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PROTECTION OF CANADIAN SPACE BASED ASSETS: A POLICY VOID

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CONTENTS

ABSTRACT

Canada's reliance on space assets put it in a precarious position in terms of the threats to space operations. The reliance on space based systems is critical to the economy and security of Canada; accordingly Canada should have a national policy that ensures its access to this crucial domain. Other space faring nations, aware of the threats, have developed their own strategic security policy for space while Canada has not. Several Departments are developing space agendas within their areas of responsibility but there is simply no unifying guidance or policy to shape and synchronize their efforts. This paper intends to prove that Canada currently has no strategic space policy to defend Canadian space systems and in the absence of an immediate threat or crisis will not likely be moved to develop one.

The topic is broken out over four chapters. To start, the operating environment for space assets will be discussed to provide background on the risks to space operations. Second, the international space treaty regime will be examined followed by a look at the examples of three key international space faring nations. Third, an exploration of Canada's documented security, defence and space policy will be conducted. This is done with an eye to defining Canada's national space security policy and will look at both the activities of the Government of Canada as well as the Department and Agencies that have a mandate which overlaps the space security issue. Finally the paper will look at our current situation in comparison to past security issues, namely the nuclear debate, ballistic missile defence and the proposed sale of Radarsat.

INTRODUCTION

Space has become an integral component of world infrastructure that facilitates the functioning of a modern information based society. The systems now in orbit provide fundamental services such as communications, earth observation, geo-location, and timing. These are services that permit the high speed movement of knowledge and goods that drive modern economies. They also provide an invaluable knowledge of events around the world. Responses to natural disaster, tracking of weather systems, the conveyance of news and ultimately the functioning of an armed force has become reliant on the capability space affords. The advantage of space is its ability to bypass the limitations and obstacles of terrestrial systems. Considered within military circles as the ultimate high ground, the vantage point of space all but eliminates the effects of terrain and synchronizes action. These advantages to space operations come at a cost. Space is a difficult environment in which to operate, specifically in Earth orbit.

Space is naturally a hostile environment. Life on Earth is protected from the ravages of space by the atmosphere and magnetic field of the planet. Objects in orbit are outside of this protective barrier and must function with minimal natural protection. The solar wind and flares that provide a constant rain of charged particles, the ambient radiation of space as well as the impact of meteoroids can all have an impact on orbital systems. These space conditions although difficult, are simply part of the cost of working in space. Hard as space operations already are, human orbital activities are making it worse.

The actions of human space activity have also increased the threat to space systems significantly. The very act of putting objects in orbit creates orbital debris that is a threat to future missions. Dead satellites, either after their useful life or by failure often remain in orbit adding to the orbital obstacle course. These systems as they stand are a sufficiently concerning threat made worse when they collide with other defunct or possibly active systems, as in the Iridium/Cosmos satellite collision creating additional debris clouds that threaten the environment. Even with an appreciation of these threats, nations have found ways to make orbit more difficult through anti-satellite (ASAT) weapons. The ASAT threat goes beyond an attack on the targeted system to the debris generated and the consequences for all systems in affected orbits.

In response to the threats an international body of law is being built around treaty work conducted under the United Nations. In time it has become apparent that the law that has developed is vague or lacking in key areas such as the weaponization of space. In response some nations have begun to fill in the blanks by extending concepts of existing international norms in other environments or simply establishing their own space security direction. Those nations without their own direction may be left out of the decision making process when it comes to defining future norms and legislations for space operations.

Canada's reliance on space assets put it in as precarious position in terms of the threats to space operations. The reliance on space based systems is critical to the economy and security of Canada; accordingly Canada should have a national policy that

ensures its access to this crucial domain. Other space faring nations, aware of the threats, have developed their own strategic security policy for space while Canada has not. That is not to say there has not been work in this area. Several Departments are pushing forward individual space agendas within their areas of responsibility but there is simply no unifying guidance or policy to shape and synchronize their actions. This paper intends to prove that Canada currently has no strategic space policy to defend Canadian space systems and in the absence of an immediate threat or crisis will not likely be moved to develop one.

