilities were numerous and inevitable given the natural human instinct to retain and increase professional expertise under one's own control, rather than lose it to another organization with competing aims and functions. Simply surrendering to the rationale of the chain of command was less palatable than attempting to influence outcomes, as illustrated by emotional articles published in the land force's professional journal. The DFU was ultimately abandoned, and an opposing, heavy force construct was created. The implications of this series of events for methodological models of organizational behaviour, governmental politics and trend innovation are suggested in the following conclusion to this work.

Conclusion

Governmental Politics, Organizational Behaviour and Trend Innovation in Armoured Vehicle Design

This dissertation has concluded that it was primarily internal politics within the Canadian land force that drove the reversal of its armoured vehicle acquisition policy in 2006. It was primarily bargaining for limited funds that caused the land force senior leadership to develop the Direct Fire Unit program (DFU) in 2003. An opportunity to use limited funds more effectively, combined with operational experience which undermined confidence in the survivability of lightly armoured direct fire vehicles, led to the subsequent cancellation of the DFU in favour of acquisition of Leopard 2 main battle tanks in 2006. Bargaining also took place on a number of other levels. While the leadership sought to make the land force more strategically relevant to the federal government, the Canadian public, and its allies, it also sought to bargain internally with subordinate land force members. It pursued a DFU 'communications strategy' to convince them that the plan was 'transformational' and would result in improvements in capabilities. Elements in the land force made counter-arguments of their own, rather than simply acquiesce to the guidance of the chain of command.

However, the governmental politics of the land force leadership came into conflict with the organizational logic of its combat arms and capability development system. In particular, the Artillery branch had severe concerns with the plan to reassign the Air Defence Anti-Tank System (ADATS) to a combined direct ground fire and air defence weapon system on the Multi-Mission Effects Vehicle (MMEV). Many in the Armoured Corps felt that light direct fire vehicles would lack the survivability and off road tactical mobility of tanks. Infantry leaders resented transferal of the TOW-Under Armour (TUA)

capability to a new organization outside of their operational control and worried about the effects on the soldiers' morale. Most significantly, the capability development system was unable to adequately demonstrate that the Direct Fire Unit (DFU) was needed, and ultimately concluded that, since the program had been developed outside of accepted planning procedures, it should be cancelled. The organizational logic of the Department of National Defence (DND) procurement system within which the land force capability development system operated also came into conflict with parts of the DFU plan, once again because standard steps in the capability development and acquisition process had not been followed.

Within the federal government, the Minister of National Defence (MND) and, more generally, cabinet, inevitably are direct actors on major military procurements. Political leaders hold the ultimate power to approve projects, and to set levels of defence spending. However, for much of the period between 1997 and 2003, the Canadian federal Liberal government only indirectly affected land force armoured vehicle planning. It did so through its general approach of appearing to favour greater emphasis on peacekeeping operations and limited military spending. While the federal government increased funding to the Canadian Forces (CF) after 2000, it was hesitant to commit to expensive acquisition programs through to 2005. However, Liberal MND John McCallum collaborated closely with the Chiefs of Land Staff (CLS), first Lieutenant General Jeffery, then Lieutenant General Hillier, to facilitate the DFU plan during 2003.

Later, the minority Conservative government, which came to power in early 2006, placed greater priority on combat operations in Afghanistan and was willing to commit to spending funds which the previous government had allocated to defence but not yet

committed to specific projects. This political shift changed the type of acquisitions the land force leadership felt able to recommend. While bargaining for purchases of tanks was unlikely to succeed under the Liberal government because of the political perception that tanks were not relevant to peacekeeping operations, such a position was treated favourably by a minority Conservative government.

Other influences external to the land force also became de facto actors in this internal conflict. The U.S. Army exerted a strong foreign influence on the Canadian land force. As a result of policy changes in the U.S. during 1996-97, a number of concepts flowing from interpretations of the RMA were adopted by the U.S. Army. Among them was the belief that achieving information superiority, and using it to apply precision firepower, would greatly increase overall force protection. As a result, vehicles would not need the passive protection of heavy armour. The U.S. Army also incorporated into its planning predictions of a chaotic global future security environment which would drive a need for more mobile and rapidly deployable weapons systems. Between 2003 and 2006 the number of members of the U.S. Army rejecting these positions grew, and the view that heavy armoured vehicles had continued relevance in combat operations gained support. The Canadian land force capability development organizations were affected by both shifts in the perceptions of their larger ally.

The academic community also had influence. U.S. military and academic analysts in organizations such as the U.S. Office of Net Assessment together generated ideas about implications of the RMA which were adopted by the U.S. Army in the 1990s. The Canadian land force as well organized conferences in the 1990s designed to encourage the exchange of ideas about RMA between academics and military personnel.

The chapters demonstrate the interactions between these major historical actors and indirect influences over three main historical periods within the overall period of 1992 to 2008. Chapter One demonstrates the emergence of the RMA as an academic theory which strongly influenced military forces by the end of the 1990s. In the academic discourse which developed following Andrew Krepinevich's 1992 Office of Net Assessment study, strong supporters of the significance and benefits of the RMA argued that information technology would allow the creation of 'systems of systems,' which could be used to facilitate information superiority and precision firepower. The U.S. Joint Chiefs of Staff endorsed variants of these views in 1996-97, in particular with *Joint Vision 2010*, and the U.S. Army subsequently adopted them in *Army Vision 2010*, the *Army After Next* program, and Transformation. In 1999, the U.S. Army leadership announced a plan to 'Transform' the Army, which included transition of a number of units to near-term Interim Brigade Combat Teams (IBCTs) based on light armoured vehicles, and a long-term Future Combat System intended to ultimately replace all remaining heavy vehicles, including main battle tanks. The LAV-III was subsequently chosen as the platform for the IBCTs and development started on ten variants, which were collectively called the Stryker, with the IBCTs becoming Stryker Brigade Combat Teams (SBCTs).

As shown in Chapter Two, the Canadian land force during the 1990s was heavily constrained by limited defence budgets, while it was also under pressure from a high tempo of peacekeeping and peace enforcement operations. These circumstances led its leadership to reorganize the land force's capability development organizations, providing them with a mandate to develop plans that would be relevant to present and future

Canadian operations. The RMA was specifically discussed during meetings of the senior leadership as one of the issues that the land force had to respond to and study in detail. Concern also emerged that the land force would lose interoperability with the U.S. Army if the Americans pursued the RMA but the Canadian land force did not do so. 1997 was therefore a year separating two historical periods. Before it, the RMA was primarily an academic theory, but after, RMA became a military concept leading to Transformation programs in both the U.S. Army and Canadian land force.

