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CANADIAN DEFENCE POLICY AND NATIONAL INTERESTS IN SPACE: AN OPPORTUNITY FOR INTERDEPARTMENTAL COOPERATION

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CANADIAN DEFENCE POLICY AND NATIONAL INTERESTS IN SPACE: AN OPPORTUNITY FOR INTERDEPARTMENTAL COOPERATION

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ABSTRACT

Defence considerations are used to emphasize the requirement for a national space plan capable of directing and coordinating efforts between civilian and military oriented space programs. The space environment will continue to have increasingly significant implications for the operational effectiveness of the Canadian Armed Forces. Current military dependency on space-based enablers, combined with the accelerating importance of space to national security, indicates that the Department of National Defence needs to pursue a more robust space program. The challenges to such development are noteworthy given recent trends in the prioritization of military and civilian space programs, both of which have been characterized by marginal levels of government interest and investment. Yet such challenges in no way lessen the evolving importance of space policy to fundamental defence requirements. Thus, Canada requires a reinvigorated approach to its military objectives in space. This study suggests a possible solution by arguing that a defence-oriented and interdepartmental national space strategy, combined with a more ambitious, specific and relevant DND Space Policy, is a fundamental requirement if the Canadian defence organization is to remain effective with its evolving mission requirements.

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LIST OF ABBREVIATIONS

BMD – Ballistic Missile Defence

CAF – Canadian Armed Forces

CANSpOC – Canadian Space Operations Cell

CARDE – Canadian Armament Research Development Establishment

CDS – Chief of Defence Staff

CFD – Chief of Force Development

CFDS – Canada First Defence Strategy

CJOC – Canada Joint Operational Command

COSINE – Co-Orbital Satellite Intercept Evaluation

CMSG – Canadian Military Space Group

CRS – Chief of Review Services

CSA – Canadian Space Agency

DARPG – Development and Associated Research Policy Group

DCOS – Deputy Chief of Staff

DG Space – Director General Space

DND – Department of National Defence

DSpaceD – Directorate Space Development

DRB – Defence Research Board

DRTE – Defence Research Telecommunications Establishment

ESA – European Space Agency

GPS – Global Positioning System

ICS – Interdepartmental Committee on Space

ISIS – International Satellites for Ionosphere Studies

ISR – Intelligence, Surveillance and Reconnaissance

ISS – International Space Station

M3MSat – Maritime Monitoring and Messaging Microsatellite

MDA – MacDonald Dettwiler and Associates

MND – Minister of National Defence

MOSST – Ministry of State for Science and Technology

NASA – National Aeronautics and Space Administration

NATO – North Atlantic Treaty Organization

NEOSSat – Near Earth Orbit Surveillance Satellite

NORAD – North American Aerospace Defence Command

ORG – Operations Research Group

PCW – Polar Communications and Weather Satellite

PPP – Public-Private Partnerships

RCAF – Royal Canadian Air Force

RCM – RADARSAT Constellation Mission

SDI – Strategic Defence Initiative

SDIS – Space Data, Imagery and Services

SDWG – Space Development Working Group

SPADATS – Space Detection and Tracking System

SSN – Space Surveillance Network

VCDS – Vice Chief of Defence Staff

INTRODUCTION

Space has been important to Canada over the last half century, but not nearly as important as it will be over the next half century.

– The Aerospace Review[1]

The militaries of Western countries have reached an unprecedented level of dependency on space assets just as those same nations are discovering the precarious vulnerabilities that space introduces to their national security. Given the objectives that Canada has in space as well as the dynamic change that the sector is experiencing, it should come as no surprise that different approaches to both old and new challenges will be required moving forward. Canada needs a clear, wide-reaching and long-term space strategy, and the requirement for such a plan is presently more relevant than ever. Without such commitment many of Canada's space stakeholders, and particularly the defence community, risk being disadvantaged in their roles. The director for the Centre for Defence and Security Studies at the University of Manitoba, James Fergusson, has studied the issue at length, and his earlier conclusions eloquently introduce the broad problem this research project addresses:

> A notable expansion of players, interests, and capabilities has taken place in all of these [space] arenas over the last fifteen years, a phenomenon that will no doubt continue to grow. However, Canada's space interest, investment, and understanding have not kept pace over the same period. On the contrary, they have arguably lessened, as has Canada's security vis-à-vis . . . Canada has no overarching national space policy, and space is not addressed in either of the latest national security and defence policies.[2]

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[1] Department of Industry, *The Aerospace Review Volume 2, Reaching Higher: Canada's Interests and Future in Space* (Ottawa: Publishing and Depository Services, Public Works and Government Services Canada, 2012), 2.

[2] James Fergusson and S. James, *Report on Canada, National Security and Outer Space* (Calgary: Canadian Defence and Foreign Affairs Institute, 2007), i.

There is a growing need for national policy to consider outer space as a domain that is critical not only to successful military operations, but also to issues of national security. That most countries of the world are, at least in stated policy, against the weaponization of space does not detract from the increasingly prolific state of space militarization.[3] Although peripheral to conventional definitions of military operations, space capability has nonetheless become increasingly important to defence operations. Without considering the complex issue of space weaponization, there is a requirement for Canadian policy – in terms of both defence and the wider issue of national security – to recognize the already present and growing militarization of the space domain.

Together, defence and security issues comprise government interests in outer space that are expanding in relevance. They are mutually inclusive interests, with current requirements for a defence space policy existing within the wider security priorities that future national space plans will have to address. Although in Canada the defence space program has in some ways remained separate from the civilian program, interdependencies continue to develop. Defence space priorities are linked to other Canadian government departments, as well as to civilian industries, academic institutions and research and development agencies. Government interests in space are increasingly interconnected by way of means, costs and benefits through considerations of economic impact, technological development and national security. A fundamental challenge, then,

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[3] Throughout this document, space "militarization" refers to using space-based assets to enable military operations on earth. Space "weaponization," on the other hand, refers to the placement of weapons in orbit so that they may be employed against orbiting or terrestrial targets. Andrew B. Godefroy provides such a definition in "Is the Sky Falling? Canada's Defence Space Programme at the Crossroads," *Canadian Military Journal* 1, no. 2 (Summer 2000): 52.

exists in the need for coordination – of research, development, funding and policy – with respect to the overall space sector in Canada.

The lack of government direction in the defence space policy field specifically has been problematic for the defence sector. It has been detrimental in consequence for both Canadian security policy as well as for Department of National Defence (DND) capability. Although pursuing more ambitious DND space programs is an objective that presents several significant challenges, chief among them financial limitations, it is also an inevitable requirement for which hesitancy to act now will be met with increased costs and capability shortcomings in the future. DND requires government commitment to a strategic direction for its role in outer space; without it, the effectiveness of DND itself continues to be at risk. This study outlines elements of a solution to that predicament. It argues that a defence-oriented and interdepartmental national space strategy, combined with a more ambitious, specific and relevant DND Space Policy, is a fundamental requirement if the Canadian defence organization is to remain effective with its evolving mission requirements. Defence considerations are used to emphasize the need for a national space plan capable of directing and coordinating efforts between civilian and military oriented space programs.

This study is framed by the perspective of the defence sector and its relevance to the space domain. However, similar conclusions – namely the need for more interdepartmental coordination – have been reached by recent government studies that assessed space from the perspective of industry.[4] As such, although the focus of this

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[4] *The Aerospace Review*, or "Emerson Report," is one such study referred to by subsequent Chapters of this document.

research is defence, relevant examples from other sectors are at times considered in order to further assert the paper's argument.

Chapter 1 summarizes Canada's military space history in order to contextualize DND's current challenges. Notwithstanding program successes in the 1960s, Canadian government policy has since consistently divested itself from a more robust interest in defence-related space issues. The historical survey provided by the chapter is relevant because, as subsequent chapters demonstrate, the defence sector has experienced important shifts in its relationship with private-sector enterprise. Whereas the military was in the past often the impetus for technologies that would later be developed commercially, modern space paradigms are instead frequently characterized by commercial innovation leading military capability.

Chapter 2 discusses the current requirements and relevance of a DND space program. The present reliance of DND on existing space infrastructure, for routine and combat operations alike, is used to highlight vulnerabilities in Canada's defence modus operandi. The space environment is discussed with a view to showing that DND's operational capability stands to be increasingly contested in space just as new and demanding defence responsibilities are encountered there. Additionally, the chapter considers requirements for a national space policy from the wider perspective of civilian space dependency. Society relies on space-enabled technologies in ways that require security policy to address civilian space capabilities as critical infrastructure. Increasingly, there is an emergent acknowledgment that national security, and defence policy relations with it, must account for new attack avenues that threaten, among other

examples, national agricultural, economic, environmental, defence and scientific interests.[5]

Chapter 3 analyzes the policy and organizational construct in which DND space issues are currently managed. It reviews policy documents associated with the DND space program as well as with the wider, national-level space sector. Several current defence-related space projects, including the RADARSAT program, demonstrate implications of legacy and future space policy developments. In turn, the lack of a current and relevant defence space strategy is shown to have had real consequences on DND effectiveness.

Chapter 4 discusses defence and national-level policy changes that would render DND more effective in its growing space mandate. In doing so, it establishes relationships among the defence, security and civilian sectors. Here, a comprehensively collaborative approach between the DND and other key agencies, particularly the Department of Industry and the Canadian Space Agency (CSA) that subordinates it, may serve as the most efficient strategic means to Canada's current and future space defence needs.

Within Canada, there is limited academic literature dedicated to Canadian space policy. Andrew Godefroy has written on Canada's Defence Space Program, and his book *Defence and Discovery: Canada's Military Space Program, 1945-74* is a thorough historical account of the country's early forays into space. He has published numerous articles emphasizing the requirement for long-term commitment to a defence space

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[5] Canadian Space Agency, *Space and National Security: How Civil and Commercial Space Contribute to Canadian Security* (Montreal: Athena Global, 2004), ii.

program. In *The Canadian Forces in 2025 – Prospects and Problems*, he depicts the DND space program's future as uncertain despite its undoubted importance. James Fergusson, too, has studied the Canadian space program, and his publications are similarly critical and forewarning on the subject of DND space policy. Focusing on national security from the perspective of space, his work has resulted in such studies as the 2007 *Report on Canada, National Security and Outer Space*.

DND itself has, since the publication of its last Space Policy in 1998, articulated little in terms of formal defence objectives or strategies in space. That said, the government has in recent years initiated studies of the Canadian space program in general. Volume 2 of the Aerospace Review, *Canada's Interests and Future in Space*, presents the conclusions from research on Canada's space sector and, more importantly, provides recommendations for future government strategy there. The study was commissioned by the Department of Industry and addresses space policy mainly from that perspective; however, many of its conclusions are also relevant to DND. Additionally, national security is addressed in earlier government studies such as the 2004 Athena Global Report, *Space and National Security: How Civil and Commercial Space Contribute to Canadian Security*, but they too are focused mainly on civilian space programs.

The following chapters aim to extend the conclusions of such reports and others, aimed as they are at the commercial sector, to considerations and implications for a DND Space Policy moving forward. This study shows that there has been a lack of government interest in defence space issues, it presents the importance of space to national security, it critiques Canada's current DND Space Policy and organization and, finally, it suggests

institutional modifications that would enhance the effectiveness of the Canadian defence space program.

Chapter 1 –THE CANADIAN DEFENCE SPACE PROGRAM: HISTORICAL CONSIDERATIONS

It is apparent that the lack of a central organization for space activities in Canada has been unfortunate.

– J.H. Chapman, *The Chapman Report*[6]

Introduction

The September, 1962 launch of the Alouette satellite made Canada the third nation in history to place in orbit an indigenously-designed space system. This event is rightly regarded as a hallmark of Canadian aerospace. It has been described as one of the most significant Canadian engineering achievements in history,[7] and the details of the defence, political and industrial environment in which it was conceived therefore deserve consideration in any debate regarding Canadian space policy. The Alouette chief electrical engineer Colin Franklin remarked similarly in 1983, stating that where Canadian space history was concerned, "We would do well to capitalize on our experience."[8] The early success of Canadian space projects, of which Alouette is only one example, was due in large part to a distinct expertise and capacity borne from the nation's defence organization. Ironically, the effectiveness of defence space policy has generally declined since that point, thus initiating a trend that has continued to the present day while impacting the ability of the Canadian Armed Forces (CAF) to fulfill their mandate. This chapter argues that despite the initial achievements of Canadian defence

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[6] J.H. Chapman, *et al. Upper Atmosphere and Space Programs in Canada Special Study No. 1* (Ottawa: Queens's Printer and Controller of Stationary, 1967), 101.

[7] Doris H. Jelly, *Canada 25 Years in Space* (Montreal: Polyscience Publications Inc. in co-operation with the National Museum of Science and Technology, 1988), 115.

[8] Colin Franklin, "Industrial Opportunities in Space," in *Canada's Strategies for Space: A Paradox of Opportunity*, ed. Brian MacDonald, 53-66 (Toronto: The Canadian Institute of Strategic Studies, 1983), 54.

projects in space, and notwithstanding their influence on the civilian space policy that was later pursued, national space interests unique to defence have since suffered from a consistent and consequential divesture from government attention.

For the era preceding the existence of the CSA, development of the Canadian space sector is considered from the perspective of the defence space projects and policies that defined it. Examples illustrate the initial importance of defence space policy to the larger, nation-wide capability in space that was to put Canada at the forefront of the global space scene. The second part of the chapter assesses the continued development of Canada's space sector from 1989 onwards. Here, the effect of the CSA is presented as having been transformative for the civilian space sector, albeit at the expense of ongoing marginalization for defence-related space priorities.

The Cold War Era: Defence Space Policy Beginnings

In the early Cold War timeframe military objectives were the initiating force behind space-related research and development in Canada. This was a characteristic of Canada's initial space sector that was to generate a significant level of technical accomplishment, but it was also a characteristic that would evolve with time. Whereas a military imperative borne of the Cold War fostered a surprisingly capable and well-accomplished space capability across both defence and industry, defence considerations were in the ensuing years gradually but eventually occluded by civilian priorities.

The post-war security environment of the 1950s was, by virtue of the then preeminent priority of defence requirements, conducive to the development of a military space capability within Canada. Many successful Canadian space programs resulted from early defence programs; indeed, the Alouette program itself derived from military

initiatives.[9] Other projects managed among the Defence Research Telecommunications Establishment (DRTE), the Canadian Armament Research Development Establishment (CARDE), and the Operations Research Group (ORG) included the launching of research rockets,[10] extensive involvement with anti-ballistic missile development and even an ambitious effort by the Royal Canadian Air Force (RCAF) to investigate the physics of ballistic re-entry.[11] Although one cannot discount the contribution of other organizations to the early Canadian space sector, the significance of the defence contribution persists as the most comprehensive. The RCAF's Co-Orbital Satellite Intercept Evaluation (COSINE) project was so successful that, by the early 1960s, the US was interested in having Canada lead its joint project on orbital intercept research, a priority not only for missile defence projects but also for the Apollo space program.[12] The dichotomy between then and now – with current governments repeatedly showing little interest in topics such as missile defence – has been consequential on policy considerations. Evidence of the initial impact of Canada's defence space program exists in several projects.

The Black Brant rocket program showcased the momentum of initial military space endeavours and the role they played in generating a wider civilian space capability. Black Brant was initially a CARDE program that sought to develop upper atmospheric

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[9] Department of National Defence, *DSAB Report 89/1 on Space R&D Sovereignty* (Ottawa: Defence Science Advisory Board, 1989), 1.

[10] W.M. Evans, "The Canadian Space Program – Past, Present, and Future: A History of the development of space policy in Canada," in *Proceedings of the Concluding Workshop, The Extended ESA History Project*, ed. B. Battrick and L. Conroy, 133-155 (Paris: ESA Headquarters, 2005), 134.

[11] L. Sevigny, *et al.*, "Hypersonic Range Wake Studies," *Canadian Aeronautics and Space Journal* 19, no. 6 (June 1973): 278, in Doris H. Jelly, *Canada 25 Years in Space* (Montreal: Polyscience Publications Inc. in co-operation with the National Museum of Science and Technology, 1988), 20.