The focus of this paper will be on the orbital portion of space systems or the space segment. The terrestrial portion, while essential, will be considered part of standard physical protections measures. These would include standard security practices such as fences and policing. The concern is that there is no single Government policy to tackle the protection of the space segment. The discussion will be broken out over four chapters. To start, the operating environment for space assets will be discussed to provide background on the risks to space operations. Second, the international space treaty regime will be examined followed by a look at the examples of three key international space faring nations. Third, an exploration of Canada's documented security, defence and space policy will be conducted. This is done with an eye to defining Canada's national space security policy and will look at both the activities of the Government of Canada as well as the Department and Agencies that have a mandate which overlaps the space security issue. Finally the paper will look at our current

situation in comparison to past security issues, namely the nuclear debate, ballistic missile defence and the proposed sale of Radarsat.

THE THREAT ENVIRONMENT

Introduction

Operations in space are exceedingly difficult, due to the physics of orbiting satellite systems. At the same time, "because of its remoteness and difficulty of access it provides a relatively safe sanctuary for global operations".[1] For this reason as well as the benefits of using space as a high ground for a number of capabilities, space is being pursued by a number of actors. All those involved in space need to be prepared for the space threats in order to extract the benefits. Concern for space operations is derived from three main threats to the satellite. On orbit "satellites are vulnerable to natural hazards, to inadvertent harm caused by other space users' activities and potentially also to deliberate interference for strategic or tactical military advantage".[2] The following discussion of threats will therefore consider three areas, natural threats, the manmade passive threat, and finally direct threats intended to neutralize space systems.

Natural Environment

Space is a hostile environment that must be understood if satellite operations are to be effective. Understanding the natural threats in the environment and mitigating their effects is key. The following will provide a basic understanding of the threat through

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[1] Stephen James, "Space is Becoming Crucial: We Need to Pick Up the Pace [the Canadian-American Defence Relationship: Where Next?]," *Policy Options* 23, no. 3 (Apr, 2002): 66.

[2] Nancy Gallagher, *A Reassurance-Based Approach to Space Security (*Ottawa: Foreign Affairs and International Trade Canada, 2009), 7.

basic definitions and a couple examples. Before going further it should be noted that the focus of this paper is on those systems in orbit of Earth in service to the Canada and its populations. There are three predominant types of orbits used in space operations, low earth orbit (LEO), middle earth orbit (MEO) and geosynchronous earth orbit (GEO). LEO extends to 3100 nautical miles and is generally used for navigation and earth observation. MEO, defined simply as between the other orbits is optimal for applications such as navigation. GEO is found at 22,300 nautical miles and provides a 24-hour period which allows satellites to appear unmoving relative the Earth's equator. GEO orbits are suited to communications and missile warning.[3] All these orbits while advantageous to the provision of certain services also expose systems to a number of natural threats.

The natural effects of space do not in general come to mind when considering the void of space. It is a consideration for any nation that is involved in any type of space operations. These aspects include temperature, radiation and solar wind, and finally meteoroids. In terms of temperature a satellite must be able to withstand changes from 200 Kelvin to 350 Kelvin (or -73C to +77C) in the conduct of operations. Satellites in orbit must be able to withstand and operate at these extremes over their lifespan. Systems must also be able to contend with a constant barrage of electromagnetic radiation in the form of "visible light, ultra-violet, X-rays, infra-red, radio..." and others across the electromagnetic spectrum. The solar wind, a flow of high energy particles ejected from the sun, can also have significant effect on satellite electronics. Its density and speed is dependent on the degree of solar activity in terms of flares and sunspots. Finally the

[3] Steven R. Petersen, *Space Control and the Role of Antisatellite Weapons* (Maxwell Air Force Base Alabama: Air University Press, 1991), 1.

constant threat from meteoroids or natural space debris is a constant concern for all activities in space. Collisions can have significant impact on physical integrity and system functions.[4] Each of these threats can have an impact on space operations.