Chapter Two also demonstrated how, in 1998, the overall command of the Canadian Forces organized studies of the RMA and then endorsed it in 1999 in *Shaping the Future of the Canadian Forces: A Strategy for 2020.* Just as *Joint Vision 2010* had led the U.S. Army to adopt the RMA, *Strategy for 2020* led the Canadian land force leadership to describe a need for an "agile," medium-weight army in the 2002 *Advancing With Purpose: The Army Strategy.* In this situation, the Canadian land force's capability development organizations studied and ultimately adopted many aspects of the American interpretation of the RMA and Transformation. The Canadian studies partly endorsed for the American concept that information superiority would provide force protection. They also, on occasion, framed arguments for light armoured vehicles in terms of specific Canadian concerns about acquiring weapons systems and developing organizational structures fitted to peacekeeping operations. Nonetheless, as of 2003 the capability development system did not conclude that Canada's Leopard-1 tanks needed to be replaced before 2010.

The second period began in 2003, when the Canadian land force launched a Transformation program based on light armoured vehicles, while the U.S. Army launched

Operation Iraqi Freedom (OIF). The resulting counterinsurgency campaign, combined with ongoing conflict in Afghanistan, provided examples of combat experience which strengthened the positions of American tank advocates. There is an element of historical irony that plans for light armoured vehicles gained temporary ascendance in Canada at the time that tanks began to regain relevance in the American perceptions. These opposing trends characterized the third historical period from 2003 to 2006.

Chapter Three showed how by 2002-2003 the land force leadership perceived a threefold crisis. The land force was still stretched thin because of operations, and concerns continued about loss of strategic relevance as viewed by the federal government and allies. Also, the rate at which older equipment was wearing out appeared to leaders such as Lieutenant-General Rick Hillier to be likely to exceed the rate at which replacement equipment could be procured. However, moderately increasing defence budgets after the year 2000 were a cause for optimism, and the leadership was able to gain political support for its plans from the Liberal Minister of National Defence (MND) John McCallum. As a result, the land force leadership had incentive to improve the land force's bargaining position. It sought to launch acquisition programs which would allow rationalization of existing inventories of weapons systems and which could also be portrayed as suitable for peacekeeping operations. Combined with these efforts, it also wanted new weapons systems which would be seen as transformational, and therefore could be used to portray an increasing relevance for the land force. A Direct Fire Unit (DFU) family combining three types of LAV-III based vehicles, one mounting a tank

gun, one mounting a Tube launched, Optically tracked, Wire data link auto-guided missile (TOW) system, and one mounting an Air Defence Anti-Tank System (ADATS) missile system, fitted these goals.

For a variety of reasons shown in Chapter Three, the Direct Fire Unit (DFU) appeared to satisfy the leadership's bargaining goals, leading to announcement of the program in 2003. Given that the Canadian land force already operated LAV-III infantry carriers and various LAV-II vehicles, it seemed that the DFU offered the opportunity to leverage the land force's existing experience with such vehicles and inventories of spare parts. As the U.S. Army had begun acquiring LAV-III based Strykers, the DFU family also appeared to fit with the goal of maintaining interoperability with U.S. forces, despite stated intent by the U.S. to eventually replace its Strykers with Future Combat System (FCS) vehicles. Furthermore, the U.S. plan to develop a Stryker Mobile Gun System (MGS) seemed to present an opportunity to leverage production of that vehicle for Canada at a reduced price. Rationalization of equipment inventory also appeared possible through the transfer of the TOW system from the Infantry to the DFU, and the ADATS from the Artillery to the DFU. By placing these units together with the MGS, the DFU would have had a combined strength of armoured direct fire ground vehicles slightly greater than the Armoured Corps had. Such changes were intended to allow for the retention of a ground based heavy direct fire capability and avoid the appearance that the number of personnel and armoured combat vehicles in the land force were being reduced. Finally, the DFU could be portrayed as less 'destabilizing' in peace support

operations than tanks. The land force leadership initiated the program because it was the first alternative that seemed good enough in the circumstances.[1]

Chapter Three also examined how the senior leadership anticipated resistance to the Direct Fire Unit (DFU) plan within the land force, and tried to 'sell' it with a communications plan. Despite this, criticism emerged from the Artillery and Infantry, both of which saw potential losses of assets to the Armoured Corps, and from proponents of tanks within the Armoured Corps. In addition, as described above, conflicting organizational logic came to hamper elements of the program, especially in the case of the Multi-Mission Effects Vehicle (MMEV). The Artillery doctrine for use of the Air Defence Anti-Tank System (ADATS) did not fit with the increased direct ground fire role envisaged for it in the leadership's DFU plan. Organizational conflict with U.S. Army policies on sharing information also impeded the Canadian land force's procurement process for the Mobile Gun System (MGS).

Chapter Four traced the culmination of these problems. Resistance to the DFU increased further, as members of the land force's combat arms began to bargain on behalf of what they perceived as the interests of their branches. Capability development analysts also questioned the DFU. The land force leadership had announced an acquisition program before standard capability development and procurement procedures had been undertaken, such as defining a need in a Statement of Operational Requirement (SOR). This chapter shows the influence of change in the U.S. Army's view of tanks on the Canadian land force. It illustrated how the political change in the Canadian federal government in early 2006 created an opportunity to abandon the DFU and the problems associated with it, and instead to acquire Leopard 2 tanks. It demonstrated that the

[1] To use Herbert Simon's term, it 'satisficed.' See the Literature Review, page 31.

Leopard 2 purchase was also, in different ways, a result of taking the first near term option that appeared to be good enough.

Chapter Four also demonstrated that, for some advocates of the RMA and Transformation, light armoured vehicle programs had not gone far enough. They viewed the Direct Fire Unit (DFU) Mobile Gun System (MGS) as a "legacy" system, similar to a tank. For them, true military 'transformation' would include acquisition of new autonomous systems, such as Unmanned Aerial Vehicles (UAVs), rather than trend innovation along the lines of existing armoured unit organizations[2] and categories of ground vehicles. Their reasoning, while speculative, might have provided a basis for experimentation with significantly different force structures, as opposed to the DFU program, which was presented by the land force leadership as transformational before capability development studies had demonstrated whether or not it was viable.

The sequence of events described in the chapters above indicated why the Canadian land force pursued the DFU program to replace its Leopard 1 tanks, only to acquire Leopard 2 tanks. However, as described in the Introduction and Literature Review, these events also raise questions about the RMA. As seen in Chapter One, in the 1990s advocates of the RMA and Transformation argued that the emergence of information technology would allow the creation of completely new weapons systems and military capabilities. Ultimately, however, the DFU program, which was supposed to showcase Canadian land force Transformation, and then the following Leopard 2

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[2] Although the DFU was supposed to be an "all arms" organization, the fact that DFU assets were to be centred in western Canada, with the Lord Strathcona's Horse (Royal Canadians) [LdSH(RC)] becoming the DFU brigade, suggested that the land force leadership was not straying far from traditional Armoured Corps organization. Also, as seen in Chapter Three, the original plan to create DFU troops of eight vehicles, which could be combined into traditional Armoured Corps groupings of two troops plus three headquarters vehicles for a squadron of 19, or three troops of vehicles plus two headquarters vehicles for a reconnaissance squadron of 26, also suggests that the traditional Armoured Corps structure was being retained.

purchase, came to resemble 'trend innovation.' Why did this happen? In the next two sections both this secondary question, and the methodological consequences of this study, are discussed.