[12] Andrew B. Godefroy, *Defence and Discovery: Canada's Military Space Program, 1945-74* (Vancouver: UBC Press, 2011), 37, 141.

research rockets.[13] At the time, understanding the upper atmosphere was a military priority due to several defence applications in rocketry and communications fields. The first launch of a Black Brant rocket was in October, 1959 from the Churchill Research Range, and by the end of 1967 more than one hundred such rockets, of increasing complexity and performance, had been fired. Incidentally, the same time period was marked by the launch of only two Canadian satellites, indicative of a certain priority of research that would shortly change.[14] And coexisting as it did with several other, concurrent programs, Black Brant was hardly an isolated example of a military space project. At the same time the RCAF was involved with both COSINE and the US Space Detection and Tracking System (SPADATS) through its tracking unit in Cold Lake.[15]

The importance of the Black Brant project to giving Canada an early indigenous launch capability – something few other nations had – is noteworthy because it makes clear Canada's once militaristic ambitions in space. Following the initial successes of Black Brant, responsibility for the program was in 1967 transferred from military agencies to Bristol Aerospace in Winnipeg, thereby serving as an early but effective example of military projects initiating industrial capability.[16] The Black Brant project was therefore responsible for contributing to a period of unprecedented growth in Canada's space program, and particularly in Canada's defence space program, during the 1960s.

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[13] J.H. Chapman, et al., *Upper Atmosphere and Space Programs in Canada*, 56.

[14] Andrew B. Godefroy, "Defence and Discovery: Science, National Security and the Origins of the Canadian Rocket and Space Program, 1945-1974" (PhD Dissertation, Royal Military College of Canada, 2004), 78.

[15] T.A. Spruston, "Science and Politics: The Evolution of Canadian Space Policy," (Canadian Forces College Information Resource Centre Archived Paper, Canadian Forces College, 1976), 51.

[16] W.M. Evans, "The Canadian Space Program – Past, Present, and Future," 134.

The concurrent success of Alouette is relevant because it too had its genesis – in both its initial conception and resources – in defence policy. Canada's first satellite began as a Defence Research Board (DRB) partnership, in conjunction with certain universities as well as with the National Aeronautics and Space Administration (NASA), that aimed to build and launch a topside sounder experiment.[17] Canada would build the device and an American rocket would carry it to space. The Alouette project attracted defence support because advanced weapons, communications architectures and miniaturization technologies all represented military interests that would be furthered not only by the effort to build the satellite, but also by the imagery and data it would deliver.[18] At the time, then Minister of National Defence Douglas Harkness had remarked publically on the importance of Alouette to "both civil and defence purposes."[19] Criticisms of Alouette for distracting resources from other DND space projects, however, were not unfounded. The initial project grew significantly in both size and complexity from the initial plans, eventually resulting in the much larger International Satellites for Ionosphere Studies (ISIS) project that was planned to consume the entirety of DRTE resources.[20] As such, the Alouette program was rightfully acclaimed as a national success demonstrating the capability of Canada's defence space research agencies; however, its transition to the more scientific, resource-intensive ISIS project was an early indication of a developing rift between defence and civilian space priorities.

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[17] Gordon Shepherd and A. Kruchio, *Canada's Fifty Years in Space: The COSPAR Anniversary* (Burlington: Apogee Books, 2008), 128.

[18] Andrew B. Godefroy, *Defence and Discovery: Canada's Military Space Program, 1945-74,* 99.

[19] External Affairs Canada Vol. 15, "Canada's First Space Satellite," (Ottawa: Department of External Affairs, 1963): 15, quoted in T.A. Spruston, "Science and Politics: The Evolution of Canadian Space Policy," (Canadian Forces College Information Resource Centre Archived Paper, Canadian Forces College, 1976), 51.

[20] Andrew B. Godefroy, *Defence and Discovery: Canada's Military Space Program, 1945-74,* 110.

The ISIS program became a manifestation of the different policy path on which Canadian space strategy was to embark, the legacy of which persists today. It had become apparent to the RCAF that, although initially supportive of defence space priorities, the DRB was transforming the Alouette effort into one oriented entirely towards scientific research. This marked divergence from military aims was further demonstrated in 1965 by a DRB proposal that would have extended the Alouette partnership into a US project aiming to orbit a satellite around Mars, something that was understandably not interpreted as relevant to Canadian defence requirements. It is not surprising that "RCAF and DND planners inferred that a DRB agenda was forming to advocate for the pursuit of pure scientific research at the expense of more defence-oriented technological application."[21] Diverging interests between the technical and defence priorities of the RCAF thereby began to conflict with the evolving scientific and research agendas of the DRB and DRTE.

In fact, the shift in national space priority away from defence projects and towards scientific ones further evolved into the prioritization of commercially-viable satellite communications by the end of the 1960s. Military space operations now found themselves subordinated to not only the research interests of the DRB, but also to the commercial priorities of the government's newly-proposed civilian space program. Cancellation of the third ISIS satellite in the summer of 1969 signalled the government's final shift in space policy away from defence research and into commercial satellite applications. The shift was apparent in policy changes that, seemingly, the defence community was not organized nor prepared to deal with. Except for a sentence

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[21] *Ibid*., 113.

acknowledging the DRB's success with Alouette, the 1964 Defence White Paper made little mention of space; nor did it discuss a policy for continuing space defence projects.[22] Meanwhile, interest in civilian communication satellite development continued to accelerate, something made clear by both the 1967 *Chapman Report* as well as the government's reaction to it. Godefroy's assessment of the period is accurate and to the point:

> By the mid-1960s Canada's evolving strategic outlook and its internal socio-political transformation directly clashed with the defence and scientific community, resulting in the erosion of security and science driven space programs in favour of more commercially applicable ventures.[23]

Ironically, the success of defence space projects had become the initial impetus for their own demise in Canada.

The time period also marked initial acknowledgment of a requirement for defence to coordinate its space activities with the wider national space policy of the government. Although the RCAF had initially supported DRTE and DRB efforts with Alouette, it had then decided to embark on its own Space Development Program, working with the US on co-orbital rendezvous techniques as part of missile defence research. Without a means of fitting those efforts to the government's wider space strategy, however, such RCAF initiatives generally lacked support. This was demonstrated by the Development and Associated Research Policy Group's (DARPG) 1965 report on the Canadian Forces Defence Space Program. It concluded that there was a "generally disorganized defence approach to national space development," and it lobbied strongly for a space policy

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[22] Department of National Defence, *1964 Defence White Paper* (Ottawa: Department of National Defence Library, 1964), 27.

[23] Andrew B. Godefroy, *Defence and Discovery: Science, National Security and Origins*, 36.

without which future efforts would be merely "academic."[24] The asserted requirement for an interdepartmental policy or coordinating effort was not unique to criticisms originating in the defence department either. The 1967 *Chapman Report*'s assessment of Canada's space programs, too, was critical of the "lack of a central organization for space activities in Canada."[25] The effects of not efficiently coordinating departments through a national space policy were beginning to emerge.

In general, the *Chapman Report* represented the interests of scientific and commercial space sectors. The report was not initially successful in advocating for a national space agency, but it was successful elsewhere. It played a key role in the development of Anik 1, the world's first domestic communication satellite, and the crown company Telesat that followed. The *Chapman Report* was also foundational in the development of Canadian space policy, with many of its arguments still reflected in contemporary government decisions. The report's emphasis of civilian space policy considerations encouraged the government to pursue commercially-viable communication satellite applications as the centerpiece of its national space program. As such, domestic satellite communications became the almost sole objective of government space initiatives, thereby marking "the end of both soldier and scientist-adviser dominance of Canada's space program."[26] The *Chapman Report* undoubtedly had an enduring and unprecedented influence on government space strategy in Canada; one that would draw priority further away from defence space programs.

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[24] Andrew B. Godefroy, *Defence and Discovery: Canada's Military Space Program, 1945-74,* 140, 149.

[25] J.H. Chapman, *et al., Upper Atmosphere and Space Programs in Canada,* 101.

[26] Andrew B. Godefroy, *Defence and Discovery: Canada's Military Space Program, 1945-74,* 173.

The late 1960s and 1970s saw several well-intentioned albeit failed efforts to reinvigorate a military space program in Canada. The Canadian Military Space Group (CMSG) met between 1967 and 1969 but, despite warning of the consequences of neglecting space defence projects, was unable to secure government commitment to its cause. Policy guidance from the Director of Strategic Force Planning, issued in direct response to the CMSG recommendations, actually stated that "At the present time there is no clear cut military requirement for the use of space technology."[27] The effect, then, was widespread cancellation of military space projects accompanied with the transferring of their associated resources to other departments.

As a further result of the *Chapman Report* an Interdepartmental Committee on Space (ICS) was founded in 1969 with the purpose of incorporating other departments such as defence. [28] It is difficult to argue that the ICS would ever have exerted consequence on defence policy, though, as it remained responsible to the Minister of Communications. Nationally, a federal space policy was ratified in 1974, but from 1970 to 1986 the defence organization did not generate a defence space policy document of any type.[29] Civilian satellite projects, including earth observation but particularly communication applications, continued to be the dominant effort while defence space projects languished and, in many cases, eventually ceased.

Clearly, defence space activity initially had significant government backing in Canada. Such activity resulted in Canada achieving an early and comprehensive

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[27] Col J.C. Henry, *Policy Guidance and CFP 200 – Implications of Military Studies,* Memorandum for Distribution: file 1150-110, 18 March 1968: quoted in Andrew B. Godefroy, *Defence and Discovery: Canada's Military Space Program, 1945-74,* 165.

[28] W.M. Evans, "The Canadian Space Program – Past, Present, and Future," 138.

[29] Andrew B. Godefroy, "Is the Sky Falling? Canada's Defence Space Programme at the Crossroads," *Canadian Military Journal* 1, no. 2 (Summer 2000): 53.

capability in space-related fields, something that was to have tangible results for the technological, industrial and academic sectors. Although the space sector in general continued to grow, a peak in military space endeavour was experienced by the mid-1960s after which the emphasis of Canadian space research programs switched to other departments.[30] This marked the initial point in what was to become a general neglect by government space policy for defence requirements which, ironically, were continuing to grow in importance.

In the years preceding the CSA there was a requirement for a whole-of-government space strategy, as well as a national space agency to implement it, which could establish prioritized objectives and allocate national space resources to them. There was a need to leverage Canadian capability to ensure investment in future multi- or bi-lateral strategic space initiatives. There were also ever-present and constraining funding restrictions. These all remain contemporary issues for DND. As subsequent chapters will show, such issues indicate that there is now more than ever a requirement for DND to coordinate defence objectives with the larger national space program.

1989 Onwards: Defence Space Policy after the Canadian Space Agency

Although the CSA has delivered many benefits to the Canadian space sector, defence has never been the focus of its mandate or organization. In recent decades – themselves marked by the presence of the CSA in a coordinating role – federal government policy has continued to hesitate in taking a more active approach to defence challenges in space.

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[30] Department of National Defence, *DSAB Report 92/1 on Canada's Security Interests in Space* (Ottawa: Defence Science Advisory Board, 1992), 3.

The circumstantial pressures that resulted in the creation of a national space agency predisposed it to an orientation towards the civilian sector. The Long Term Space Plan of 1986 encouraged the Ministry of State for Science and Technology (MOSST), in response to consistent industry requests, to continue advocating for a coordinating agency.[31] The CSA was subsequently created in 1989 by an order-in-council with a mandate focused on coordinating research and industrial efforts in support of federal government projects in space. Unlike many national space activities that were transferred to the CSA from other departments however, management of defence space projects continued to reside within DND.[32] That said, and given previous frustrations, the CSA certainly marked an improved state of affairs for the Canadian space sector in general. Its establishment was a positive move towards the centralization and coordination of space activities, and it coincided with a notable increase in the value of the Canadian space industry, with sales estimates of $100 Million in 1980 increasing to $300 Million by 1990.[33] Given the economic benefits associated with commercial space endeavours at the time, the agency's detraction of attention even further away from defence was, however, inevitable. An emphasis on the civilian space industry, spurred on by the sector's growth, meant that the new Canadian approach to space continued to result in low prioritization for defence space considerations.

Incidentally, the initial post-CSA period may have coincided with false optimism for the defence sector. In February, 1986 a House of Commons report recommended

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[31] W.M. Evans, "The Canadian Space Program – Past, Present, and Future," 145.

[32] House of Commons, Office of the Auditor General of Canada, *Report to the House of Commons: Chapter 7, Canadian Space Agency – Implementing the Canadian Space Program,* December, 2002, 3.

[33] W.M. Evans, "The Canadian Space Program – Past, Present, and Future," 146.

"that the Government undertake, without delay, a Canadian Military Space program." [34] The Chief of Review Services (CRS) reported back with several recommendations, and the Space Development Working Group (SDWG) was formed to coordinate their implementation. Studies emerged from the group in the form of Space Appreciation documents (one was published in 1992 and another one in 2000) that described national security concerns presented by the expansion of military and civilian space activities.[35] A Defence Space Policy was published in 1992 that accurately asserted that "a comprehensive space capability is fundamental to effective force projection."[36] Following the 1992 Space Policy the SDWG continued to develop documents on planning and guidance, all of which presented the need for an indigenous military space capability. The Liberal Government's decision to create the Directorate of Space Development (DSpaceD) within DND was further acknowledgment of the requirement for a defence space program, following as it did the government's realization that public support for military space programs was becoming increasingly important to other foreign policy objectives.[37] Notwithstanding these developments, and despite the acknowledgment of space as an area of concern for defence, progress continued to be challenged by several factors.

The increased appreciation for defence requirements that characterized the 1990s was not followed with requisite policy developments or resource allotments. The 1994

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[34] Department of National Defence, *A Canadian Military Space Strategy: The Way Ahead for DND and the Canadian Forces* (Ottawa: National Defence Headquarters, 1998), 1.

[35] Department of National Defence, *Space Appreciation 2000* (Ottawa: Directorate of Space Development, 2000), 1.

[36] Department of National Defence, *1998 Space Policy* (Ottawa: National Defence Headquarters, 1998), 3.

[37] Andrew B. Godefroy, "Is the Sky Falling? Canada's Defence Space Programme," 55.

Defence White Paper addressed space policy in terms of "the possibility of developing a space-based surveillance system" but pointed out that any efforts in the sector would have to be "subject to a variety of military, financial and technological considerations."[38] Indeed, the 1994 White Paper was relatively inconsequential for Canada's almost non-existent military space program.[39] In fact, the period was seemingly characterized by a deliberate hesitancy to avoid the subject of space militarization due to the political intricacies of the contemporary weaponization and missile defence debates. This was certainly manifest in the government's refusal to cooperate on Ballistic Missile Defence (BMD), but it was also reflected in the 1992 Defence Space Policy, which focused on enabling support to operations instead of addressing the need for a "dedicated, national, space-based capability."[40] This was an important distinction that would play into future policy developments, including the RADARSAT program discussed below. From a policy perspective, the requirements for a deliberate approach to defence space issues continued to be neglected although, late as it was, government policy had begun to acknowledge space militarization as important if not imminent.

Concurrent to these policy developments, the organization of the defence space sector within DND was itself characterized by an inconsistency that failed to reflect the importance of DND's space requirements. The organizations that had resulted from earlier space policies were ambitious in terms of goals but were too subordinate in their organization, or in some cases too transient, to have the desired effect. By 2005 there was

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[38] Department of National Defence, *1994 Defence White Paper*, (Ottawa: Canada Communications Group, 1994), 4.
[39] Andrew B. Godefroy, "Is the Sky Falling? Canada's Defence Space Programme," 54.
[40] James Fergusson and S. James, *Report on Canada, National Security and Outer Space*, 41, 33.

still "no overall management/administrative structure within the Government of Canada capable of moving space on to the national security agenda."[41] Although defence space concerns had been acknowledged by higher policy documents, any assertions that the defence space sector was subsequently afforded the prioritization it required are refuted by the organizational changes it endured. With the 2005 Defence Policy Statement and associated restructuring of the department, the elimination of the Vice Chief of Defence Staff (VCDS) organization resulted in DND's space branch moving to the newly created Chief of Force Development (CFD). This essentially "downgraded" the organization to section status under the Joint Production Capabilities Directorate, something indicative of a move even "further away from direct access to senior decision-makers."[42] Defence space projects then, although increasingly mentioned in departmental documentation, continued to be shepherded by an organization that was too far removed from national space strategy.

To suggest that the government intended the CSA to address space as a growing security priority would be to ignore the security policy it published. The government's 2004 National Security Policy aimed to "Adopt an integrated approach to security issues across government"[43] but did not, at all in fact, address space. Nor was space as a security concern reflected in the government's 2005 policy statement on defence. It noted that DND may be required to support other departments in helping to secure Canadians,

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[41] *Ibid*., 58.
[42] *Ibid*., 62.
[43] Privy Council Office, *Securing an Open Society: Canada's National Security Policy* (Ottawa: National Library of Canada, 2004), vii.

but did not discuss dependency on space as a security concern.[44] National policy aimed at whole of government approaches to security continued to avoid confronting the challenges in space, and the CSA was not encouraged to expand its coordination mandate into the defence sector but instead continued to "implicitly exclude military linkages."[45] The assertion that "Canada has no overarching national space policy, and space is not addressed in either of the latest national security and defence policies,"[46] thus continues to exist as consequential on the sector. With this context in mind, the progress of certain defence projects is illustrative.

The RADARSAT program demonstrated how the CSA, while achieving considerable success in its original mandate, may have further marginalized the requirements of a Canadian military space program. The project was envisioned by the government's 1994 Long Term Space Plan II, which prioritized earth observation projects within the Canadian space program.[47] At the 1985 announcement of an Interim Space Plan for Canada the Minister of State announced the RADARSAT program, but he did so without any reference to DND; in fact, among a list of several proposed applications for RADARSAT I provided in the media backgrounder, defence was noticeably absent. To the contrary, RADARSAT was described as a "civilian space radar."[48] Accordingly, DND did not invest in the project nor was it involved in the satellite's development. It became a user of the satellite's imagery but only in the

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[44] Department of National Defence, *Canada's International Policy Statement, A Role of Pride and Influence in the World: Defence* (Ottawa: Assistant Deputy Minister Policy, 2005), 6, 10.

[45] Department of National Defence, *DSAB Report 92/1 on Canada's Security Interests in Space*, 4.

[46] James Fergusson and S. James, *Report on Canada, National Security and Outer Space*, i.

[47] Government Consulting Services, *Evaluation of the RADARSAT-2 Major Crown Project* (Ottawa: Public Works and Government Services Canada, 2009), 1.

[48] Ministry of State (Mines), National Press Theatre, *Notes for Remarks by the Honorable Robert E.J. Layton at the Announcement of the Interim Canadian Space Program*, March 20, 1985, 1.

capacity of a client for the commercial entity that the project, through CSA's partnership with industry, had created.[49] While it is true that this approach did provide earth observation data for DND, it did so in a way that introduced considerable vulnerabilities to military operations by making them dependent on commercial business plans (something addressed in subsequent chapters).

Later developments with RADARSAT II did see participation from DND – two supporting arrangements with the department were ratified, one of which was to incorporate the Moving Object Detection Experiment (MODEX) onto the satellite.[50] Nonetheless, in terms of obtaining data products DND continued to occupy the position of a commercial client. In this particular case, the government started with a credit of $449.5 million (due to its role in assisting with development of the satellite), and that amount has been gradually withdrawn from with subsequent orders of data or services for departments such as DND.[51] The RADARSAT program provided the CF with access to earth observation data, but it did so in a way that subordinated defence space policy by rendering it a user entity, or consumer, dependent on commercial technology.

The approach to RADARSAT is not without problems from a DND perspective. It is here relevant to consider that as recently as 2013 the media was reporting that the limited observation time allocated to DND through credits was becoming a constraint.[52] Fundamentally, this results from the program's original objectives which, although emphasizing synergistic partnerships with industry and business sectors, made no

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[49] James Fergusson and S. James, *Report on Canada, National* Security *and Outer Space*, 33.

[50] Government Consulting Services, *Evaluation of the RADARSAT-2* Project, 13.

[51] *Ibid*., 1.

[52] David Pugliese, "Canadian Military Hungry for More Radarsat-2 Imagery," Space News, December 31, 2013, last accessed 5 January 2014, http://www.spacenews.com/article/military-space/38880canadian-military-hungry-for-more-radarsat-2-imagery.

mention of furthering defence priorities or requirements in space.[53] Ironically, the success of the program itself, and the success of the CSA in enabling it, had but further distanced defence space issues in Canada from the realities of the government's national space policy.

While a more prominent role for DND is expected to result from the recent announcement to develop the RADARSAT Constellation Mission (RCM), it is too early to discern the effects of this on defence space policy per se. Particular to the case of defence, the Polar Epsilon Project and its reliance on the download of RADARSAT data to DND processing centres may indicate a shifting paradigm.[54] Even with this effort by the defence community to involve itself more with the control of RADARSAT though, recent history would still seem to indicate a DND policy orientation that favours reliance on commercial programs.

The Sapphire satellite project is also mentionable as indicative of progress towards more active participation in defence space projects. Launched in 2013, the satellite is Canada's only dedicated military satellite project.[55] It is a contributor to the Space Surveillance Network (SSN) with the United States, and it is designed to monitor the position of satellites in outer orbits. Indeed, the program is consistent with recent CSA correspondence stating that the agency aims to provide future space solutions that "will contribute to the delivery of growing or cost-effective programs and services related

[53] Government Consulting Services, *Evaluation of the RADARSAT-2* Project, 2.

[54] James Fergusson and S. James, *Report on Canada, National and Outer Space*, 33.

[55] Chris Gainor, "Sapphire – Canada's First Military Satellite," *Space Quarterly Magazine*, March 6, 2012, 1.

to key national priorities, such as sovereignty, defence, [etc].”[56] That said, it is in fact possible that Sapphire does not represent a sufficient contribution given Canada’s current requirements in space. When the general currently in charge of Canada’s CFD organization was recently asked about Sapphire by a Senate Committee he noted that Canada harvests “exponentially” more from the SSN than it contributes.[57]

The low prioritization of space defence policy, something the sector first began to experience in the late 1960s, has continued since the CSA became responsible for Canada’s civilian space program. Policy documents in the early 1990s acknowledged the importance of space to defence operations, although in many cases the policies themselves did not translate into definitive change. Recently, the DND space program has continued to be characterized by minimal government investment or policy interest despite increasingly consequential requirements. The RADARSAT program served as an example of defence priorities becoming dependent on commercial enterprise instead of defence policy pursuing indigenous capability. Recent developments with Sapphire and Polar Epsilon are potentially indicative of a changing defence modus operandi in space, but it is likely too early to discern the nature of the projects’ real implications. Indeed, James Fergusson and Stephen James in particular have argued that “The DND . . . has progressively scaled back its space interest and pursuits since its mid-1990s peak.”[58] This conclusion remains a valid premise representing the essence of why a new approach to the DND space program may be necessary.

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[56] Department of Industry, *2013-14 Estimates: Report on Plans and Priorities* (Montreal: Canadian Space Agency, 2014), 5.

[57] Senate, Standing Committee on National Security and Defence. *Proceedings of Meeting Number 13 concerning Ballistic Missile Defence and Canada’s Space Program*, Monday, April 28th, 2014

[58] James Fergusson and S. James, *Report on Canada, National and Outer Space*, i.

Conclusion

This chapter highlighted the once strong albeit declining influence that defence priorities have held in the national space sector. Although Canada's initial space program was motivated and enabled almost entirely by defence programs, a gradual separation of defence space requirements from the larger national space agenda has since occurred. In the 1950s and 60s the Canadian defence research community was involved in a wide breadth of space projects, something that was ultimately responsible for generating technical developments in Canada's growing civilian space sector. A transition of national space priority away from defence and into first research, but then commercial applications, represented the beginning of a national space paradigm that has since seen the federal government divesting itself from a more prominent role in defence space policy. The legacy has contributed to the current state of Canada's military space program, with the assertion that "Current Canadian policy remains firmly grounded in the *Chapman Report*"[59] seemingly accurate.

That the defence space sector has in some ways been left behind by the pace of civilian sector projects is not a suitable argument for a reduced DND presence in space; in fact, and as the subsequent chapter will argue, the role for defence in space has been expanding for several decades. Policy makers will be required to address this reality sooner or later as the proliferation of different countries and different activities in orbit continues. The *Space Appreciation 2000* document was correct in concluding that DND

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[59] James Fergusson, "Out of Sight, Out of Mind: Canada, Outer Space, & National Security," *Fraser Forum* (May 2004), 15.

"must now seriously proceed . . . to address today's unfolding 2nd Space Age realities; the security and sovereignty implications are too great to ignore."[60]

The challenge of addressing this requirement is complicated not only be the neglect defence spacy policy has experienced, but also by the dynamics of the evolving space environment. There is a paradox in that, whereas the Cold War imperatives that motivated initial space programs may no longer be present, the importance of defence's role in space has not decreased. There is a requirement, then, for DND space policy to realize that the current policy environment is different than it used to be.[61] Future defence space endeavours, although no less important, will be required to draw on different sources for both their inspiration and their support. Whereas Cold War defence motivations were once sufficient to produce a capable defence space program, modern circumstance suggests that DND space programs will have to rely more closely on civilian efforts for impetus. The success of future defence space policies will depend on the imperative of integrating and coordinating within a national, interdepartmental approach. The next chapter addresses the implications of space to DND operations as well as the dependency of national security on space capability. Together with the resource challenges faced by current space programs, both issues combine to indicate that such a new approach will be necessary.

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[60] Department of National Defence, *Space Appreciation 2000*, 21.

[61] James Fergusson and S. James, *Report on Canada, National Security and Outer Space*, 22.

Chapter 2 – THE CASE FOR AN INCREASED CANADIAN MILITARY SPACE PROGRAM

As nations become more dependent on space-based assets and as the commercial sector continues to invest in outer space, the defence of space will become of increasing interest.

– The Future Security Environment 2008-2030[62]

Introduction

The relevance of space to current and future military operations is rapidly increasing. Internal Canadian government studies have concluded that "The world is at a point where falling behind in space security may prove to be fatal to a state's sovereignty."[63] On a holistic level, the proliferation of space-based technology has introduced new players and challenges to the space security arena. These include foreign militaries that were until recently considered to be non-space-faring, as well as civilian corporations which, in certain cases, have space capabilities exceeding those of many national governments. These changes require DND to evolve in its approach to space; yet, and notwithstanding an undisputed increase in military space dependency around the world, Canada's space defence capability continues to be relatively stagnant in its response. Specific to DND, policy makers should accept that emergent trends are causing the requirements of a military space program to increase in importance. This chapter discusses some of these trends in order to demonstrate their increasing relevance to DND and to national security at large. In doing so, an argument is made for a more robust DND space program on the basis of current military space dependencies, as well as on the

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[62] Department of National Defence, *The Future Security Environment 2008-2030: Part 1 Current and Emerging Trends* (Ottawa: Chief of Force Development, 2008), 98.

[63] Department of National Defence, *Discussion Paper Done By Andrew Godefroy for D Space D 3-5 on CANUS Space CO-OPERATION as an Element of the Development of an Instrument of Agreement on CANUS Space Cooperation* (Ottawa: National Defence Headquarters, 1999), 38.

expectation that the Canadian defence sector will shortly face an expanded security role in the space environment. Both perspectives indicate a requirement for a more comprehensive and deliberate approach to the DND space program, one that can efficiently and reliably ensure military space capabilities while also confronting the national security challenges that are emerging in orbit.

Far from an examination of space's military utility,[64] this chapter instead focuses on certain applications in order to more emphatically present the emerging importance of space to DND policy. The first part of the chapter focuses on the reliance of military operations on space assets, depicting space as a fundamental enabler of the current CAF. The second part presents space as an operating environment in which DND should anticipate increased responsibility. Space is indeed a domain on which national security depends, and DND should expect that this will have implications for its evolving role there.

Space as an Enabler of Military Operations

Over twenty years ago the Gulf War demonstrated to Canadian defence leadership the DND's "near outright dependency on American space support."[65] Throughout the conflict, reliance on space assets was a recurrent theme: satellites detected missile launches, discovered enemy formations, provided navigational cuing, analyzed the weather, and provided instantaneous communications between field commanders and

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[64] There is considerable literature on this subject. For a comprehensive discussion of military space applications according to support, control, enhancement and application roles see Andrew Godefroy, "Prometheus Bound: Canada's Defence Space Program in the Year 2025," in *The Canadian Forces in 2025 – Prospects and Problems*, ed. J.L. Granatstein, 1 – 42 (Victoria: FriesenPress, 2013).

[65] Department of National Defence, *Discussion Paper for D Space D 3-5*, 33.

strategic staffs.[66] Years later, this dependency of operations on space continues to accelerate. Now, in fact, the modus operandi of western militaries relies on space-based assets which in many cases are commercially owned. For instance, during Operation Iraqi Freedom there was a 560 percent increase in the use of commercial satellites for military purposes.[67] In another example, British aerospace doctrine emphasizes the vulnerability associated with having "over ninety percent of current United Kingdom military procurement projects rely to a greater or lesser extent on space."[68] The Canadian military, certainly, is not an exception to such dependencies on space-based enablers.

Many of the CAF's most sophisticated weapon systems rely on uninterrupted access to Global Positioning System (GPS) satellites, without which employment capability is significantly degraded. It is true that such systems are increasingly designed to counter GPS-denied environments, with encrypted signals and alternate guidance modes frequently incorporated. As with other examples though, the dependency on GPS satellites transcends the oft-cited, obvious ways in which such space assets enable militaries. In this case, the dependency runs deeper than simply navigation. The precision time and position data provided by the satellites also synchronize the algorithms of many military communications and data-link networks that rely on frequency agility techniques to deter jamming.[69] Even more fundamentally, military operations – especially domestic ones – often assume a certain baseline of civilian infrastructure functionality. But civilian society, too, depends on the same GPS timing signals for applications ranging from air

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[66] AST Engineering Services, *Space System Capabilities – Potential Opportunities for NORAD and CANADA* (Colorado Springs: AST Engineering Services, 1998), 9.

[67] Joan Johnson-Freese, *Space as a Strategic Asset* (New York: Columbia University Press, 2007), 29.

[68] Ministry of Defence, *British Air and Space Power Doctrine, AP 3000 4th Edition.* (Swindon: Headquarters Defence Academy, 2009), 19.

[69] *Ibid*.

traffic control to cell phone time synchronization.[70] GPS is only one of many examples demonstrating the extent to which Canadian military operations currently depend on space.

The reliance of military operations on remote sensing technologies illustrates additional consequences encountered when operational effectiveness depends on civilian space infrastructure. Increasingly, military remote sensing imagery is obtained from commercially owned or operated satellites. This created problems for the US military in Afghanistan where, in order to safeguard imagery of its operations, the Pentagon was forced to buy exclusive rights to the products of remote sensing company Space Imaging.[71] Furthermore, the issue of civilian dependency encompasses more than just surveillance. During Operation Enduring Freedom in 2003, sixty percent of military communications passed through civilian satellites.[72] Other studies suggest that commercial satellites provide eighty percent of western military space-based functionality.[73] And in the case of GPS, but equally true for other examples, there is evidence indicating that military planning processes still under-estimate the full extent of satellite dependency. A US Army-sponsored war game analyzed a 2020 scenario in which an in-orbit, indiscriminate explosion electromagnetically degraded satellite capability. A report bluntly related the results for allied operations by stating that allied

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[70] David Wright, Laura Grego, and Lisbeth Gronlund, *The Physics of Space Security: A Reference Manual* (Cambridge: Union of Concerned Scientists, 2005), 165.

[71] Laurence Nardon, *Satellite Imagery Control: An American Dilemma* (Paris: Institution Francais des Relations Internationales, 2002), 20.

[72] David Wright, Laura Grego, and Lisbeth Gronlund, *The Physics of Space Security*, 117.

[73] Joan Johnson-Freese, *Space as a Strategic Asset*, 29.

"military forces just ground to a halt."[74] The reliance of current defence systems on commercial satellite capability creates vulnerabilities that, being neither sufficiently anticipated nor addressed, threaten to undermine effectiveness.

Such expanding dependency on civilian space assets is creating other distinct vulnerabilities for Canadian military operations. The previous chapter discussed certain programmatic challenges inherent with DND's participation in earlier RADARSAT programs. Although such programs have provided space data to the military, thereby potentially rendering calls for indigenous space capability as unfounded, the consequences of depending on such civilian assets are not trivial. Contemporary military planning does not sufficiently account for civilian remote sensing systems becoming unavailable, and cases of DND requirements being undermined by data limits or other departmental priorities already exist.[75] In 2014 the *Ottawa Citizen* reported that DND could be at risk of utilizing its entire data allotment under the RADARSAT agreement by 2017, a date that was much earlier than originally predicted due to the satellite having become so "essential, particularly for the military's surveillance of the country's coastline."[76] The report indicated that DND was experiencing "exponential" growth with the use of RADARSAT data for military applications, and it went on to note that RADARSAT was contractually bound to deliver on data agreements with other countries

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[74] William B. Scott, "Wargames Underscore Value of Space Assets for Military Ops," *Aviation Week and Space* Technology, April 28, 1997, 60, quoted in Benjamin S. Lambeth, *Mastering the Ultimate High Ground: Next Steps in the Military Uses of Space* (Santa Monica: RAND Publishing, 2003), 100.

[75] David Pugliese, "Canadian Military Hungry for More Radarsat-2 Imagery," *Space* News, December 31, 2013. http://www.spacenews.com/article/military-space/38880canadian-military-hungry-for-more-radarsat-2-imagery.