The RMA, Trend Innovation and 'Satisficing'

As argued above, for Mary Kaldor trend innovation has both a military and an industrial component. In her model, established economic interests and military organizations together create industrial inertia. As seen in Chapters Three and Four, the senior leadership and capability development organizations often placed more apparent focus on factors other than Canadian industrial concerns in their planning documents relating to the Direct Fire Unit (DFU). That the LAV-III was built in London, Ontario was a political convenience for the land force. This was also true of the likelihood that integrating the Air Defence Anti-Tank System (ADATS) with the LAV-III to create the Multi-Mission Effects Vehicle (MMEV) would create jobs at the Oerlikon-Contraves branch in Quebec. However, although decision makers may have been influenced by industrial interests more than records suggest, such interests did not drive decisions. Instead, the Canadian land force cancelled the MMEV even when it considered that there was potential for "political ramifications."[3] Furthermore, as described in the introduction, the DFU vehicles were not designed to be superior to main battle tanks in all ways. They had far less passive armour protection, because they were intended to rely on achieving information superiority and then use it to direct precision fire, which would have the effect of providing force protection. Yet, by 2006, capability development was

[3] See Chapter 4, p. 285.

questioning whether the vehicles would work together as a 'system of systems;' problems increased, and the cost of the Mobile Gun System (MGS) steadily rose towards the price of a main battle tank.

In this case, trend innovation happened without a significant industrial component because of the process that Herbert Simon has called 'satisficing.' As described in Chapters Three and Four, the land force leadership pursued what appeared to be the best near-term option, both in 2003 with the DFU, and in 2006 with the Leopard 2 tank. Focus on near-term concerns by an organization's leaders, budget limitations, and uncertainty about pursuing potentially drastic organizational changes too quickly all help constrain the extent of change that is deemed feasible. In the Canadian case, it was this set of constraints which limited change to an evolutionary rate generally and in particular reinforced trend innovation in armoured vehicle design. However, this outcome raises another question: was it organizational behaviour or governmental politics that was most significant in driving the land force leadership to 'satisfice?'

Organizational Behaviour and Governmental Politics

Graham Allison separates organizational behaviour and governmental politics into two distinct methodologies which he calls "lenses." However, he and Zelikow also suggest that using multiple overlapping conceptual models can improve understanding.[4] This dissertation has proposed that a degree of methodological synthesis is possible

[4] They write: "While at one level... models produce different explanations of the same happening, at another level the models produce different explanations of quite different occurrences." Graham Allison and Philip Zelikov, *Essence of Decision: Explaining the Cuban Missile Crisis* (New York: Longman, an imprint of Addison Wesley Longman Educational Publishers, 1999), 387-388.

between the organizational behaviour and governmental politics models. Taking a core example from this dissertation, organizational behaviour alone does not explain the decision by the Canadian land force to 'satisfice' by launching the Direct Fire Unit (DFU) project in 2003. As described in Chapter Four, some capability development analysts reviewing the Mobile Gun System (MGS) Statement of Operational Requirement (SOR) pointed out that the Canadian Leopard 1 had been upgraded in the late 1990s and early 2000s, and was expected to remain serviceable until 2015. Operating by organizational logic alone, the land force might have taken a 'wait and see' approach to replacing the Leopards. If long-term interoperability with the U.S. Army was a major concern, it would have made more sense to observe American progress with the Future Combat System (FCS) program and then plan to either acquire FCS variants or develop vehicles that would be compatible with it. The decision to pursue the DFU program in 2003, as opposed to later, was driven by the land force leadership's perceptions and desire to establish a better bargaining position for further budget increases.

However, organizational logic constrained what the leadership could do. As seen in Chapter Three, the DFU plan included consolidation of the Tube launched, Optically tracked, Wire data link auto-guided missile (TOW) system and the Air Defence Anti-Tank System (ADATS), along with the planned MGS into an organization with a similar structure to Armoured Corps units. These changes would have slightly increased the land force's armoured direct fire vehicle strength from the 114 Leopard 1 tanks in the Armoured Corps to 132 DFU vehicles, although technically Armoured Corps strength

would have shrunken to a 66 MGS contribution to the Direct Fire Unit (DFU).[5] As seen in Chapters Three and Four, this change generated resistance in all three combat arms, each of which had members who foresaw losing a critical capability. If the leadership was consistent in the belief that what had been armoured, infantry and artillery assets could be combined into a new 'system of systems,' why did it leave existing organizations in place as de-facto force generators which would contribute personnel to the DFU? Why not instead have dispensed at an early stage with the organizational designations of infantry, artillery, and armour, and separate career paths for officers and Non Commissioned Officers (NCOs) in those branches?

Such far-reaching measures would have forced the land force to do little else but reorganize during the period of transition, creating a potential problem if operational deployments were needed. Massive restructuring disrupts all routines, and requires copious amounts of money.[6] It also eliminates subordinate organizations, such as Armoured or Infantry Regiments, to which leaders may be expected to still feel loyalty, or 'esprit de corps,' from earlier in their careers. As seen in Chapter Three, the leadership expressed concern that retaining personnel was a greater priority for the land force than retaining equipment.[7] Key members of the land force leadership had also been

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[5] See page 192.

[6] These constraints have been described well by Raoul Henri Alcala, a retired U.S. Army Colonel and Foreign Policy consultant: "...it is organized ideas including military doctrine that dominate and rationalize the processes by which the U.S. military services conceive of and shape future military capabilities... there is no alternative to evolution as the upper limit to change. It is simply impossible to terminate activities overnight. Moreover, however revolutionary the process of change becomes at the design end, it will be necessary to maintain current capabilities in being until a transition can be effected..." Raoul Henri Alcala, "Guiding Principles for Revolution, Evolution, and Continuity in Military Affairs" in *Whither the RMA: Two Perspectives on Tomorrow's Army.* (Carlisle Barracks, Pennsylvania: Strategic Studies Institute, U.S. Army War College, 1994), 30.

[7] See Chapter Three, p. 162.

associated with the Land Force Western Area (LFWA), where Canadian armoured forces have long been concentrated.[8]

The organizational logic constraining the leadership and the leadership's desire to establish a better bargaining position were both driving forces. By using both 'lenses,' as Allison calls the methodologies, two complementary answers are produced. Had different personalities been involved, perhaps less willing to bargain for increased relevance for the land force, the Direct Fire Unit (DFU) program may have never been created. However, without the constraints of organizational logic, senior capability development analysts, combat arm leaders, and the land force senior leadership would likely have had more freedom to arrive at different bargaining positions. In the Canadian land force Transformation and the case of the LAV-III, both governmental politics and organizational behaviour were integral parts of the bureaucratic politics that took place.