[76] David Pugliese, "Time's Up? Federal Government could run out of Radarsat-2 data unless it finds more money – satellite has become essential for coastline surveillance," *PostMedia News,* 10 March, 2014. http://www.canada.com/technology/Time+Federal+government+could+Radarsat+data+unless+finds+more+money/9601476/story.html.

as well, including Norway, the US and China, as part of its ongoing commitments.[77] This dependency of military operations on remote sensing satellites and, even more importantly, the rates at which these dependencies are expanding, has significant consequences for DND Space Policy formulation. That the RADARSAT program has obligations to supply data to not only other departments within Canada, but also to many other national governments and commercial companies, is in the best case a contingency that DND space policy must account for and, in the worst case, a significant security vulnerability.

As the military embraces new applications for space, the dependency of operations on space data is accelerating at rates that may exceed the capacity of national assets to provide the services demanded. In other words, the issue of military reliance on space is accentuated by the rapidly expanding list of potential applications. The Automatic Identification System (AIS) is one such example of a relatively new technology serving as a force multiplier in novel ways. Incorporation of AIS systems on satellites offers real-time data on the position and trajectory of nearly every ship greater than 300 tonnes in the world. The CAF has been clear regarding its intent to rely on AIS data in maritime surveillance roles,[78] proposing the system for inclusion on the RADARSAT Constellation Mission (RCM). The development of defence-applicable space technologies such as AIS, however, contributes to user expectations for real-time, priority access to space data in all scenarios. Military leaders in Canada already take the

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[77] *Ibid*.

[78] Paris Vachon and R. Quinn, *Operational Ship Detection in Canada using RADARSAT: Present and Future* (Presentation of Defence Research and Development Canada, 20 June 2012), 27.

availability of space-derived data for granted.[79] For instance, the Canada Command Lessons Learned Document from the 2011 crash of First Air Flight 6560 expressed a sense of surprise that real-time space surveillance of the crash site was not available, and it went on to recommend that the federal government "look at expanding satellite coverage by procuring new initiatives that give 100% satellite imagery coverage of the north."[80] The accelerating dependency on, and expectation for, space support within DND manifests the requirement for a greater national interest in the defence space sector. Any dichotomy between resource availability and user expectation only heightens the CAF's vulnerability in space.

Technological developments require Canadian defence space programs to expand in concert with the changing space environment. The potential defence utility of microsatellites, for example, demonstrates the extent to which DND reliance on space should be expected to grow with advancing technologies. A Defence Research and Development Canada (DRDC) proposal recently recommended that defence micro-satellites, each weighing less than one hundred kilograms, be used to provide "persistent wide-area coverage" services.[81] Such satellites would augment the capability of the CAF with an economical, responsive and flexible solution that, importantly, would be indigenous to the CAF. It would further operationalize space for defence organizations, in the process providing solutions that are more independent, secure and responsive to

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[79] Andrew Godefroy, "Prometheus Bound," in *The Canadian Forces in 2025 – Prospects and Problems,* ed. J.L. Granatstein, Chapter 4 (Victoria: FriesenPress, 2013), 39.

[80] Department of National Defence, Canada Command, *Canada Command (Canada Com) Lessons Identified from First Air 6560 (FA 6560) Incident in Resolute Bay* (Ottawa: Department of National Defence, 2012), 16,

[81] Donald Bedard and A. Spaans, "Responsive Space for the Canadian Forces" (paper presented at the 5th Responsive Space Conference Los Angeles, California, April 23-26, 2007), 1.

defence requirements. DND will require a space organization and policy capable of adapting to such new roles and technologies.

Although cost remains a significant challenge, it alone does not negate the inevitability of future reliance on technologies such as microsatellites. Canadian defence scientists estimate that, if pursued, capable microsatellite capabilities could be developed for between $15 and $30 million dollars per platform, a comparatively small sum given the capability.[82] Other nations have already expressed intent to develop microsatellite programs. A 1999 United States Air Force study recommended that the US government pursue microsatellites as a matter of priority.[83] In the United Kingdom, aerospace doctrine has described microsatellites as "a potential route for the development of indigenous space capabilities as an alternative to cost-sharing or negotiating access to the space assets of allies and partners."[84] In Canada such technologies have been demonstrated on a limited basis, with partnerships between the CSA and DRDC resulting in both the Near Earth Orbit Surveillance Satellite (NEOSSat) and the Maritime Monitoring and Messaging Microsatellite (M3MSat). In both cases the involved agencies concluded that partnering had allowed them to "leverage each other's funding, resources and expertise."[85] The future use of microsatellites by small militaries is, to a certain extent, inevitable. For now, it is certainly manifest of a Canadian requirement for a comprehensive defence space program capable of adopting itself to new capabilities.

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[82] Donald Bedard and A. Spaans, "Responsive Space for the Canadian Forces," 3.
[83] Joan Johnson-Freese, *Space as a Strategic Asset*, 138.
[84] Ministry of Defence, *AP 3000 British Air and Space Power Doctrine*, 20.
[85] Donald Bedard and A. Spaans, "Responsive Space for the Canadian Forces," 4.

The importance of space to facilitating Canadian military operations cannot be underestimated. In light of contemporary examples, the 1992 Space Awareness document's conclusion that space would shortly be identified as an operational centre of gravity[86] is likely now a truism instead of a prediction. The Chinese military's assessment of space having been a "battle winning advantage" for the West during recent middle-Eastern engagements is also valid.[87] The Space Foundation's 2012 Report seemingly agreed, publishing similar conclusions while summarizing the extensive reliance on space that had characterized the military operation responsible for discovering and killing Osama Bin Laden.[88]

It is no longer sufficient to pursue space policy or capability that merely uses space technology to facilitate traditional military operations. Dependency has reached a level whereby space is representative of an attack avenue, and as such it requires protection. A future security environment study in fact concluded that technological advantages held by modern militaries over asymmetric threats may be eroded in space as the technology necessary to disrupt or destroy satellites continues to become less sophisticated and costly.[89] Military space capability has to be secured, but so too does civilian space capability. Thus, the country also requires a defence space program that addresses space as an independent operating environment in which DND will bear increasing responsibility for national security.

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[86] Department of National Defence, *Space Appreciation 2000*, 17.
[87] Ministry of Defence, *AP 3000 British Air and Space Power Doctrine*, 19.
[88] Space Foundation, *The Space Report: The Authoritative Guide to Global Space Activity* (Colorado Springs: Space Foundation, 2012), 25.
[89] Department of National Defence, *The Future Security Environment 2008-2030*, 98.

Space as an Operating Environment and its Impact on National Security

In 2000 Canadian government correspondence acknowledged that certain threats to national security from space were increasing in prominence, and that many of them would become a DND responsibility.[90] Indeed, the CAF must be prepared to defend Canadian interests in space not only for the purposes of securing space-based military enablers, but also as part of its evolving mandate to protect Canadian security in general.

Canada needs a space program that accepts the contestation and militarization of the space environment as a fait accompli. Contemporary conceptualization of space as a free, uncontested domain is erroneous even if significant treaty and policy efforts continue in their endeavours to preserve space as a "sanctuary."[91] The remote, isolated and peaceful-purposed characteristics of the space environment, perhaps once applicable, can no longer be counted on to protect space assets. The increasing societal importance of satellite capabilities increases their worth as targets for Western adversaries;[92] moreover, and as previously discussed, the militarization of space has to a large extent already occurred. Canadian policy makers should therefore view space as an increasingly contested operating environment because the technology needed to contest it is proliferating rapidly. Many examples apply, including a well-known one in which China, in 2007, intercepted and destroyed one of its own satellites with a ground-based weapon, in the process creating three hundred thousand pieces of space debris.[93] In doing so China not only revealed a significant strategic capability, it also demonstrated the potential for

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[90] Department of National Defence, *Space Appreciation 2000*, 17.

[91] Brian E. Fredriksson, "Space Power in Joint Operations: Evolving Concepts," *Air & Space Power Journal* 2, no. 18 (Summer 2004): 87.

[92] James Fergusson, "Out of Sight, Out of Mind: Canada, Outer Space, & National Security," 16.

[93] Adam E. Frey, "Defense of US Space Assets: A Legal Perspective," *Air and Space Power Journal* XXII, no. 4 (Winter 2008): 78.

unilateral action in space, no matter the intention, to result in problems (such as debris) that incur significant worldwide consequences.

Space systems are inherently vulnerable because, by virtue of their design, they are generally predictable, easily detected and in many cases incapable of defensive manoeuvring.[94] Kinetic options aside, satellite technology is also vulnerable to less sophisticated threats such as jamming and spoofing, something the 2003 alleged jamming of the Telstar 12 communications satellite by Iranian agents manifested clearly.[95] Other states have acknowledged these facts. United States Air Force space policy not only recognizes space as a distinct operating environment, it also asserts the pre-eminence of the requirement to "protect and defend" space capabilities.[96] Accordingly, the presence of technology capable of threatening space capabilities, be they defence related or otherwise, will continue to emphasize a strategy that more actively extends CAF responsibility into the space domain.

Indeed, the nature of the space environment is demanding an expansion to the definition of aerospace power itself. Whereas Canadian Air Force doctrine defines aerospace power with rather traditional terminology, describing it as an "element of military power applied within or from the air and space environments to achieve effects," it is likely that space establishes requirements for a broader, more inclusive definition. Societal dependency on satellite services is reaching new levels and, aware of it or not, the public has placed a high value on the services that satellites assure for them. For

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[94] David Wright, Laura Grego, and Lisbeth Gronlund, *The Physics of Space Security*, 109.
[95] *Ibid*., 121.
[96] Department of the Air Force, Air Force Policy Directive 13-6: Nuclear, Space, Missile, Command and Control Space Policy (Washington, DC: Air Force E-Publishing Office, August 13, 2013), 3.

example, current trends in social media such as accelerating video data stream requirements indicate that mobile-satellite hybrid networks will emerge as a cost-efficient solution to providing media content everywhere.[97] A country derives power in part from the productivity of its citizens; thus, a country's "aerospace power" in space is quickly becoming directly connected to much more than military capability. From cell phones to banking transactions, from remote industrial plant monitoring to emergency response capability, satellite infrastructure has become central to the basic functioning of Canada's populous. Industrial strength also contributes to a nation's aerospace power,[98] and this too is a reason for strengthened ties between Canada's aerospace industry and its DND space strategy. Canada therefore requires a defence space policy that not only addresses the protection of DND space infrastructure, but also one that anticipates the requirement to protect other national interests threatened from or within space.

Civilian economic and industrial dependency on space capabilities means that a Canadian defence space policy will have to transcend traditional organizational paradigms. Indeed, there is already evidence to confirm an earlier prediction that "Pressures will likely build from the commercial sector for the military to provide defence for commercial assets."[99] The Canadian Council of Chief Executives has concluded that space is now vital to Canadian commerce.[100] More recently, the CAF lessons learned document published following the 2009 Schriever-V War Game reached

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[97] Olaf Acker, Florian Potscher and Thierry Lefort, *Why satellites matter: The relevance of commercial satellites in the 21st century – a perspective 2012-2020*, A Report by Booz & Company for the European Satellite Operators' Association (Amsterdam: Booz & Company, 2012), 4.

[98] Department of National Defence, *DSAB Report 89/1 on Space R&D Sovereignty*, 9.

[99] Department of National Defence, *Space Appreciation 2000*, 13.

[100] D. Bercuson, *et al*., "National Defence, National Interest: Sovereignty, Security and Canadian Military Capability in the Post 9/11 World" (A Report Prepared for the Canadian Council of Chief Executives, Calgary, Canadian Defence and Foreign Affairs Institute, 2003), 18.

a similar assessment, finding that "Our financial system, electrical grid, telecommunications, commercial fishery, agriculture, natural resource management, and aircraft movements" all relied on space.[101] Such arguments have basis in real events too. In 1996, for example, a timing error transmitted to a GPS satellite for six seconds caused over one hundred cellphone networks to be degraded.[102] More recently, problems in Canadian telecommunications, internet, banking and air traffic control services observed over a twenty-four hour period in 2011 were jointly attributed to a failure aboard the Anik F2 satellite.[103] The Canada First Defence Strategy describes ensuring the security of Canadian citizens as the "first and foremost" role of the Canadian military.[104] So whereas opponents of widened DND activity in space may argue that space problems are beyond the scope of military responsibility, such reasoning ignores the very premise on which defence organizations exist. As national interests extend into space, so too will the requirement to protect them; consequently, any Canadian defence space program will simply have to address the growing array of threats to national security that are found in space.

Space assets are not only threatened by the intents of other actors though; they are also increasingly threatened by the environment itself. As an example, the array of objects orbiting earth represents a threat to Canadian satellites, civil and military, of increasing significance. The CAF will have to prioritize monitoring of orbital activity not

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[101] Francois Malo, "Schriever V: Lessons Learned – A Canadian Perspective," *High Frontier – the Journal for Space & Missile Professionals* 5, no. 4 (2009): 30.

[102] Joan Johnson-Freese, *Space as a Strategic Asset*, 41.

[103] Space Working Group, *Final Report Submitted to the Aerospace Review* (Ottawa: Department of Industry, 2012), 22.

[104] Department of National Defence, *Canada First Defence Strategy* (Ottawa: Department of National Defence, 2006), 7.

only for defence purposes, but also for protecting wider Canadian interests from the threat of space debris. Arguments that space surveillance programs disguise weaponization ambitions draw on the example of ballistic missile defence and the use of space surveillance network (SSN) assets for warning and targeting. Other potential applications of the SSN aside, the requirements for orbital surveillance should not be discounted. In 2009 the Cosmos 2251 satellite collided with an operational Iridium satellite in what was a "wakeup call" for the space community because it seemed to demand a new approach to the management of space traffic.[105] Both the European Space Agency and NASA regularly encounter scenarios in which they have to perform evasive maneuvers with satellites in order to avoid collisions. In 2007, for example, the orbital altitude of the International Space Station (ISS) had to be changed in order to avoid a collision with a Russian rocket stage that had been in orbit since 1971.[106] That Canada requires a defence space program capable of sustaining and in fact augmenting current allied space surveillance efforts is but one reason for why the CAF should expect to take on an expanded role in the space environment.

But the space debris issue also has more subtle implications for defence because it helps to illustrate why responsibility for issues associated with the protection of civilian satellites will likely remain with the military. Just as DND, with the North American Aerospace Defence Command (NORAD), maintains responsibility for Canadian airspace sovereignty, space situational awareness will also continue to be a DND jurisdiction. In

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[105] K. Becker, *et al*., *Space Situational Awareness*, SSE Educational Series 2012 (Austria: Space Generation Advisory Council, 2012), 10.

[106] D. Mehrholz, *et al.*, "Detecting, Tracking and Imaging Space Debris," *European Space Agency Bulletin* 109, (February 2002): 129.

the past Canada has had access to US space surveillance data in return for contributing to NORAD.[107] This is one way that the DND collaborates with the United States in order to access its space surveillance catalog data. In orbit itself, the mainstay of Canada's contribution is Sapphire, an electro-optical satellite designed to track objects in outer orbits or deep space.[108] However, that Canada is currently able to rely on the US for space surveillance data due to niche contributions like Sapphire is not a suitable argument against the need for further expenditures and policy developments in the in the field. Canada's ability to benefit from American data is precariously based on its ongoing contribution to the process, something that will have to keep pace with US developments. Sapphire in fact demonstrates the need for long term commitment to a Canadian space plan – it is, after all, scheduled for only a 5-year operational mission.[109] It is an equally telling point that, as of 2012, the US space surveillance system's operating budget was financed entirely by the Air Force Space Command budget, and that the US Air Force did not charge recipients for use of the data.[110] Recent developments in American policy may indicate changing trends, though, causing sector analysts to anticipate that the US will require Canada to invest more in military space programs if it is to remain an active and valued partner in such arrangements.[111] The case of space surveillance therefore accentuates the requirement for a more robust, independent presence of DND in space, one that is capable of expanding its commitment to meet the requirements of lateral

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[107] D. Bercuson, *et al.*, "National Defence, National Interest," 17.

[108] K. Becker, *et al*., *Space Situational Awareness*, 7.

[109] Kendall, D., "Advances in Canada's Contributions to Space Situational Awareness" (Scientific and Technical Subcommittee presentation to the United Nations Committee on the Peaceful Uses of Outer Space, New York, NY, February 13, 2014), 29.

[110] K. Becker, *et al*., *Space Situational Awareness*, 19.

[111] James Fergusson and S. James, *Report on Canada, National Security and Outer Space*, 22.

agreements while also preserving a certain level of independent capability for Canada in the field.