As a more general observation, the governmental politics and organizational behaviour methodologies appear to be a 'natural fit' with the history of military technology. 'Interservice rivalry' has long been noted as an influential factor in military affairs. What took place in the Canadian land force's interpretation of the RMA, Transformation and its approach to armoured vehicle design could be described as partly the result of 'inter-branch rivalry,' but the basic type of interactions were similar. As governmental politics focuses on bargaining between leaders of government organizations, and organizational behaviour provides insight into incompatibilities between the policies of different government organizations, these models are useful tools in conceiving how interservice rivalry affects weapons system acquisition choices.

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[8] These include Lieutenant-General Rick Hillier, and then-Colonel M.D. Kampman.

The RMA and Incremental Versus Revolutionary Change

The contrast between the position of 1990s RMA advocates such as Krepinevich and Kaldor's concept of trend innovation is at the core of this dissertation. In the late 1980s and early 1990s, trend innovation also became a point of concern for defence analysts.[9] Although the Direct Fire Unit (DFU) was portrayed as transformational by the land force senior leadership in 2003, its separate components soon displayed a trend innovation pattern of less capability at greater cost. As seen in Chapters Three and Four, between 2003 and 2006 the Multi-Mission Effects Vehicle (MMEV) increasingly appeared unlikely to be able to perform a combined air defence and anti-tank role very well. At the same time, the Mobile Gun System (MGS) became increasingly expensive and delayed. Without a working MMEV to complement it, it was ultimately a tank replacement with less capability than a tank. In this case, bureaucratic politics turned the idea of the RMA advocates into Kaldor's trend innovation.

However, this was in part because of the approach inspired by Krepinevich. From a historical perspective, he and others defined many RMAs as occurring over a short period of time, thereby ignoring the possibility that incremental change can have revolutionary consequences. However, as seen in the Literature Review, Alvin and Heidi Toffler and Van Creveld describe only three or four major RMAs throughout all of history. From that long-term perspective, incremental changes over a number of decades

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[9] At the end of the 1980s, David Haglund wrote that: "Some writers have observed that one of the West's principal security challenges in the next decade will stem from the problem of 'structural disarmament,' taken to be the process whereby the costs of modern weapons systems escalate at a much faster rate than the budget for weapons procurement." David Haglund, Introduction to *The Defence Industrial Base and the West* (London and New York: Routledge, 1989), 2-3. He adds that Kaldor describes it as "more and more money delivering less and less capability." Kaldor, quoted in ibid, 3.

can add up to a change that is revolutionary. Very few of the ideas touted as revolutionary by RMA proponents of the 1990s were completely new. Ideas about "push-button warfare" had been developing for decades. Transistor microelectronics, satellite observation and communications, and other related technologies had been gradually adding to military capabilities since the mid 20th century.

To some extent, the military leaderships understood this, at least from the point of view of managing risk in organizational change. As seen, the U.S. Stryker brigades were originally intended as an interim step on the way to more far-reaching change. From 2003 to 2006, the Canadian land force occasionally referred to the Multi Mission Effects Vehicle (MMEV) as a "version 1" vehicle, with the expectation that funds would be secured to develop a more capable MMEV in later years. Transformation goals failed not because of the slow pace of incremental interim steps, but because, due to bureaucratic politics, an interpretation of the RMA was adopted that started the process before adequate experimentation had defined what capabilities were needed. After 2006, the U.S. Army retained its Stryker brigades as a medium weight organization seen as complementary to its light and heavy forces. The Canadian land force leadership chose to use its more limited funds to acquire Leopard 2 tanks which would be useful in near-term combat operations in Afghanistan.[10]

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[10] Combat experience is an effective way to evaluate equipment and doctrine. Although extensive changes in military organization were envisioned by some in the 1990s and 2000s, as the example of the advocates of unmanned vehicles illustrates, combat experience had made clearer near term requirements for armoured vehicle design. Lessons learned invalidated some of the post-1997 concepts linking information superiority, mobility and light armoured vehicles, although the U.S. Army's 1993-1997 *Force XXI* approach that information technology could act as a force multiplier for existing weapons systems was not disproven.

Implications For Canada of Being An Ally of the Larger United States

As seen throughout this work, a strong U.S. influence was exerted on Canadian land force planning. This effect existed previous to the 1990s. Canadian land force planning during the Cold War had to take into account interoperability with larger NATO allies, in particular the U.S., for potential military operations in northern Europe. Canada has also frequently used military equipment developed by allies. American examples include the C7 assault rifle, which is a modified American M16, M113 armoured personnel carriers, and F-18[11] fighter jets. Before the U.S. was Canada's major ally, the U.K. filled this role. On occasion, Canadian military leaders cooperated with Canadian industry to pursue specifically Canadian projects, such as the Ross rifle immediately before the First World War and the Avro Arrow jet interceptor in the 1950s. However, these projects were ultimately cancelled, being replaced by acquisition of allies' weapons systems. Some studies of those projects also reveal the role of individual personalities bargaining for a preferred procurement program.[12] Because of the relatively small size of the Canadian population and economy as compared to larger allies, Canadian industry is relatively small and military budgets are limited. Using allies' military equipment and following their doctrinal and organizational models avoids large financial expenditures. Such constraints on the Canadian military have been noted repeatedly in the past.[13]

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[11] Known as the CF-118 in Canada.

[12] See, for instance: Ronald Haycock, "'Done in Our Own Country': The Politics of Canadian Munitioning," in *Canada's Defence: Perspectives on Policy in the Twentieth Century*. ed. Barry Hunt and Ronald Haycock (Mississauga: Copp Clark Pitman Ltd., 1993), 44-68.