Traditional multi- and bi-lateral commitments also represent for Canada areas that will continue to be dependent on having a capable defence space program. Space surveillance applications aside, the benefits of Canada's membership in organizations such as the North Atlantic Treaty Organization (NATO) and NORAD will continue to rely on the capability and contributions of a Canadian defence sector. A Canadian Council of Chief Executives document summarized:

> Given the obvious vulnerabilities of the Canadian economy to attacks on Canadian satellites, and the pressing need for up-to-date satellite surveillance of the entire North American land mass for security reasons, it is inconceivable that Canada aspire to play a full role in North American defence without setting down a comprehensive Canadian policy on the 'securitization' of space.[112]

With the relatively new issue of space security then, policy along the lines of Canada's oft-cited niche strategy may not necessarily suffice – wider participation may be necessary. In the case of ballistic missile defence, Canada's 2005 decision not to cooperate with the United States in the endeavour resulted in changing dynamics that may still prove detrimental.[113] In 1985 after all, with a similar decision not to participate in Strategic Defence Initiative (SDI) research, a derivative effect had been the decline in Canadian access to US military space

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[112] D. Bercuson, *et al.*, "National Defence, National Interest," 18-19.

[113] The issue was recently raised by Senator Daniel Lang during a 2014 session of The Standing Committee on National Security and Defence when he suggested that, as a result of Canada's stance on BMD, Canada may no longer be entitled to the same intelligence sharing privileges that it has benefited from in the past. See Senate, *Proceedings of Meeting Number 13 concerning Ballistic Missile Defence and Canada's Space Program,* Monday, April 28th, 2014.

programs.[114] Space defence capability therefore represents not only a requirement of any national security policy, but also a requirement of importance to Canada's future security partnerships with other nations.

Debates on the likeliness of space weaponization are irrelevant to the immediate challenges a DND space program faces. What is relevant are the dependencies of national security on space and, more importantly, the proliferation of technology, much of it ground-based, that is capable of threatening these dependencies. Together such factors necessitate a Canadian space defence capability that identifies threats to Canadian satellites and takes measures to defend against them. Emerging vulnerabilities and national security concerns in space indicate that DND should expect an expanded jurisdiction in space. The defence organization will have to anticipate the developing requirement to protect space-based assets, be they military or civilian, from a range of natural and deliberate threats. Defence priorities as well as wider, developing national security concerns require it. A Canadian defence space policy must be wide in scope, looking to space not simply as a taken-for granted source of data but also as a unique, discrete operating environment.

Conclusion

This chapter presented several arguments for a more active DND presence in space. The Canadian military is dependent on space-based assets, exposing significant vulnerabilities that some experts warn may result in a "Space Pearl Harbor."[115] It is, however, not sufficient only to view space as merely a military enabler. To do so is to

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[114] James Fergusson and S. James, *Report on Canada, National Security and Outer Space,* 28-29.

[115] Commission to Assess United States National Security Space Management and Organization, *Executive Summary* (Washington, DC: U.S. Government Printing Office, 2001), 8.

underestimate the future contributions of DND to Canada's national security. Canada's defence space policy must be capable of anticipating future requirements. It must view space as an operating environment in which the military will be required to take on additional roles to do with the defence of Canadian interests.

The requirements of a defence space policy are further complicated by the breadth of national stakeholders for whom space is becoming an increasingly vulnerable dependency. Defining a military space policy for Canada is uniquely challenged because, as a US commission led by former US Secretary of Defense Donald Rumsfeld once assessed, the issue of national security in space continues to transcend a country's traditional departmental dividing lines.[116] This renders future DND involvement in space as an interdepartmental endeavour, likely much more so than it is even today.

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[116] *Ibid*., 25.

Chapter 3 – ISSUES WITH CURRENT SPACE POLICY AND ORGANIZATIONAL PARADIGMS

There is no over-arching articulation of what we want to do in space or how we want to do it.

– The Aerospace Review[117]

Introduction

Having discussed the historical divesture of federal government interest from defence space policy in Canada, and having then argued for the increasing relevance of space to present and future DND operations, this study now turns to the subject of the policy and organizational framework within which DND pursues its space agenda. Clear and comprehensive strategic guidance is required for DND to be successful in the space environment, but such policy has been slow to promulgate. Moreover, the DND space sector requires an organization that better optimizes the interdepartmental efforts on which it depends. Although significant defence space initiatives have been recently undertaken with varying success, their progress may be due more to the pragmatism of DND leadership than to the clarity of departmental or national space policy. Space policy specific to DND has been slow to evolve and, partly as a result, national space plans have not sufficiently accounted for either the requirements or contributions of the defence sector. This chapter discusses current space policy at both the DND and national levels while arguing that, as presently structured, the national approach to defence space policy and organization is not conducive to evolving military requirements.

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[117] Department of Industry, *The Aerospace Review Volume 2, Reaching Higher.* 30.

Part one of this chapter discusses the current DND Space Policy while also addressing other relevant strategic directives. It shows that DND policy has been slow to react to the challenges of the space environment itself. Part two expands the discussion to a consideration of the wider, national construct of space policy and organization into which the DND space program currently fits.

DND Space Policy: The Consequences of Antiquation

Space policy documentation particular to DND is inadequate due to its antiquated nature, its inconsistency with current government direction and its lack of specificity. This section addresses DND's current defence space strategy documents and organizational paradigms. In the former case, DND has suffered in capability from failure to regularly publish and review a space policy. In the later, and with respect to the particular case of DND organization at the operational level, a suitable space framework has been proposed although it has yet to be fully implemented.

The current DND Space Policy was published in 1998. It was intended to align DND space documentation with both the 1994 Defence White Paper and the 1996 NORAD renewal. The policy identifies objectives for DND in space, including the protection of national interests from threats in space, as well as the use of space technology in fulfilling Canada's defence commitments. It also conceptualizes an appropriate approach through the "use of all available civil, governmental technologies" and cooperation with other agencies both domestic and international.[118] However, since 1998 the Canadian military has undergone several strategic changes, with evolution of the military space sector having been particularly dynamic. The events of 9/11 changed

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[118] Department of National Defence, *1998 Space Policy*, 1, 6.

the strategic orientation of DND, resulting in departmental transformation and, associated with it, several new policy documents such as the Canada First Defence Strategy (CFDS). Moreover, changes to the NORAD agreement, originally the impetus for the 1998 policy, have continued to occur. The 2006 NORAD renewal incorporated a maritime warning mission, and it acknowledged implications of developing space-based threats to NORAD operations.[119] Although policy authorities in Canada continue to work towards an updated DND Space Policy, it has yet to be completed and, according to an Assistance Deputy Minister Policy (ADM –POL) officer, there is no timeline for its release.[120] Combined with the accelerating requirements of the DND space program, the department's reliance on a space policy published sixteen years ago persists as a significant detraction. DND requires a space policy that is current if it is to maintain relevancy.

A further challenge for current DND space policy is that of maintaining consistency with evolving government intent. Without a policy that is regularly reviewed, DND space programs risk inconsistency with the strategic intent of changing governments. The 1998 Space Policy resulted in specific directives on projects, plans and management structures necessary to further the policy's broader aims. However, many of these directives are no longer consistent with wider defence strategy. For example, the 1998 DND Space Strategy documentation refers to a departmental structure – one centred on the Directorate of Space Development (DSpaceD) – that no longer exists, and many of

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[119] US Department of Defense and the Canadian Department of National Defence, *Treaty E105060: Agreement between the Government of Canada and the Government of the United States of America on the North American Aerospace Defense Command* (Ottawa: Canada Treaty Information, 2006), 2. http://www.treaty-accord.gc.ca/text-texte.aspx?id=105060.

[120] Ryder Mckowen, correspondence with author, 7 January 2014.

the projects referred to by the document have come and gone, been cancelled or absorbed into other departments. Similarly, the 1998 documentation's discussion of ballistic missile defence is not consistent with the 2005 political developments on the issue. Foreseeing such dynamism, the 1998 Space Policy addressed the requirement for it to be kept up to date, asserting in opening paragraphs that the document would have to be regularly "reviewed, updated and reissued."[121] But the department has nonetheless continued to operate without a more relevant policy to guide its decisions on space. An important consequence of relying on a legacy policy is that it may, expectedly, be inconsistent with other DND developments.

Considering the years since DND published a space policy, the organization of DND space personnel has nevertheless evolved considerably to a point whereby it is now better suited to the de facto operating environment. Operationally, DND space organizations presently reside within the Canadian Joint Operational Command (CJOC), the Chief of Force Development's (CFD) Director General Space (DG Space) and the Canadian Space Operations Cell (CANSpOC). This structure suggests that DND grasps the importance of closer integration with Canadian operational military commanders as well as with external players.

Figure 1, below, illustrates the space force management structure presently proposed for DND. It incorporates a single space "chain of command" that reports to a CJOC Deputy Chief of Staff (DCOS) position, which is held by a Brigadier General.[122]

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[121] Department of National Defence, *A Canadian Military Space Strategy: The Way Ahead for DND and the Canadian Forces* (Ottawa: National Defence Headquarters, 1998), 9.

[122] Andre Dupuis, "Integrating Space into CF Operations" (lecture, Canadian Forces College, Toronto, ON, January 9, 2013), with permission.

Two separate lines of operation exist underneath this DCOS position, one for the daily operations of DND space activities and a second for the CFD DG Space effort. In the former, a Space Operations and Readiness cell oversees a 24/7 Space Watch Organization, two Joint Space Support Teams and a Space Operations and Plans section. The DG Space organization, on the other hand, is comprised of several out-of-Canada exchange positions, the Directorate of Space Policy and Strategy and, thirdly, the Directorate of Space Requirements. Significant re-organization of personnel internal to DND will of course be necessary to ensure that the positions become occupied in the future, forcing personnel resources to be re-directed from other, less critical areas of the organization. Although these positions remain unfilled, the fact that they have been identified as necessary, have been incorporated into operational level command structures, and have been accepted by senior military leadership indicates that, operationally, DND is well positioned to handle the growing reliance of military operations on space.

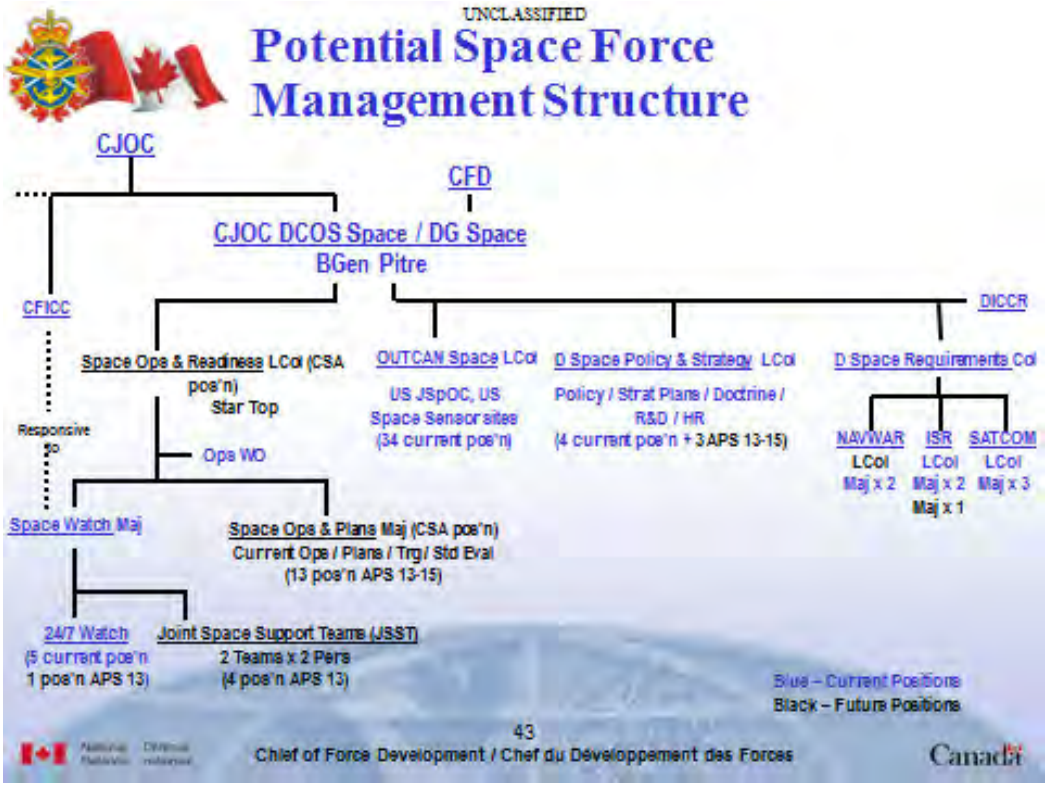

Figure 1 – Operational Level Space Organizational Structure

Source: Dupuis, "Integrating Space into CF Operations," 43.

This study posits that higher level DND strategy, unable to reference an accurate and recent DND Space Policy, has itself only been capable of addressing space issues with only vague, uncertain priorities. The 2008 CFDS is one such document that describes in detail exact procurement commitments deemed necessary for transitioning the CAF to a "first class military capable of providing enhanced security for Canadians."[123] Despite its resounding effect on DND funding and capabilities though, the document makes no reference to space at all. It is difficult to discern a reason for this omission, although the detail with which the CFDS discusses other projects suggests that it may be for none other than a general lack of government commitment to a military

[123] Department of National Defence, *Canada First Defence Strategy* (Ottawa: Department of National Defence, 2006), 21.

space strategy. Indeed, the importance of other, space-related defence programs at the time is difficult to dispute. But these programs – RADARSAT being one – nevertheless go without mention. Meanwhile, other controversial capital procurement projects (such as next generation fighter acquisition) are outlined in detail.[124]

The failure of higher-level defence policy documents to address space specifically is further demonstrated by the 166 pages comprising DND's *Future Security Environment 2008-2030* document. In this publication the defence of space is addressed on a single page as something that "will become of increasing interest."[125] This hesitancy to address space more specifically – the fact that it is seldom addressed in terms of actual priorities or resources – is a trend that persists through other planning documents. In the DND 2012-13 Report on Plans and Priorities "Space Capabilities" are listed as a joint objective to be pursued but, aside from the requirement to "re-establish" a meaningful contribution to the US Space Surveillance Network, space receives little specific attention in the document.[126] The subject of space is not mentioned at all in the document's Aerospace Readiness section.[127] The declining relevance of DND's Space Policy has, then, resulted in other DND policy documents addressing the subject with decreasing detail. This in and of itself continues to advocate for the release of a new policy that is not only recent and consistent with government intent, but also specific.

A comparison of current DND space documentation with that of the past indicates that space defence issues, once addressed in detail, are conspicuously absent from

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[124] *Ibid*., 4.
[125] Department of National Defence, *The Future Security Environment 2008-2030*, 98.

[126] Department of National Defence, *2012-13 Report on Plans and Priorities* (Ottawa: Department of National Defence, 2013), 44, 26.
[127] *Ibid*., 35.

contemporary strategic guidance. Whereas 1998 documentation identified concrete objectives as well as related funding avenues, management structures and projects, recent documentation is comparatively vague in its consideration of space issues. From an organization perspective, a position centric to CJOC headquarters now maintains oversight of DND space activities, and there are liaison or exchange positions with both the CSA and at various US locations. However, many positions remain unoccupied and, given the reluctance of DND strategic documentation to address space operations specifically, may be likely to remain that way for some time. If the space operations structure being proposed is to effectively tackle the challenges of military space operations, a comprehensive DND Space Policy directing the organization to do so will be necessary. A policy is needed not only to clarify objectives, but to communicate to the rest of the department (as well as to the rest of the government) an appropriate rationale and approach to achieving a more significant presence for DND in space.

National Space Policy: The Consequences for DND

The modern interdependence between defence space capability and civilian space programs indicates that continued integration of DND operations with national space strategy is inevitable. It also implies that shortcomings in DND Space Policy will affect other agencies such as the CSA. The present situation, whereby DND does not have a new space policy, has contributed to defence space priorities being under appreciated by other agencies throughout the space sector. For this reason and others, the wider organization of the national space sector into which the DND program currently fits also warrants examination from a policy perspective. The success of military space programs depends on more than just DND strategy – it also depends on the policy and

organizational framework of wider national space plans. Here, and similarly to the case of DND-specific policy discussed in the previous section, problems with national space policy paradigms have in some ways subordinated DND space priorities.

The Canadian Space Agency's 2005 Space Strategy document is the last comprehensive policy guiding the agency. The document aims to achieve an interdepartmental approach with the CSA as the coordinating entity. It asserts a vision for integrating "space fully and completely in Government of Canada departments and agencies as an invaluable tool in helping them fulfil their mandates."[128] Yet defence figures into the 2005 Space Strategy only peripherally. It is identified as an enabler of certain security and foreign policy objectives, but little detail is provided regarding how such objectives should be met.[129] That the document affords comparatively little attention towards security or defence objectives is an issue the CSA itself has previously acknowledged, claiming in a 2004 report that a principle problem continued to be the "insufficient integration of space in security systems [and] the lack of space awareness in the security community."[130] Government and civilian senior leaders alike are informed by DND and CSA space policy documents. A consequence of relying on policies that are either out dated, in the case of the DND policy, or that are under-appreciative of defence requirements, as in the case of the CSA Space Strategy, is the continued subordination of DND space concerns.

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[128] Canadian Space Agency, *The Canadian Space Strategy: Serving and Inspiring the Nation* (Montreal: Canadian Space Agency, 2005), 7.

[129] *Ibid*., 11.

[130] Canadian Space Agency, *Space and National Security: How Civil and Commercial Space Contribute to Canadian Security* (Montreal: Athena Global, 2004), 32.

At the macro level, Canada has consistently hesitated to champion a truly national space policy despite repeated and convincing recommendations to do so. The 2012 Space Working Group, commissioned by the Aerospace Report Commission, made this point succinctly:

> The space industry does not consider the Canadian Space Strategy, generated in 2004 by the CSA, to be a national strategic framework, as it was applicable to the CSA only and thus had no impact on the conduct of the space activities of other government departments (e.g. Department of National Defence).[131]

Recent attempts to achieve a comprehensive space plan that would incorporate DND have for the most part been ineffective. The National Aerospace and Defence Strategic Framework, announced in 2005, noted that investment in the defence industry could be used to realize policy objectives of the government's economic development agendas (an idea further argued by this study in Chapter 4).[132] However accurate the recommendation may have been, the government's framework was never widely implemented.[133]

More recently, the CSA's proposed "Long Term Space Plan" has seemingly attracted little attention from Ottawa policy makers.[134] In early 2014 the government responded to the critical *Aerospace Review* by issuing a national *Space Policy Framework*. It represents a significant step towards a national space strategy in its recognition of space as a means to "protecting our national sovereignty, security and safety."[135] It is a framework though, not a plan, and the document's impact on defence, if

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[131] Space Working Group, *Space Working Group Report Submitted to the Aerospace Review* , 32.

[132] Department of Industry, *National Aerospace and Defence Strategic Framework 2005-2025* (Ottawa: Industry Canada Communications and Marketing Branch, 2005), 22.

[133] Space Working Group, *Space Working Group Report Submitted to the Aerospace Review*, 32.

[134] *Ibid*.

[135] Canadian Space Agency, *Canada's Space Policy Framework: Launching the Next Generation* (Montreal: Canadian Space Agency, 2014), 6.

any, has yet to be determined. As such, not only does DND presently operate without a recent and relevant DND Space Policy; it also operates within a wider national space strategy that is similarly struggling to integrate defence-related issues.

In terms of the national space sector, current organizational paradigms do not facilitate a natural integration of space stakeholders; rather, they contribute to the continued subordination of the defence sector. The tendency for space projects to transcend departmental dividing lines has meant that the CSA incurs a major role (even if just in a coordination capacity) in most DND space projects. The RCM mission and the Polar Communications and Weather (PCW) satellite program are both examples of projects in which the CSA is heavily involved. The CSA, however, is organized under the Ministry of Industry and, perhaps expectedly, maintains a focus towards civilian agendas. As such, the general organization of the Canadian space sector may result in a predicament for DND whereby a Department of Industry agency retains significant responsibility for programs that are critical to DND effectiveness. The 2012 Space Working Group team acknowledged this situation as problematic, concluding that "It is difficult, if not impossible, for Industry Canada to place the priorities of other departments ahead of its own departmental priorities."[136] Ironically, this has resulted in the CSA becoming the "de facto champion" for many programs that in large part belong to other departments.[137] It is thus likely that government agencies are not suitably organized for the complexities of interdepartmental space projects. As one of the most space-dependent departments, DND continues to be disadvantaged by this situation.

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[136] Space Working Group, *Space Working Group Report Submitted to the Aerospace Review*, 45.
[137] *Ibid*.

That the strategic organization of the national space sector may require modification should not be a surprise. Inefficiencies in the organization of Canada's space program and, specific to this study, the placement of DND within it, have resulted from a failure to evolve with changes in the relative contributions of different stakeholders. In many cases, organizational paradigms still reflect realities of the CSA's initial period of operation, a time during which the CSA accounted for ninety percent of total government expenditures in space with DND playing only a minor role. Since that time DND involvement in space has grown considerably: it is now responsible for close to thirty percent of the total Canadian space program budget.[138] So whereas DND has historically occupied only a small portion of Canada's overall investment in space, its share is rapidly increasing. Additionally, in fulfilling their individual mandates other government departments are increasingly reliant on the CSA. Examples include the departments of the Environment, National Resources, Agriculture, Fisheries, and Aboriginal Affairs.[139] These stakeholders are interdependent with each other and with DND in the field of national space capability. From a military perspective, this continues to advocate for a strategic level organization of Canada's space sector within which DND priorities can be more fully incorporated.

The effects of space sector organization are not trivial. The problems of a legacy DND Space Policy conspire with the organizational subordination of defence space considerations nationally to result in inefficiencies not only for DND programs, but also for the programs of other departments. Business leaders in the sector depend on national

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[138] *Ibid.,* 44.

[139] Department of Industry, *The Aerospace Review Volume 2, Reaching Higher,* 16.

policy to signal government intent in space;[140] and organizational and policy problems of one department are increasingly consequential on the performance of other departments as well. When government strategy fails to clearly convey intent with defence space projects DND is negatively affected, but so are the space agendas of Industry Canada and the CSA.

The nature of this relationship was demonstrated by government commitment to the RADARSAT Constellation Mission (RCM). Here, it can be argued that lack of a clear, long-term national space plan contributed to the federal government hesitating in its commitment to the project. The government's 2012 budget did not reference RCM at all, leaving industry leaders to speculate whether or not the project would proceed. Without commitment to further contract phases MacDonald Dettwiler and Associates (MDA) was forced to restructure its workforce, in the process releasing more than one hundred of the engineers needed for the project.[141] In the end the program was funded, but the lack of a long-term strategy created consequential inefficiencies for industry and defence planners alike. In a related critique the *Aerospace Review* remarked that the RCM project had been "announced, only to disappear from view and then reappear later."[142] Ultimately the RCM example concerns the very essence of what a national space policy should articulate, and of what a national space organizational construct should look like. An *Air and Space Law* study of all space-faring nations concluded similarly, stating that national space policies should clarify government intent for

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[141] Marc Boucher, "In the Absence of Government Leadership Canada's Space Sector Faces Uncertain Future," last accessed 11 February 2014, http://spaceref.ca/space-quarterly/in-the-absence-of-government-leadership-canadas-space-sector-faces-uncertain-future.html.

[142] Department of Industry, *The Aerospace Review Volume 2, Reaching Higher,* 30.

"commercial, research and educational sectors."[143] Coordination, then, continues to emerge as an essential organizational element.

Despite the 2014 *Space Policy Framework*, evidence continues to suggest that Canadian businesses face an uncertain future when considering investment in defence-related projects. As an example, in March, 2014 the Chief Executive Officer of MDA, Daniel Friedmann, described the PCW program, which has been a planned military project for several years, as being stagnant with "no approved program, budget or procurement." Friedmann added that MDA currently assesses government commitment to military space expenditures as "weak."[144]

In a related issue, the ability of programs like RCM to deliver DND consistent, assured and prioritized control over space assets during wartime scenarios is a contingency that the national space sector needs to account for. Given the various stakeholders in projects like RADARSAT (Chapter 1 discussed the fact the program was responsible to corporate and government customers from several countries) there is a need for clear policy that directs the priority of usage with such assets during national emergencies or war. Currently, the issue is governed by the *Remote Sensing Act*, Bill C-25, which stipulates that the Government of Canada retains special powers whereby it can demand the satellite's civilian operators provide priority access to the government or interrupt the delivery of services to other customers.[145] The power to direct any remote sensing satellite provider to prioritize or cease delivery of data products rests with the

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[143] Graham Gibbs, "An Analysis of the Space Policies of the Major Space Faring Nations and Selected Emerging Space Faring Nations," *Annals of Air and Space Law*, Vol. XXXVII (2012): 282.

[144] Peter B. de Selding, "Canada's MDA Corp Awaiting U.S. Government's Return from 'Capex Holiday,'" *SpaceNews*, March 3, 2014, 11.

[145] Library of Parliament, *Legislative Summary LS-499E, Bill C-25: An Act Governing the Operation of Remote Sensing Space Systems* (Ottawa: Parliamentary Information and Research Service, 2004), 1.

Minister of National Defence (MND).[146] Although there is, then, legislation that covers foreseeable contingencies, the issue remains controversial and is certainly an indication of the challenges that a national space plan will have to address. Commercial satellite operators will rightfully expect compensation for losses resulting from government interference in their operations,[147] and the fact that a minister can invoke the securitization of an issue to alter a company's operations will be a source of considerable uncertainty for industrial leaders of such projects in the future. Contemporary paradigms towards government-corporate partnerships in space are producing new, unique and complex interdependencies. Canada will require a national space plan capable of fully dealing with the breadth of possible scenarios.

It is possible that the government's recent appointment of retired Army General Walter Natynczyk to the presidency of the CSA represents a top-down approach to integrating that agency more formally with other government objectives. Although media commentary was quick to suggest that his appointment represented a possible militarization of Canada's space program,[148] the appointment was likely only designed to provide a more whole-of-government, interdepartmental leadership approach to the organization. Natynczyk recently commented to this effect, stating that nothing had changed with the peaceful mandate of the CSA but that there was a "natural relationship"

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[146] *Ibid.*, 5, 8.
[147] *Ibid.*, 14.

[148] Mark Kennedy, "Harper's appointment of Walter Natynczyk to Canadian Space Agency raises eyebrows," *The National Post*, June 16, 2013, http://news nationalpost.com/2013/06/16/harpers-appointment-of-walter-natynczyk-to-canadian-space-agency-raises-eyebrows/.

between civilian and military space programs strategically.[149] In either case, the militarization of Canada's space sector is here already and it is here to stay. The national paradigm would be much better suited to accept this – and in fact to leverage military priorities for technical and economic gains – than it would be to continue with organization and policy structures designed to keep the two space programs distinct from each other.

It is not only in DND's interests for military organizational elements to secure more representation within the strategic organization of Canada's space sector; it is also in the interests of the CSA and Industry Canada. This contention can be controversial because closer integration with DND may be interpreted as contesting with the CSA's peaceful mandate. If this is in fact a current impediment to closer interdepartmental cooperation though, it only serves to further emphasize the requirement for a new national space plan with an altered organization. Indeed, the government owned and in large part DND-funded RCM project was in 2013 the CSA's number one priority within its Space Data, Imagery and Services (SDIS) subprogram. The second SDIS priority was the PCW mission,[150] another project designed to support DND operations but one that, as indicated earlier, is facing an uncertain future. If, as its 2005 Space Strategy states, the CSA is to continue to "support government agencies and departments . . . to carry out their mandates,"[151] then it should be expected that changes to the organization of Canada's space sector may be necessary. In reacting to similar challenges, the Japanese

[149] The Canadian Press, "Space agency boss Walt Natynczyk says militarization not his goal," last accessed 20 April 2014, http://www.cbc.ca/news/politics/space-agency-boss-walt-natynczyk-says-militarization-not-his-goal-1.2616159.

[150] Canadian Space Agency, *Departmental Performance Report* (Montreal: Canadian Space Agency, 2013), 6.

[151] Canadian Space Agency, *The Canadian Space Strategy*, 16.

government recently restructured its space program, incorporating a space strategy office with oversight from the Prime Minister's Cabinet and adjusting restrictions on the Japanese space agency's mandate so that military space programs were included. These changes have succeeded at enabling "major space program decisions – objectives, programs and funding – to be made at the national level in response to national, rather than departmental, needs."[152] As Chapter 4 argues, such reorganization persists as a strong consideration for Canadian policy makers seeking the optimal approach to the issue of space sector organization.

A consequence of Canada's lacking a comprehensive national space plan is that interdepartmental space programs continue to underappreciate both the contributions and requirements of the defence sector. Strategically, organizational structures may cause current DND space issues to be subordinated to the Department of Industry. The current organization of the national space sector does not suit DND's objectives in space, nor does it facilitate an efficient approach to a national space strategy. The Aerospace Review succinctly captured the problems resulting from the status quo approach, stating simply that "There is no clear mechanism to manage space activities across government."[153]

Conclusion

DND requires a new space policy. A policy is needed not just for near-term capability requirements, but also for its usefulness in supporting a strategic plan that will help guide relevant partners. Improvements to DND Space Policy would also help communicate to government policy makers and to the citizens of Canada the requirement

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[152] Space Working Group, *Space Working Group Report Submitted to the Aerospace Review*, 45.

[153] Department of Industry, *The Aerospace Review Volume 2, Reaching Higher*, 30.

for defence expenditures in space. The defence space program should not expect to be perceived as a critical capability requirement until its emerging pre-eminence is communicated with policy.

Additionally, DND requires an organizational paradigm that permits the department's leadership to interface directly with other national space stakeholders. It requires a national space strategy with which it can interact. Although the CSA Act gives the Minister of Industry responsibility to coordinate all the space programs and policies of the government, the space sector lacks a cabinet-level organization or structure through which this aim can be properly implemented.[154] As the DND case makes clear, so long as efforts towards national-level space coordination are pursued through a single department, strategic opportunities in other departments may be lost. DND space strategy guidance from 1998 recommended participation in an Inter-departmental Committee on Space or a Space Program Overview Committee.[155] Years later this still represents a recurring theme, most recently encapsulated by the government's public response to the Emerson Report in which it emphasized the requirement for a long-term space policy.[156] As such, it is prudent to anticipate that any solution to DND's space challenges may involve colocation of a military operational level space cell with government space support entities, including the CSA and other departmental stakeholders.[157]

There are significant challenges for DND's space program and the policy documents that guide it. As previous chapters have shown, these problems are not

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[154] Space Working Group, *Space Working Group Report Submitted to the Aerospace Review*, 45.
[155] Department of National Defence, *A Canadian Military Space Strategy*, 9.

[156] Aerospace Industries Association of Canada, *Industry Minister James Moore announces new measures in response to Emerson Report on Space* (Ottawa: Aerospace Industries Association of Canada Communications, 2013), 1.
[157] Andre Dupuis, "Integrating Space into CF Operations," 42.

necessarily new. What may be new is the urgency of the present situation. Policy makers should expect the current government to pursue new strategies in the space domain. Indeed, only recently the release of the *Space Policy Framework* clearly signaled intent in this respect, in fact stating that national sovereignty and security would be among the "key" drivers behind the first of five new core principles for the Canadian space sector.[158] As DND progresses in the space environment it can no longer afford to delay implementing policy and organizational changes. Given the government's commitment to the 2014 framework, it is now left to DND leadership to address main issues (several of them presented in this chapter) in a way that will ensure synchronization with the framework's aspirations. That is the discussion left for the final chapter.

[158] Canadian Space Agency, *Canada's Space Policy Framework*, 9.

Chapter 4 – THE FUTURE OF DND SPACE PROGRAMS IN CANADA: ADJUSTING TO NEW PARADIGMS

Space is an interdepartmental activity with an increasingly broad national impact – and the governance of the Canadian Space Program needs to reflect this.

– 2012 Canadian Space Working Group, *Final Report*[159]

Introduction

An important solution to DND's requirements in space is a national space policy that more actively integrates defence with civil security priorities. Thus far, this study has used the defence perspective to frame that argument. It is worth noting, however, that the *Aerospace Review* arrived at similar conclusions by studying Canadian space policy from the industrial perspective. That report's recommendations have been well received by the current government, which has indicated an intention to pursue several of them. With that in mind, DND should be anticipative with its own policy so as to maintain synchronization with future government intent in space. It should be proactive in restructuring its space strategy to fit with national-level changes. Just as importantly for defence objectives, though, is the requirement for other civilian space stakeholders to adapt to the increasing relevance of DND space concerns. If Canada's success in space-related fields is to continue, reform will be needed on both the military and civil sides. DND space policy should embrace a new, emerging national approach to space and, concurrently, the government should structure a national space program that better accommodates and encourages defence priorities.

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[159] Space Working Group, *Space Working Group Report Submitted to the Aerospace Review*, 45.

This chapter discusses certain DND and national-level strategies necessary for ensuring future DND effectiveness in the space environment. Whereas previous chapters approached defence space issues from a critical view, this chapter is future-oriented towards identifying potential solutions. It first considers policy ideas that can be implemented within DND and, second, paradigm shifts that are needed within the national space sector. In the end, such reform would see DND's space program become more connected with civilian stakeholders and vice versa, something from which the entire Canadian space sector would benefit.