[13] Plamondon has written that: "purchases of foreign military equipment were often necessary due to the limited size of Canadian industry and its inability to compete in international markets – this is often called economies of scale." Aaron Plamondon, *The Politics of Procurement: Military Acquisition in Canada and*

Within this historical pattern, analogous episodes to various specific issues encountered with components of the Direct Fire Unit (DFU) can be found. For example, the pattern of difficulties with access to an ally's vehicle design process experienced with the Mobile Gun System (MGS) reflects past Canadian experiences throughout the 20th century. Plamondon has noted that during the 1920s imperial standardization with Britain impeded independent Canadian aircraft development because the Air Ministry in the U.K. maintained control of research and design.[14] Furthermore, if Canada wished to build British standard aircraft, it had to go through a process of obtaining permission, paying royalties, and only then obtain prints of aircraft designs.[15] Also, when the British decided to cease to use certain parts or designs, they would not provide spares or blueprints.[16] Furthermore, British designs were often inappropriate to Canadian needs, such as different weather conditions.[17]

However, in the case of the DFU, the influence of a larger ally was at work as much within military planning as it was on the Canadian political and industrial context. As seen in Chapter Two, concerns about interoperability with the United States drove both the land force leadership and its capability development system to adopt the

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the Sea King Helicopter (Vancouver: University of British Columbia Press, 2010), 15. He has also quoted Desmond Morton as stating in the case of the Avro Arrow that Prime Minister Diefenbaker took "one hard look at the costs of technological independence, quailed, and fled." Desmond Morton, quoted in ibid, 28. At time historians and defence industry analysts emphasize politically motivated constraints on defence spending over economies of scale, as in the following statement by Alistair Edgar and David Haglund: "The furor triggered by the federal budget of February 1994 demonstrated once again that defence spending can stir passions in Canada. This has to do, in part, with the lingering suspicion held by many Canadians that there is something inherently dubious about military expenditures in a country that, in their eyes, has no interests that could effectively and ethically be safeguarded by the use of force." Alistair Edgar and David Haglund, *The Canadian Defence Industry in the New Global Environment* (Montreal & Kingston: McGill-Queen's University Press, 1995), xiii.

[14] Aaron Plamondon, "Casting Off The Imperial Yoke: The Transition of Canadina Defence Procurement Within The North Atlantic Triangle, 1907-1953" (master's thesis, Royal Military College of Canada, 2001), 54.

[15] Ibid., 55.

[16] Ibid., 61.

[17] Ibid., 41-78.

American model of the RMA. This led to an interest in light armoured direct fire vehicles for both of these land force elements. The respective interest of each group resulted in different effects. For capability development, it led to studies of vehicles much like the Mobile Gun System (MGS) or Multi-Mission Effects Vehicle (MMEV), but not a near-term procurement recommendation. For the leadership, it combined with a desire to pursue a near term procurement program that appeared sufficient in the context of the general economic and industrial constraints faced by the Canadian military. Although this led to different bureaucratic politics from both actors, the indirect American influences caused both groups within the Canadian land force to frame their plans around light armoured vehicles. This observation that such effects on military planning can happen has implications for Canada as a small ally of the United States. It can affect Canadian military bureaucratic politics alongside a perceived economic and political need to rely on cooperation with a larger ally's industrial base to achieve economies of scale.

The influence of the U.S. ally resulted in sometimes contradictory results. Between 1997 and 2003, both capability development and the land force leadership were concerned about interoperability with the U.S. When the land force leadership initiated the Direct Fire Unit (DFU) program, it claimed that Transformation would make the land force interoperable with evolving U.S. force structures and so help make Canada still relevant within the alliance. However, the organization which DFU-equipped units would have had most in common with would have been the U.S. Stryker brigades. As noted in previous sections, the Stryker was intended to be an interim vehicle. In 1999, General Shinseki intended for it to be replaced by the Future Combat System (FCS)

within the first two decades of the 21st century. Had the U.S. Army continued with its original Transformation plan, the result of pursuing the Direct Fire Unit (DFU) might not have been interoperability. As seen in Chapter Two, the Director General Land Staff (DGLS) found that acquisition of a light armoured vehicle before 2015 would have achieved near-term interoperability with the U.S. Army, but would have locked the land force into a system with long term interoperability problems.[18]

Due to the different actions taken by the land force leadership, capability development, and the land force combat arms during the DFU program from 2003 to 2006, the effects of the American influence are complex. A simple summary is not feasible. However, an opportunity exists to summarize the set of actions of each actor in this case study and then place them within the context of a longer-term study of Canadian defence policy. Such a study could reveal patterns in the influence of larger allies on Canadian military bureaucratic politics.

Recommendations For Further Research

An opportunity also exists to pursue study of the U.S. Army Stryker and Future Combat System (FCS) programs. This would be a considerably more complex project, as these U.S. programs were on a necessarily larger scale than the Canadian DFU program, and likely produced a substantially larger amount of internal documentation.[19] Nonetheless, there are indications that the U.S. Army went through a similar though

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[18] See Chapter Two, page 174.

[19] For a Canadian analyst, obtaining access to the documentation would also be difficult. However, using this work as a reference point, an American analyst, for example, would be in a position to pursue such a study using a similar approach with the American Freedom of Information system.

wider and more intensive process to that seen in the Canadian land force. As mentioned at the end of Chapter One, American analysts such as Douglas MacGregor and Thomas K. Adams described aspects of governmental politics in their work on U.S. Army approaches to the RMA and Transformation. MacGregor believed that there was significant pressure on the U.S. Army to conform to the model of the RMA endorsed by the U.S. Joint Chiefs of Staffs, which placed great emphasis on information superiority and rapid strategic mobility. Adams' argument was that the desire of the U.S. Army leadership to increase the strategic relevance of its organization as compared to the U.S. Air Force drove a desire to create lighter and more rapidly deployable forces. By 2006, the U.S. Army had reaffirmed a need for heavy armoured vehicles; however, this was not the unanimous position of all of its planners. Robert Gates, appointed U.S. Secretary of Defense in 2006 by President Bush and continuing in that position under President Obama, is quoted by Bob Woodward in *Obama's Wars* criticizing planners who remained focused on RMA inspired visions of future technology. He commented that many military officers and civilian employees were overly focused on planning for theoretical future wars and designing futuristic weapons systems, while ignoring the requirements of U.S. armed conflicts in 2008.[20]

Although the U.S. retained the Stryker, in April 2009, Gates cancelled the Future Combat System (FCS) program. He described it as an "exquisite" technology which was

[20] "Inside the Pentagon, the uniformed military, the generals, admirals, colonels and thousands of other officers and civilians, were largely focused on planning and equipping the force for future wars rather than effectively fighting the wars in which they were in... Many of the Pentagon's endless meetings, schedules and intense debates seemed to be about some distant, theoretical war. Those officers were busy designing and buying the new ships, jets, tanks, radars, missiles and the latest high-technology in their modernization programs. They were gearing up to fight the wars of 2015 or 2020, while ignoring the wars of 2008." Bob Woodward, *Obama's Wars* (New York: Simon & Schuster, 2010), 20-21.

too expensive while being irrelevant to current needs.[21] He indicated that he wanted the U.S. Army to develop plans for new combat vehicles that would better protect soldiers from roadside bombs, rather than continuing with the Future Combat System (FCS).[22] He commented that: "a program that was first designed nine years ago had not fully integrated lessons" from combat in Iraq and Afghanistan, and cited the tradeoff of armour for "situational awareness capability" in the design approach as a core problem.[23] His comments accord largely with a trend innovation and bureaucratic politics criticisms of military behaviour. A large amount of funds were being spent to develop capability that provided no practical operational benefit, making the weapons systems unaffordable. Evidently, different organizations and personalities in the U.S. Army pursued their own preferences in armoured vehicle design throughout the decade from 2000 to 2009.