Positioning DND for Success within the National Space Sector

DND space policy development should remain attuned to trends that characterize Canadian government strategy in space. The challenge of doing so is amplified by an apparent hesitancy of recent governments to articulate an overarching national space plan or policy. That said, DND should develop policy that accepts a position within a sector that will remain civilian-dominated, niche-oriented, financially strained, and precariously dependent on both private-sector and foreign relationships.

In a recent communication of future strategy for Canada's space sector, the federal government in early 2014 published a *Space Policy Framework*. It identifies commercialization, research and development, and the exploration of space as three areas for action. The Policy Framework aims to rely on Canadian space projects as a means to "strategic goals of jobs and growth, sovereignty, security and the advancement of knowledge."[160] It also represents an important step towards a national space plan by

[160] Canadian Space Agency, *Canada's Space Policy Framework*, 7.

acknowledging space as essential for "protecting our national sovereignty, security and safety."[161]

The effect of the 2014 framework on DND space programs will depend on the ability of military leaders to position DND for success within the paradigm it describes. Although the Policy Framework refers to defence only in passing, it does acknowledge an increasing role for DND by directing that Canada's Space Program be driven by "National sovereignty, security and prosperity."[162] It also commits to continued progress with the Strategic Aerospace and Defence Initiative, including a new Technology Demonstration Program.[163] The framework is therefore consistent with the emerging impact of civilian and commercial space systems on national security.[164] It behooves DND to apply the approach articulated in the 2014 Framework to the formulation of its own space policy. DND should be anticipative of, instead of reactive to, wider government intent in space while striving to retain relevance amidst the changing dynamic of Canada's space sector.

The DND space program stands to benefit from the 2014 *Space Policy Framework's* emphasis of "Canadian Interests First." In one example, the document suggests that space infrastructure will form a critical component of Canada's Arctic strategy. An independent report by NORSTRAT Consulting agreed, describing space capability as "the essential enabler of Canada's Northern strategy."[165] Regardless of the

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[161] *Ibid*., 6.
[162] *Ibid*., 9.
[163] *Ibid*., 11.
[164] Canadian Space Agency, *Space and National Security: Civil and Commercial Space*, ii.
[165] NORSTRAT Consulting Inc. assists client businesses with implementing Canada's Northern Strategy; in 2012 they were engaged by the Aerospace Review to report on aerospace issues unique to the Arctic. Refer to: Department of Industry, *The Aerospace Review Volume 2, Reaching Higher*, 23.

exact nature of any space programs resulting from this intent to deliver space-based capability to the North, it is likely that DND will be part of the effort. DND is already a prominent partner in like-minded projects such as RADARSAT and the Polar Communications and Weather Satellite (PCW), and the air force continues to see space as an area for which it will be charged with significantly responsibility. A study of the RCAF's future requirements concluded in 2009 that the military would have to "take a leading role in all Canadian space-based systems and programs."[166] Together, such conclusions have important consequences for any future DND Space Policy. The Arctic represents an example of developing opportunities that future defence space programs could aim to leverage. DND should not just await further involvement with Arctic issues; it should be proactive in pursuing technologies that will ensure it develops the key space capabilities and expertise required by Canada's strategic objectives.

The PCW satellite project is an example of defence interests facilitating partnerships between the CSA, DND and other government departments. If implemented, the project would launch two satellites into orbit to provide weather and communications services in regions where normal satellite communications are presently not possible.[167] The project is seen as central to the Prime Minister's aim of encouraging a more prominent economic and military presence in the Arctic. As a project PCW is still in its infancy – actual work is not planned to begin until 2016– [168] and as described earlier

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[166] Department of National Defence, *Projecting Power: Canada's Air Force 2035*, ed. Andrew B. Godefroy (Ottawa: Canadian Forces Aerospace Warfare Centre, 2009), 57.

[167] Canadian Space Agency, "Polar Communication and Weather Mission," last accessed 27 January 2014, http://www.asc-csa.gc.ca/eng/satellites/pcw/default.asp.

[168] David Pugliese, "Telesat, Com Dev launch $800M bid to build Canadian government satellite," *Ottawa Citizen*, February 25th, 2014, last accessed 20 March 2014,

there continues to be uncertainty over the project's future. Nonetheless, PCW conceptually represents the type of applications DND space policy should focus on if it wishes to capitalize on the current interaction between government objectives and the financial constraints they encounter. There is after all a renewed interest in Northern presence, and Canadian government strategy there will continue to rely on an ability to generate space-based capabilities in areas such as communications, surveillance, environmental monitoring, navigation and pollution detection.[169] Moving forward, DND space policy should commit resources towards the development of technologies that will make DND an essential player in such "Canada First" projects.

The 2014 *Space Policy Framework's* identification of "Progress through Partnerships" as a means of distributing the financial burden of space development also has implications for DND strategy. There is good reason for DND to focus future efforts towards partnerships with civilian agencies, businesses and academic partners in Canada. Whereas the military was in the past often the impetus for ideas in the commercial sector (see Chapter 1), modern paradigms are now frequently characterized by commercial innovation leading military capability. As a DRDC report indicated, "much of the innovation applicable to defence and security can now be found outside government laboratories, driven by industry and universities."[170] The defence procurement strategy is changing too in a way that, if properly exploited by DND, affords the defence sector an opportunity for furthering its space objectives. In a recent announcement the Minister of

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http://www.ottawacitizen.com/technology/Telesat+launch+800M+build+Canadian+government+satellite/9550738/story html.

[169] Space Working Group, *Space Working Group Report Submitted to the Aerospace Review*, 25.

[170] Department of National Defence, *Defence and Security S&T Strategy. Science and Technology in Action: Delivering Results for Canada's Defence and Security* (Ottawa: National Defence Headquarters, 2013), 14.

Public Works and Government Services presented a new Defence Procurement Strategy in which economic outcomes for Canada would be a key consideration in all defence acquisitions.[171] This was a response to the *Aerospace Review's* recommendation that procurements bring "industrial and technological value for the Canadian space sector."[172] In a similar assertion, Industry Minister James Moore announced that future space procurements would be aligned with the principle of "driving opportunities for space-related commercial activity."[173] Although there are benefits to a military space program that exists independently of civilian counterparts – military security concerns are one example – it is clear that in the Canadian context any notions of a DND space program existing in isolation should be discounted in favour of policy that turns to domestic industrial sources for the development of space technologies.

There is an opportunity for defence strategy in Canada to position DND as a niche technology initiator for industry. DND research and development agencies should develop technologies that conform to the criteria for key industrial capabilities as identified by the government, including operational application, an ability to penetrate international markets and a potential for innovation.[174] The micro-satellite field is one technology application where DND research resources can be applied in this regard. Doing so would not only be conducive to defence objectives, it would also fit with the domestic industrial paradigm in a way that would incur government and industrial

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[171] Diane Finley, "Announcing the Defence Procurement Strategy" (speech to the Economic Club of Canada, Ottawa, Canada, February 5th, 2014).

[172] Department of Industry, *The Aerospace Review Volume 2, Reaching Higher*, 2, 39.

[173] Aerospace Industries Association of Canada, *Industry Minister James Moore announces new measures in response to Emerson Report on Space*, 1.

[174] Department of Public Works and Government Services, *Canada First: Leveraging Defence Procurement through Key Industrial Capabilities* (Ottawa: Public Works and Government Services Canada, 2013), 24.

support. Technology now permits small satellites weighing between ten and 150 kilograms to deliver full spectrum mission operations at costs that are orders of magnitude smaller than traditional projects such as RCM.[175] Such applications may represent a niche area into which the CAF could expand. There is therefore an opportunity for DND space policy to leverage the internal development of defence-related space technologies for further support from Canadian industries.

For DND, the 2014 Policy Framework's mention of partnerships does not, however, only have domestic implications; rather, any space strategy for DND should also emphasize the development of technologies that are exportable to partner countries. The *Aerospace Review* emphasized bilateral arrangements with partner countries for their utility in developing markets for Canadian aerospace defence industries. Current economic forecasts support this idea. The value of global satellite revenues is growing exponentially.[176] Canada owns the most export-based space sector in the world, and it operates in a global space marketplace that has expanded by forty-eight percent in the past several years.[177] Future DND space policy should regard this situation as an opportunity. There is already a $4.4 billion positive trade balance for the Canadian defence industry, within which Intelligence Surveillance and Reconnaissance (ISR) is a significant (third overall) contributor.[178] Moreover, in 2014 the government committed to supporting Canadian companies that showcased defence technologies to the international

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[175] House of Commons, Standing Committee on Finance, *Pre-Budget Consultations Brief for the House of Commons Standing Committee on Finance: Brief from COMDEV*, Friday, August 12, 2011, 4.

[176] Department of Industry, *The Aerospace Review Volume 2, Reaching Higher*, 27, 19.

[177] Space Working Group, *Space Working Group Report Submitted to the Aerospace Review*, 9, 27.

[178] KPMG Advisory Services, "Economic Impact of the Defence and Security Industry in Canada," 12, last accessed 19 March 2014. http://www.defenceandsecurity.ca/UserFiles/File/IE/KPMG-%20Economic%20Impact%20of%20the%20Defence%20and%20Security%20Industry%20in%20Canada%20(CADSI)%20-%20Final.pdf.

marketplace.[179] Although a sizeable opportunity exists with American trade – in 2007, seventy-six percent of Canadian defence-related exports went to the US[180] – there is also a need to expand relations in order to hedge against programmatic risks of dependency on anyone nation. Regardless of partners, though, the Canadian space defence sector remains one in in which there is a developing opportunity to generate niche technologies that will be in high demand by the defence sectors of allied countries.

By developing military space technologies exportable to other countries such as the United States, Canada's defence space program would benefit more than just economically. Technology contributions help achieve legitimacy for Canada in organizations like NORAD, thereby serving an important foreign policy role. The 2012 Space Working Group acknowledged that "With changing policies in the United States, where Department of Defense co-operation with coalition partners appears to be the new paradigm, the ability for DND to meaningfully contribute to coalition infrastructure starts with Canada's space and defence industry."[181] An important corollary is that evolving DND space policy should embrace the militarization of space as inevitable and the weaponization of space as at least possible. Indeed, evidence suggests that the militarization of space is accelerating as treaties lapse or are ignored.[182] As such, DND efforts with industry partners to develop space defence technologies marketable to other countries do not only create economic advantages; they also position Canada advantageously in the context of foreign relations and military alliances. The

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[179] Diane Finley, "Announcing the Defence Procurement Strategy."

[180] Department of Public Works and Government Services, *Canada First: Leveraging Defence Procurement Through Key Industrial Capabilities*, 9.

[181] Space Working Group, *Space Working Group Report Submitted to the Aerospace Review*, 41.

[182] Department of National Defence, *Projecting Power: Canada's Air Force 2035*, 18.

militarization of space is well underway – Canadian defence policy should now focus on contributing relevant technologies to the international organizations that will control how that militarization unfolds.

The government recently charted a path for the national space sector; it is now up to DND to develop policy that ensures relevance within that framework. The dangers of not reacting proactively should not be underestimated. As discussed previously, the defence space sector can no longer afford to be subordinated to other space priorities. Above all, DND needs to issue a new, relevant and specific space policy identifying priorities and a means to achieving them. As DND formulates this policy, it should aim to be both a niche supplier and consumer of domestically-developed space defence technologies. Policy should recognize that the way ahead for Canada's limited space program will likely involve combining the financial resources from several departments to further its technical aims in space. At a recent press conference, the former CDS and current President of the CSA Walter Natynczyk surmised as much by stating that "The CSA's budget isn't the only federal money that can be used for extra-terrestrial projects."[183] A recent Public Works study had previously formalized his remarks, saying that "Canada has an opportunity to leverage the exceptional circumstances that are being created by the sustained increase in defence procurement to promote a long-term growth trajectory for our defence-related industries."[184] The economics of space technology development generate opportunities for DND. A DND space policy should aim to

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[183] Chuck Black, "CSA President Walt Natynczyk Pops-up and Looks Around," *The Commercial Space Blog* (Blog), April 20, 2014, http://acuriousguy.blogspot.ca/2014/04/csa-president-walt-natynczyk-pops-up.html.

[184] Department of Public Works and Government Services, *Canada First: Leveraging,* 42.

position the defence organization so that it is more reliant on civilian industry and vice versa. This is the time for DND to be proactive with its space policy.

Positioning the National Space Sector for Defence Space Challenges

Changes internal to DND will not by themselves be sufficient to ensure that future defence space priorities are addressed. The civil space sector also requires modifications if it is to better accommodate the increasing importance of defence programs. There exists a requirement for the implementation of national space policies that more comprehensively involve defence.

If national security is to be a driver of the Canadian Space Program – as the 2014 Framework says it will be – then there is a requirement for strategic space decisions with interdepartmental consequences, and particularly ones involving DND, to be made at levels of government that sit above individual departments. As previous chapters have shown, the increasing relevance of national security has caused space issues to transcend traditional departmental dividing lines, making the interface between the CSA and other stakeholders less clear. This is not a new trend. In the US a 2001 National Security Commission warned that "security space interests [should] be recognized as a top national security priority," and that "the only way they will receive this priority is through specific guidance and direction from the very highest government levels."[185] In Canada on the other hand, the 2012 Space Working Group concluded that the Canadian space program continues to be managed departmentally instead of at a national level. The Working Group's report pointed out that, because of the strategic consequences of

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[185] Commission to Assess United States National Security Space Management and Organization, *Executive Summary* (Washington, DC: U.S. Government Printing Office, January 11, 2001), 9.

space activity to a country, most other nations had developed "interdepartmental or inter-agency processes to ensure coordination, planning and implementation of all space activities of the nation."[186] In other examples, the national space agencies of many countries now report directly to the executive branch of their national government. Without such an organizational construct, Canadian space projects will continue to lack the government commitment, or the "political impulse,"[187] so essential for their success.

The government should develop a national space plan that more actively encourages cooperative relationships between DND and other departments. Although DND presently relies on interdepartmental cooperation in space, there is growing consensus that the approach is not sufficiently formalized to deal with future challenges. To this effect, the *Aerospace Review* recommended that a Space Program Management Board be used to "coordinate federal space activities," and that all departments involved in space be required to "report on how they are implementing priorities set out by Cabinet."[188] Indeed, the CSA's placement within the Department of Industry means that Canada still lacks a Cabinet-level process for coordinating the space policies of different departments. If the CSA is to be the national leader of Canadian projects in space, and if DND is to benefit from such leadership, then the agency requires a more interdepartmental placement. The DND space program would benefit from such a system, and it would be best chaired at the cabinet level as opposed to within the Department of Industry, as the Aerospace Review recommended.

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[186] Space Working Group, *Space Working Group Report Submitted to the Aerospace Review*, 44.
[187] *Ibid*., 44, 33.
[188] Department of Industry, *The Aerospace Review Volume 2*, 33.

A clear articulation of federal priorities in space is necessary if space stakeholders, including DND but particularly industry, are to formulate appropriate long term plans. Although the 2014 *Policy Framework* generally addresses the prioritization of national space objectives, it does not highlight defence-specific vulnerabilities from the perspective of national security. It is in the interests of the government to articulate the extent to which it is willing to prioritize and invest in space where issues to do with national security or sovereignty are at stake. Failure to do so results in industrial uncertainty as well as surprise policy announcements, both of which stand to affect the long term decisions taken by industry leaders. This is particularly important given the increasing relevance of space business decisions to wider government of Canada objectives. The government's decision to block MDA's proposed sale of its space and information systems division to an American company in 2008 – something that would have included the sale of the Canadarm and RADARSAT technologies – is a recent example of confusion attributable to unclear national priorities.[189] Both DND and industry require a national space plan that prioritizes defence projects appropriately in light of their increasing security implications.

But the requirement for prioritization is not the only argument in favour of top-down strategic management of the Canadian space sector. Many DND space programs would be well-suited applications for government initiatives targeting industrial growth and technological development objectives. Canadian commercial industry currently has significant expertise and experience whereby, if properly leveraged through appropriate

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[189] Chris Gainor, "Blocked sale exposes the neglect of Canada's space program," *The Space Review*, June 2, 2008, 1. http://www.thespacereview.com/article/1139/1.

government policy and organization, an indigenous, responsive and marketable military space capability could be achieved in certain areas. There are several applications in which a more robust DND space program would be well positioned as a niche "first consumer" of discrete space technologies through interactions with Industry Canada. As discussed above, the Arctic is one such example. Microsatellites are another. Here, "modest, but critical, seed investments from the CSA and DND" have so far enabled the partial development of COMDEV's microsatellite constellation "exactEarth".[190] The system provides AIS data directly to DND while also serving other customers. There are several other such potential "small-space" applications, and they are not only promising for economic reasons. Among other benefits, having a comprehensive domestic defence industrial base furthers strategic aims concerning sovereignty, readiness and economic power.[191] As such, the government should encourage the development of limited indigenous defence space technologies by Canadian industry as a means to both security and industrial-oriented objectives.