The U.S. case is more likely to accord better with Kaldor's trend innovation model. The U.S. has a large automotive industry which has been closely involved with the U.S. Army in armoured vehicle design projects since the Second World War. However, as this study has shown, the bargaining positions of leaders, the pressure of organizational logic to take certain approaches to weapons system design, and opportunities to 'satisfice' can cause trend innovation without a significant industrial component. A study of U.S. Army Transformation approaches to armoured vehicle design could provide better clarity into the interaction between the U.S. Army and the

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[21] John T. Bennett, "Gates: Cutting FCS was tough," *AirForceTimes*, http://www.airforcetimes.com/news/2009/04/defense_gates_roundtable_040709/ (accessed April 9, 2009).
[22] Ibid.
[23] Ibid.

U.S. defence industry, and the question of whether the military or industry was the greater driving force behind the Stryker and the Future Combat System (FCS).[24]

Recent or current acquisition programs in other services of the Canadian Forces could also be productively examined using the methodology in this work. As of 2011, ongoing political debate is taking place in the Canadian federal government over the purchase of F-35 fighter jets to replace aging CF-118s. It has many of the characteristics of trend innovation; it is designed to do what its predecessors did, except better, and it fits neatly within existing organizational structures. Based on informal discussions with members of the military and other Canadian academic defence analysts, I have been given the strong impression that, just as with armoured vehicle design, there are a number of different well-established positions on this question. Some question the need for a traditional piloted fighter jet, asking instead whether spending the money on a large Unmanned Aerial Vehicle (UAV) fleet might not be more effective. Could UAVs carrying sophisticated air-to-air missiles make piloted jets redundant? Does Canada need to have a fighter jet designed to fight other fighter jets? Can UAVs provide more effective close air support to troops on the ground than piloted jets? Some questions similar to those raised in the debate over armoured vehicle design inevitably appear in this debate. The pattern of Canada following the policy of its larger American ally is also apparent here. Procuring a platform identical to one that the U.S. Air Force will use

[24] Such a study would also provide an early 21st century comparison point to some of I.B. Holley's work. As noted on p. 9 in the Introduction, Holley identified a triangular set of interactions between the U.S. government, the U.S. air force, and U.S. industry as determining acquisition choices. What were the interactions between the U.S. Army, U.S. government and U.S. industry between 1999 and 2009?

maintains interoperability and leverages the result of U.S. studies and development work.[25]

In terms of Canadian defence procurement, this dissertation has much in common with Aaron Plamondon's work. He describes the case of the replacement program for the *Sea King* helicopter as the "ultimate case study"[26] for this subject because it has been drawn out for decades, and comments that: "The fact that attempts to replace the... helicopter necessitate a book-length study reveals that there is a procurement problem in Canada."[27] He points out that political interference forced military planners to rewrite a Statement of Operational Requirement (SOR) repeatedly. During this process, as the capability development analysts quoted in Chapter Four put it, military planners were forced to "situate the estimate" in order to justify acquisition of a politically acceptable weapons platform. He also finds that the Canadian military frequently encounters major problems from becoming involved in developmental vehicle projects. This is again apparent in the cases here of the Mobile Gun System (MGS) and Multi-Mission Effects Vehicle (MMEV).

A major difference between this work and Plamondon's is the context of the RMA. A perceived need to proceed with Transformation created motives and opportunities for bureaucratic politics that would not otherwise have existed. However, there are two significant differences. First, many of the problems which arose in the

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[25] Canada has been a minor participant in the F-35 development program since 1997, contributing a relatively small amount of funds to the project. The Canadian Department of National Defence joined the Concept Demonstration phase with an investment of U.S. $10 million. It then contributed U.S. $100 million to the System Development and Demonstration phase, and U.S. $50 million through Canadian investment programs including the Strategic Aerospace and Defence Initiative. Industry Canada, "F-35 Joint Strike Fighter (JSF)," *Industry Canada website*, http://www.ic.gc.ca/eic/site/ad-ad.nsf/eng/ad03863.html (accessed February 3, 2011).

[26] Aaron Plamondon, *The Politics of Procurement: Military Acquisition in Canada and the Sea King Helicopter* (Vancouver: University of British Columbia Press, 2010),ix.

[27] Ibid., x.

Direct Fire Unit (DFU) program resulted from internal bureaucratic politics within the land force. When political intervention took place, it was not so much interference as the result of politicians reacting to the bargaining of the land force leadership. Second, while the story of the *Sea King* replacement is one of delays, that of the DFU is one of a service attempting to shortcut established capability development and procurement procedures. Perhaps the land force leadership was motivated to attempt to replace the Leopard 1 tank earlier than 2010 because of the example of overly prolonged procurements in the Department of National Defence (DND). Whatever the case, the attempt to undertake a procurement rapidly, avoiding normal delays, resulted in enough problems to write another book length study.

In this sense, both this dissertation and Plamondon's work are "ultimate case studies" of the Canadian procurement system, written from opposite ends of the spectrum: delays versus shortcuts, internal problems versus political interference. Plamondon quotes David Bercuson: "in any well-stocked bookstore today there will be tomes on great military leaders, decisive battles, the evolution of strategy and tactics, intelligence, the art of war, military leadership, even supplies, logistics, and communications. But nothing on procurement."[28] The contrast between the story of the DFU and the *Sea King* replacement suggests that there may be many more studies on Canadian defence procurement to be written.

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[28] David Bercuson, quoted in ibid., 16.

Appendix
Access To Information Requests

The first stage of making access to information requests was to re-request the release of previously released information. It was hoped that this would expedite the access to information process and provide most of the relevant material. The original set of re-release requests are listed here. In some cases, the text of the original request does not include date parameters, however, the year that the request was made is always the first sequence of four numbers in the file number at the beginning. For instance, the information in the first request listed below, A-2007-00349, was requested in 2007:

Category: Tanks

A-2007-00349
MCU2007-02104 - Loan of Twenty Leopard Tanks and Two Armoured Recovery Vehicles from the German Ministry of Defence

A-2007-00800
All documents, reports or analyses regarding the impact on the Afghan people of the deployment of Leopard 1 tanks in Afghanistan (15 September 2006)

A-2007-00699
Records held by MND, CEFCOM, CMP and MCU that analyze, assess or review the decision to borrow 20 Leopard tanks from Germany and purchase 100 Leopard tanks from the Netherlands, for the period of 1 January to 30 April 2007

A-2007-00224
Copy of all records concerning the plan for airlifting Canada's Leopard tanks to Afghanistan

A-2007-00225
Copies of all records concerning the requirement to transfer Canada's Leopard tanks from Antonov 124 aircraft to C-17 aircraft in Kyrgyzstan enroute to Afghanistan

A-2007-00349
Copy of MCU2007-02104 Loan of 20 Leopard tanks and two armoured recovery vehicles from the German Ministry of Defence

A-2007-00020
Copy of documents including but not limited to emails, proposals and memos detailing deployment options of the Leopard A6M tanks leased or bought from Germany. Timeline is March 23 to April 10, 2007

Category: LAV-based Vehicles

A-2007-00597
Copies of briefing notes and policy documents related to the termination of the Mobile Gun System Project

A-2006-00380
All Briefing Notes prepared for the Minister of National Defence from May 2004 to June 2006 on the Mobile Gun System

A-2005-00686
Copies of departmental briefing notes and memos requesting Ministerial/Deputy Minister's approval for Multi-Mission Effects Vehicles (MMEV) project, to include the approval to enter into contract on a non competitive basis with Oerlikon Contraves Canada and affiliates

A-2005-00515
All current Air Defence (AD) info (ORBATS, correspondence, cost Info, current status of 119 DF MMEV Battery, etc. for the period of 20 August to 22 September 2005, to include: Air Defense Anti-Tank System (ADATS) and Multi-Mission Effects Vehicle (MMEV) from Directorate Land Strategic Planning (DLSP), Director Army Doctrine (DAD) and CO of 4 Air Defence Regiment

A-2005-00432
All current Air Defence information for the period of 1 May 2005 to 19 August 2005, to include Air Defence Anti-Tank System (ADATS), Multi-Mission Effects Vehicle (MMEV), for Lord Stratcona's Horse and 119 AD Battery and TOW information for E Company LdSH from Director Land Strategic Planning

A-2004-01074
Copy of all briefing notes, memoranda or reports concerning the acquisition by the Canadian Forces of the Stryker MGS produced between 1 August 2004 and 31 January 2005

A-2004-00216
All briefing notes, memoranda or reports concerning the acquisition of the Stryker MGS produced between January 1 and June 30, 2004

A-2004-00648
Copy of the current Mobile Gun System (MGS) Statement of Operational Requirement (SOR) as posted on the Director Armoured Vehicle Project Management (DAVPM) website

A-2004-00649
All documentation and organization reports for the period of 1 February 2004 to 31 October 2004 concerning: Mobile Gun System (MGS); Multi-Mission Effects Vehicle (MMEV); Air Defence Anti-tank System (ADATS); Direct Fire System (DFS) and Future Indirect Fire Capability (FIFC) for the following organizations: Director Armoured Vehicles Program Management (DAVPM); MMEV Project Office; Ground Based Air Defence (GBAD); Director Land Strategic Planning (DLSP) and Directorate Army Doctrine (DAD)

A-2004-00651
All documentation and organization reports for the period of 1 February 2004 to 31 October 2004 concerning: Mobile Gun System (MGS); Multi-Mission Effects Vehicle (MMEV); Air Defence Anti-Tank System (ADATS); Direct Fire System (DFS) and Future Indirect Fire System (FIFC) for the following organizations: Air Defence Regiment Commander; Lord Strathcona's Horse (Royal Canadian) (LDSH (RC)) Commander; Chief of the Land Staff (CLS); Acting Chief of the Land Staff (A/CLS) and Director General of Strategic Planning (DGSP)

A-2003-00860
DND reports/ documents discussing recommendations and/or offering a solution relating to testing of survivability of armoured personnel carriers, including the M113 and the newer Light Armoured Vehicle, against anti-tank mines/ordinance carried out at DREV for period Jan 99 to 3 Nov 03

A-2003-00803
For the period January 1, 1999 to October 23, 2003, all records concerning deficiencies, problems or weaknesses with the Stryker armoured vehicle and for records pertaining to the plans by the Defence department to replace the Leopard tank with the Stryker

A-2003-00733
All briefing notes, assessments and audits related to any Army plans to acquire an advanced lightweight anti-armour system for period 1 Jan 03 - 16 Sep 03

A-2003-00694
All briefing notes, assessments, and audits related to any Army plans to acquire a mobile gun system (most likely Stryker) from 1 January to 25 January 2003

A-2003-00737
Request all records between August 1, 2003 and October 1, 2003 relating to the use of 'add-on armour' for the LAV-III and Coyote armoured vehicles deployed to Afghanistan as part of Operation Athena

A-2003-00693
All briefing notes, assessments, and audits related to any Army plans to transform the Air-Defence Anti-Tank System (ADATS), to include a direct fire role (anti-tank) from 1January to 25 September 2003

A-2003-00659
Any reports, emails, letters or briefing notes to or from the Operational Research Division (ORD) on the issue of tanks, armoured combat vehicles or Stryker vehicles from Jan 99 - 3 Sep 03

A-2003-00658
Any reports, emails, letters or briefing notes to or from Maj J.J.L.C. Noel de Tilly, M.K. Ormrod or P.R.S. Bender in the Operational Research Divison (ORD) on the issue of tanks, armoured combat vehicles or Stryker vehicles, for the period Jan 99-3 Sep 03

A-2003-00516
Any document from 1998 to 30 Jul 03 regarding the possible replacement of the Leopard main battle tank and the acquisition of a new main battle tank/direct fire support vehicle

A-2003-00425
All briefing notes and emails to and from the Chief of the Land Staff on the issues of replacing Canada's Leopard 1 tank and/or procuring Armoured Combat Vehicle (ACV or Stryker) replacements from 1 Oct 02 - 27 Jun 03

A-2003-00424
All briefing notes and emails to and from the Assistant Deputy Minister (Material) on the issues of replacing Canada's Leopard 1 tank and/or procuring Armoured Combat Vehicle (ACV or Stryker) replacements from 1 Oct 02 - 27 Jun 03

A-2003-00401
Access to all documents related to plans for the possible purchase of Stryker or Stryker-like vehicles

A-2003-00253
Any and all documentation related to or concerning any accident, incident or occurrence involving the Light Armoured Vehicle (LAV) III where any wheel assembly, wheel, or any other suspension parts were or may have been involved

Category: Other Armoured Vehicles

A-2006-00943
All Memoranda and Briefing Notes held or generated by CEFCOM or CLS, and all email to or from the Chief of the Land Staff, specifically, concerning the deployment of the M113-A3 Armoured Personnel Carrier, July 01 to 15 November 2006

A-2006-00600/4-2
Any record that analyzes plans to purchase a Light Armoured Recon Vehicle (LARV), for the period 1 January 2005 to 1 August 2006

A-2005-00749
Light Armoured Vehicle (LAV) documentation to include, M113LE production status chart, with breakdowns per variant; the latest Bison distribution per unit/area/WFM Component; the MLVW CP distribution (TCP & DCP) per WFM and the latest LAV-III (CP) and LAV-III (CP) and LAV-III (with variants) production status chart, etc