Canada's domestic space industry requires new capital, projects and customers if it is to continue developing.[192] In recent testimony to the House of Commons Standing Committee on Finance, COMDEV emphasized that low investment and the "disappearance of most technology seed funding" had conspired to threaten Canada's economic success in the space sector, particularly given the rising competition from other nations. It proposed a "small-space" strategy that would emphasize Public-Private-

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[190] House of Commons, Standing Committee on Finance, *Pre-Budget Consultations Brief from COMDEV*, 4.

[191] Department of Public Works and Government Services, *Canada First: Leveraging*, 21-22.

[192] Fernand Amesse et al., "Economic Effects and Spin-Offs in a Small Space Economy: The Case of Canada," *Journal of Technology Transfer 27*, no. 4 (Dec 2002), 340.

Partnerships (PPP) as "alternatives to funding the large space projects needed for Canada's essential space infrastructure."[193] COMDEV's concern over Canada's traditionally-held niche expertise is justified. Synthetic aperture radar technologies are among other examples of niche expertise being threatened by international programs – when China launched its Yagon11 remote sensing satellite in 2010, it was the fifth such launch in seven weeks.[194] That there is a developing opportunity for Canada to develop defence industrial expertise by using DND as a customer of niche technologies is a point that has been made before. There is also, however, a developing risk of losing the niche expertise on which Canada's successful space endeavours of the past have so fundamentally depended.

In addition to domestic partnerships, the prosperity of DND's future space program also depends on the government articulating a national space plan that continues to emphasize foreign relationships. International partnerships will prove critical to the success of Canada's space sector within both military and civilian fields. They will also continue to be contentious. As the previous Director of the Simons Centre for Disarmament and Non-proliferation Research Wade L. Huntley points out, Canada will face conflicting priorities between continued cooperation with the US space program and its own stance against the weaponization of space.[195] For this reason and others, international relationships in the space sector will have to be balanced in order to

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[193] House of Commons, Standing Committee on Finance, *Pre-Budget Consultations Brief from COMDEV*, 3.

[194] S. Pagkratis, "Developments in Space Policies, Programmes and Technologies throughout the World and in Europe," in *Yearbook on Space Policy 2010/2011: The Forward Look*, ed. P. Hulsroj, S. Pagkratis and B. Barnews, 75-113 (New York: Springer Publishing, 2013), 78.

[195] Wade L. Huntley, "Smaller State Perspectives on the Future of Space Governance," *Astropolitics* 5, (2007): 255. http://www.ligi.ubc.ca/sites/liu/files/Publications/Smaller_States_Astropolitics_final.pdf.

preserve a certain extent of Canadian sovereignty and independence.[196] They should also be balanced across the varying economic conditions, technical capabilities and weaponization policies between, for example, the US space program and the European Space Agency (ESA). Canada has always leveraged partnerships in order to further its space program. In many cases, however, past examples have focused on civilian projects such as the Canadarm or the Canadian-built spectrometer currently exploring Mars aboard the Curiosity Rover.[197] A national space plan could more actively pursue similar opportunities through defence projects because there is a developing opportunity to do so. Frankly, the government should encourage the development of niche expertise in areas that would make Canada essential to the defence space programs of other nations.

It is inevitable that the government will have to apply more financial resources towards civilian and military space programs in the future. The 2014 framework was a significant step in terms of policy but, as Canadian media were quick to point out, it was not accompanied with commitment to additional funding for Canadian space programs.[198] From a funding perspective, Canada is presently not competitive. The Canadian space budget expressed as a share of GDP is significantly below that of Finland, Luxembourg, Belgium, and Norway. In fact, viewed in terms of real dollars and spending power, funding to the CSA has steadily decreased since 2001.[199] In 2010 testimony to the House of Commons Standing Committee on Industry, Science and Technology, then CSA president Steve Maclean stated that $2 billion dollars was

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[196] Space Working Group, *Space Working Group Report Submitted to the Aerospace Review*, 23.

[197] Canadian Space Agency, *Canada's Space Policy Framework*, 10.

[198] Andrea Hill, "Where's the beef?: Plan to make Canada a 'global leader' in space exploration needs funding, opposition says," *National Post*, February 7, 2014. http://news.nationalpost.com/2014/02/07/james-moore-canadian-space-agency/.

[199] Department of Industry, *The Aerospace Review Volume 2*, 30, 35.

required over five years to "drive innovation."[200] Later, a 2011 House of Commons Standing Committee on Finance similarly asserted the importance of the budgetary issue with the following commentary:

> The disappearance of most technology seed funding from the Canadian domestic space budget is putting the continuation of this grand success at serious risk of collapse. As a result of more than ten years without a budget increase, inflation has seriously eroded CSA's ability to operate. It currently has almost no funds to invest in new or emerging technologies, or to take advantage of new international partnering opportunities. Its available discretionary budget is almost fully committed in the near-term to the CSA's share of a single large project (Radarsat Constellation Mission).[201]

Unfortunately, there is little indication that government spending in space is about to be significantly increased, either for the case of defence specific projects or otherwise. The 2013 Economic Action Plan did commit $1 billion across a five year period in support of the Strategic Aerospace Defence Initiative.[202] This initiative aims to provide "repayable contributions to support strategic innovation of programs and practices of relevance to the aerospace and space sectors."[203] Although the program had by 2013 granted $826 million to twenty five such projects, such spending was relatively small in comparison to other sectors (automobile or forestry for example).[204] The 2014 federal budget, on the other hand, is noticeably vaguer when it comes to space investment. It

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[200] Chuck Black, "Two Billion Dollars for the Canadian Space Agency," *The Commercial Space Blog* (Blog), February 22, 2011, http://acuriousguy.blogspot.ca/2011/02/two-billion-dollars-for-canadian-space.html.

[201] House of Commons, Standing Committee on Finance, *Pre-Budget Consultations Brief from COMDEV*, 3.

[202] Department of Finance, *Economic Action Plan 2013* (Ottawa: Public Works and Government Services Canada, 2013), 6.

[203] *Ibid*., 113.

[204] *Ibid*., 157.

commits to a procurement strategy that will "create jobs, build industrial capacity, encourage innovation, promote export opportunities and drive economic growth in Canada,"[205] but it does not commit to increasing the space sector budget even though doing so is clearly required by any such plan. So long as the CSA is to maintain its mandate as a coordinating agency of Canadian space projects it is right to expect, as it articulated in its last National Space Strategy, that partner departments will have to "ramp up their support and resource investments."[206] As the importance of the space sector to both industry and defence continues to grow, so too must associated budgets.

The success of DND's space program depends on a national space plan that can incorporate defence priorities in a more comprehensive manner. Such a plan needs to recognize the preeminent priority of space security concerns and to encourage interdepartmental programs that would benefit the strategies of both defence and industry.

Conclusion

From the perspective of either industry or DND, the status quo approach to Canadian space programs is no longer sufficient. The defence space sector requires more impetus and greater means. It requires leadership from the highest levels of government, and it requires organizational reform that would allocate more resources, financial and otherwise, to the priorities of defence space considerations. The industrial sector, on the other hand, requires a market for its technologies. There is presently an opportunity available for a national space plan to capitalize on this by using DND project

[205] Department of Finance, *2014 Budget, The Road to Balance: Creating Jobs and Opportunities* (Ottawa: Services Canada, 2014), 125.

[206] Canadian Space Agency, *The Canadian Space Strategy*, 22.

requirements, but doing so will require significant reorganization of the space sector as well as funding augmentation.

Some studies on Canadian security go so far as to suggest that a Canadian national space policy should be based on national security as its focal point.[207] It is clear, then, that changes within DND as well as the national, commercial space sector are needed if the growing security and defence issues to do with outer space are to be addressed. It is also clear that such changes would benefit industry and DND alike. If DND is to be successful with the challenges it faces in space it must articulate a defence space policy that truly embraces interdepartmental approaches. Nationally, any such approach must account for the increasing priority and relevance of defence space projects.

[207] James Fergusson and S. James, *Report on Canada, National Security and Outer Space*, ii.

CONCLUSION

I believe we are at a strategic cross road. I believe it is a reality that requires us to address how we protect our space systems, challenge traditional acquisition practices and consider alternative space architectures that are more resilient and affordable.

– General William Shelton, Commander US Air Force Space Command[208]

The preceding chapters demonstrated that General Shelton's testimony, recently delivered to the US House Armed Services Committee, is equally relevant in the Canadian context. Through a study of Canada's defence space policy this study showed that a solution to DND's space challenges may rest with an interdepartmental, national approach that more actively integrates defence policy with civil and security-oriented space strategies. The Canadian objectives in space are more consequential now than ever, but they nonetheless remain under-prioritized and, certainly in the contemporary context, regarded as unaffordable. This is indicative of a requirement to change the way in which space is conceptualized from the defence perspective. National space policy needs to acknowledge the importance of space to national security and to military operations alike. It also needs to acknowledge that the challenges, opportunities and vulnerabilities of space are accelerating and changing.

With the evidence presented, there can be no doubting the importance of space policy to Canada's defence organization. The CAF is comprehensively dependent on space-based infrastructure through applications that are as far-reaching as they are vulnerable. Perhaps more importantly, though, is the dependency of Canadian society on

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[208] Torri Ingalsbe, "Space Superiority remains vital to National Security," *U.S. Air Force News*, 7 April, 2014. http://www.af mil/News/ArticleDisplay/tabid/223/Article/475299/space-superiority-remains-vital-to-national-security.aspx.

space infrastructure and the derivative implications that this holds for DND and its role of contributing to national security. Experts now estimate that the average Canadian relies on a space-based functionality of some sort between twenty and thirty times *every day*.[209]

The challenges for a national space policy are presently different than they were only a decade ago. The proliferation of space military capability continues to accelerate and space, once the domain of only select national governments, is now contested by a host of national and corporate stakeholders from around the world. At the same time, the lack of Cold War military imperatives has rendered space policy an issue that, for countries with limited budgets and capabilities like Canada, is often subordinated to other national priorities. On a technical level, too, space paradigms are shifting. Military space programs, once the source of commercial innovation, now look to the commercial sector for technologies on which they can depend for the furtherance of defence objectives. Specific to national security, such trends culminate in the assertion that there is indeed a "need to re-examine current Canadian space policy overall, and the relationship between National Defence and the Canadian Space Agency in particular."[210]

Given the problems with DND's Space Policy that this study identified – namely the fact the department has not published one since 1998 – it would appear to be an opportune time to do so. Additionally, there are concrete reasons for DND to restructure its space program. For one, Canada needs to secure its civilian space infrastructure as well as its space-enabled military capabilities. Doing so is a responsibility that the military should anticipate. It behooves the military to be proactive here – to allot

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[209] Space Working Group, *Space Working Group Report Submitted to the Aerospace Review*, 22.

[210] James Fergusson, "Thinking the Unthinkable: On Revolution, Outer Space and Canadian Policy," *Canadian Military Journal 1*, no. 2 (Summer 2000): 49.

resources and policy now – as opposed to adopting reactive approaches in the future. But there are also technical rationales for augmenting Canada's defence space program, and from the DND perspective they are manifest as opportunities. Investment in DND space programs is a demonstrated initiator of technical gains in other sectors. This, in turn, has a national economic pay off. Indeed, and as Chapter 1 showed, this was a characteristic of Canada's military space program during the 1960s, although one that has been somewhat eroded as the Canadian space program transitioned to more civilian-oriented priorities.

Central to the thesis presented in this study is the idea that defence applications can be leveraged to accomplish national objectives associated with economic development, technical expertise or even foreign policy in ways that civilian space programs – the Canadarm for example – were once relied upon. To a certain extent, the 2014 *Space Policy Framework* resounds of this potential. It signals a new space paradigm for Canada and in doing so offers DND the opportunity for more significant involvement in Canada's space sector. The effects of the framework's implementation, though, remain both unclear and subject to interpretation. When recently asked by a Senate Committee whether or not military applications (hypothetical government commitment to allied BMD research programs was the example used) could help "position the private sector" for industrial and technical gains the President of the CSA – not unexpectedly – would not comment on whether or not such a national space policy tenet represented sound strategy.[211]

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[211] Senate, The Standing Committee on National Security and Defence. *Proceedings of Meeting Number 13 concerning Ballistic Missile Defence and Canada's Space Program*, Monday, April 28th, 2014.

There are several internal changes that DND should implement now. Firstly, DND should prioritize the issuance of a comprehensive space strategy that communicates the importance of DND capability development in outer space. The policy should embrace an interdepartmental approach to defence space challenges because, if only for pragmatic reasons, the department does not have the resources to go it alone. In doing so, the policy should target dual-use technologies that would leverage participation with industrial sector initiatives. As we have seen in the preceding chapters, RADARSAT, PCW and AIS represent promising starts in this respect, albeit each with their own limitations.

Defence policy should focus on using DND resources to develop expertise in niche areas that will be of interest to industrial and foreign partners alike. To hedge against the dangers of dependency on civilian infrastructure, and to stay abreast of developing military trends, DND should consider pursuing indigenous capability through the development of microsatellites. This is not to suggest that Canada requires an indigenous launch capability, but rather to state that DND should focus on smaller space projects that will accomplish more for defence with less financial commitment. Although successful, the projected cost of the RCM project likely means that another project of that scale cannot be afforded for years to come.[212] Defence should look to develop niche expertise in areas that correspond to not only defence interests, but also to the interests of commercial entities and foreign partner militaries.

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[212] House of Commons, Standing Committee on Finance, *Pre-Budget Consultations Brief from COMDEV*, 5.

There are also national-level strategic approaches that, this study argued, would contribute to a more capable DND space program and, by consequence, to a more secure Canada. Although this study made that assertion on the basis of defence priorities, it has shown that such policy considerations also stood to deliver considerable benefit to Canadian economic and technical sectors. In general, space programs are still managed on a departmental level in Canada – either through DND on the military side or through CSA on the civil side – despite the fact that the programs themselves have become completely interdependent. Ultimately, the rationale for an interdepartmental approach to space issues, particularly defence space issues, is based on the requirement to achieve more with less.

Moreover, it is indeed true that without national, interdepartmental leadership strategic opportunities may be missed due to the departmental biases of individual projects.[213] The Canadian space sector would benefit from truly interdepartmental management. Practically, this likely means the establishment of an interdepartmental committee on space that is chaired at cabinet level. It certainly involves the formalization of a national space plan that establishes clear objectives, priorities and, most significantly, that commits government resources to space development over the long term. Canada is a global exception in that its space spending power has decreased over the past five years,[214] indicating that changes in the prioritization of federal investment strategies is becoming necessary. Only through a comprehensive interdepartmental approach to space will this be accomplished.

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[213] Space Working Group, *Space Working Group Report Submitted to the Aerospace Review*, 45.
[214] *Ibid.*

Canada stands to benefit more from a joint civilian approach to the militarization of space than it does from any political efforts, be they initiated by Canada or foreign countries, towards the weaponization of space. It is interesting to note the elegance of the opportunity afforded by the contemporary space environment to Canadian policy. Domestically, national interests in space, of which defence is only one, stand to encourage interdepartmental cooperation and economic development through future policies on a more frequent and far-reaching basis. Internationally, the opportunity in space – the fact that there is so much to be gained economically and technologically from cooperation – naturally predisposes itself as perhaps the most formidable, and certainly the most pragmatic, source of momentum against space weaponization. When regarded internationally, the space environment emerges as a hopeful foundation from which further international cooperation can be naturally encouraged, and as a catalyst for supressing policy options aimed at space weaponization which, so far, only a few nations seem to embrace.

Where a nation's space policy is concerned, opportunity accompanies proactive policy approaches. For the Canadian defence organization the final frontier presents an opportunity on which an ambitious defence policy approach can now capitalize. Of course, if Canada continues with an approach to military space that is mired with hesitancy, restraint and a generally minimalist, reactive mentality, that same frontier becomes opportunity for others, and it does so at the expense of Canadian technological or economic opportunity. In that case space becomes a vulnerability – an attack avenue per se – for the essence of Canadian national security itself. Canada may have a relatively small military, but for that military the stakes in space are significant. For the country as a

whole, the stakes have never been higher. Canada cannot afford to adopt a "wait and see posture" regarding the securitization of space; [215] to do so would not only be to forgo the technological and economic opportunities that space presently presents to Canada, but would also be to expose Canadian society to dangerous vulnerabilities.

Sic Itur Ad Astra

[215] James Fergusson and S. James, *Report on Canada, National Security and Outer Space*, 8.

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