A-2005-00077
All current Air Defence (AD) information for the period of 1 November 2004 to 29 April 2005, to include Air Defence Anti-Tank System (ADATS), Multi-Mission Effects Vehicle (MMEV), GDF 005 Twin 35 mm gun, Skyguard Mk ll AD radar, EX Potent Knight starting 21 April 2005 from Director Land Strategic Planning (DLSP)

A-2003-01063
All documents from 2003 related to the replacement of M-109 self-propelled artillery of the Canadian Land Forces

A-2003-00695
All briefing notes, assessments, and audits related to any Army plans to reduce the mortar systems and/or eliminate the M109 for the period 1 Jan 03 - 16 Sep 03

Category: Procurement Background

A-2007-01171
A copy of the most recent DND/CF Cost Factors Manual, reflecting procurement announcements since February 2007

A-2002-00007
A copy of the Deputy Chief of the Defence Staff (DCDS') plan for implementation of the capabilities and force structure required to meet future asymmetric threats and substantiate the resources required to provide the required capabilities, including consideration of reserve complementary rolls

A-2003-00986
All records of the Strategic Capability Investment Plan, including annexes, briefing documents and notes that led to its approval

A-2003-00989
All records of ministerial briefings from January 1, 2001 to December 8, 2003 regarding the strategic outlook for the Canadian Forces

A-2003-00926
Request briefing notes in the possession of the office of Director General Strategic Planning (DGSP) for 2003

Category: Transformation

A-2006-01252
CDS proposed endstate to the CF transformation. Please include an Organization chart.

A-2005-00034
Any and all documents concerning a presentation made by Gordon O'Connor at the 6 April 2005 Conference "The New Defence Agenda: Transforming National Defence Administration" held at the Sheraton Hotel in Ottawa

A-2003-00689
The Army's plan for transformation into a rapidly deployable, medium-weight, flexible force developed under former Chief of the Land Staff, LGen Mike Jeffery

Category: Background on Senior Decision Makers

A-2005-00850
All records on the Chief of Defence Staff, General R. J. Hillier's postings for the period of 1992-2006, to include a copy of CF 490 or equivalent listing all postings, as well as career curriculum vitae, biographical data, produced by him or on his behalf during his postings/appointments to the NDHQ Secretariat

A-2004-00267
The briefing book that has been prepared for the new Defence Minister, Bill Graham

A-2003-01239
A copy of all briefing notes prepared for the appointment of David Pratt as Minister of National Defence in December 2003

A-2003-01048
All briefing notes prepared for Minister David Pratt upon his appointment to the position of Minister of National Defence in December 2003, to include records in any and all formats, including, but not limited to, electronic (e-mail) and written files

A-2002-00309
All briefing documents prepared for the new minister of National Defence, John McCallum

Once the documents in some of these requests were provided, it became possible to focus on key terms such as Direct Fire Unit (DFU). Based on discussion with Department of National Defence Access to Information and Privacy project officers, a comprehensive request was made in order to cover the gaps in the above requests:

> Information concerning the Canadian Forces Direct Fire Unit (DFU) plan in effect from 2003 to 2006, including decisions taken regarding the intended combat roles, and acquisition of, the Main Gun System (MGS), Multi-Mission Effects Vehicle (MMEV), and Tow-Under-Armour on the LAV-III. The search should extend to information on the decisions to cancel the DFU components and to instead deploy existing Main Battle Tanks (MBTs) and to acquire new MBTs in 2006-2007. The search should also extend to planning documents concerning CF Transformation during the period under question as it pertains to plans at that time to develop an all-wheeled medium-weight land force. Information retrieved should include records of CDS and Defence Ministers' decisions on

> Transformation, MGS and MBTs during 2003 to 2007, as well as CF planning documents.

However, in a further discussion on March 9, 2009, it was decided to split this request into new requests on: (1) the MGS, (2) MBTs, (3) the Air Defence Anti-Tank system (ADATS), including the MMEV, (4) Canadian Forces Transformation, and (5) Records pertaining to the Chief of Defence Staff and the Minister of National Defence. At this point not all of the earlier requested documents had been provided. A telephone discussion on March 11, 2009 indicated that "several" of the previously released documents had been reclassified and could not be re-released until another thorough review. The author was also advised that some of the new requests would have similar problems. Ultimately, the Access to Information system broke up requests, sending multiple responses to each request.

The covering letters in the final sets of responses were dated to May 18, 2010, June 25, 2010, September 24, 2010, and November 4, 2010. The information dated June 25 arrived in mid-July. The information sent in May and June of 2010 proved critical and allowed this dissertation to become a far more comprehensive study of Canadian interpretation of the RMA armoured vehicle design than earlier drafts based on the re-release of previous information.

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Curriculum Vitae

Robert Addinall was born in Mississauga, Ontario, on May 11, 1977. He graduated from Port Credit Secondary School in 1996, and was awarded the Douglas M. Burgess Memorial Scholarship to study at Trinity College at the University of Toronto from which he graduated with high distinction in 2000 with a Bachelor of Arts degree, specializing in history with a minor in English. He graduated from the Master of Arts program at the University of Toronto in the fall of 2001. His thesis paper, "Intelligence Failures and the German Defeat in Russia, 1941-1943," dealt with the view presented by a number of historians that the Soviet failure to anticipate the German attack of June 1941 was the greatest intelligence blunder of the Second World War. The thesis argues that German intelligence failures to correctly analyze the size of the Soviet forces and the environmental and poor infrastructure conditions that would be encountered in Russia were an equally great blunder, leading to ultimate strategic defeat for the German military.

During 1999 to 2001, Robert worked at the information technology start-up company Universal Software Builders/Myubi, which specialized in developing search technology. Projects included software designed to categorize search results by date and relevance, and to automatically summarize documents, much as the Google News service has subsequently done. During 2001 to 2002, he worked at the information technology consulting and marketing firm ITPR (Information Technology Public Relations), later G2M (Go 2 Market), in Toronto, Ontario. While there, he wrote business intelligence reports for large clients such as SAP and Adobe.

Robert enrolled in the PhD program in War Studies at the Royal Military College of Canada in the fall of 2002 with the help of a generous federal government DRDB scholarship. During 2002 to 2005, he published a number of papers in conference proceedings. These included papers on the Revolution in Military Affairs (RMA) and Transformation in the 2003 and 2005 Conference of Defence Associations Institute (CDAI) Graduate Student Symposia, and a paper, "Information in Warfare from Sun Tzu to the 'War on Terror," in the 2004 CDAI Graduate Student Symposium. He also presented the paper "Perspectives on the RMA and the Effects on Canada of Changing Concepts of Military Organization and Practice" at the 2004 University of Calgary Strategic Studies Student Conference. A slightly altered version of one of his CDAI conference papers, "Transformations of War and Public Perception: Implications For 21st Century Warfare," was republished in the spring 2006 edition of the Canadian Army Journal.