These natural threats are the price of working in a space environment. All space actors will have to deal with their effects, as Canada is well aware. In 1994, Canadian communications satellites Anik E1 and E2 were disabled by the effects of increased solar activity. Their flight controls were damaged but control of the satellites was eventually regained.[5] Anik E1 and E2 were a significant portion of Canada's telecommunications infrastructure, and replacement systems would have been costly in terms of alternate services and new satellites. Acknowledging the natural threats of space itself, it is now important to look at the effect human activities have on the space environment. The primary issue is one of debris. By connection the natural effects on manmade systems "... under the influence of extreme ultra violet radiation, impinging atomic oxygen and impacting micro particles, surfaces of space objects start to erode".[6] These results of natural effects are only the beginning of the debris issue.

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[4] Canadian Forces School of Aerospace Studies, *Space Indoctrination Handbook 5th Ed.* (Winnipeg, Manitoba: Canadian Forces School of Aerospace Studies, 1996), 1-2/3.

[5] James Fergusson, and Stephen James, *Report on Canada, National Security and Outer Space* (Calgary, Alberta: Canadian Defence & Foreign Affairs Institute, 2007), 69.

[6] European Space Agency, "Space Debris Environment," http://www.esa.int/SPECIALS/Space_Debris/SEMQQ8VPXPF_0.html; Internet; accessed 27 March 2010.

Manmade Passive

Beyond the naturally occurring threats of the space environment itself there are additional considerations to space operations that are attributable to the space operations themselves. More accurately, it is the remnants of previous activities that are forming an increasingly dangerous and costly threat for current and future operations. Be it discarded rocket bodies, defunct satellites or associated refuse these items have become a hazard to all activities in space. It is a hazard that is getting worse, generated as a function of the launch and space systems.

Numbers put out by the European Space Agency show the development of the space debris issue over the past 50 years. Of approximately 6000 satellites placed into orbit only 800 are still functioning with a majority of the defunct satellites remaining in orbit. The functioning satellites comprise 8% of the total objects being tracked. Proportionally, 36% of the objects tracked are non-functioning satellites, spent rockets and other mission related items. The remaining 56% contains objects generated through collisions and explosions that have occurred in orbit.[7] It should be noted that these numbers represent objects of a size that can be tracked with current technology. Related to each action there are untold numbers of smaller objects that still constitute a hazard. In perspective, “even a paint flake, traveling at orbital velocities, can crack the space shuttle's windshield”.[8] The issue only gets worse as operations continue.

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[7] *Ibid.*

[8] Robert L. Hotz, "Harmless Debris on Earth is Devastating in Orbit," http://online.wsj.com/article/SB123568403874486701.html#printMode; Internet; accessed 27 March 2010.

The more space operations that take place, the more debris will be generated. This, along with existing debris is but one factor that contributes to the amount of objects in orbit. As the number of objects in orbit increase so do the chances of a collision in orbit that ultimately creates more, if smaller, debris. This increase in debris then increases the probability of additional inter-debris collisions. In fact, "...NASA has shown that, in LEO [Low Earth Orbit], inter-debris-debris collisions will become the dominant source of debris production within the next 50 years". Allowed to continue this self producing debris would be a threat to space access.[9] At such a stage all space assets and the nations they support would be impacted. As if to underscore how simply this could occur there have been several impacts between complete satellites.

On 10 February 2009 a collision occurred between the US Iridium 33 communications satellite and the decommissioned Russian COSMOS 2251 communications satellite. The impact turned two stable space objects into debris clouds totaling some 823 space objects as of March 2009 with more being recorded.[10] The incident, while significant for the two nations involved is now also a concern for all operators in related orbits. This is a simple example of how quickly the debris issue could get out of hand. Each of the new objects could, if not monitored, create more debris should they collide with other objects. Assessments made in the US indicate the

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[9] Jessica West ed., *Space Security 2009* (Kitchener, Ontario: Pandora Press, 2009), 27.

[10] National Aeronautics and Space Administration, "Satellite Collision Leaves Significant Debris Clouds," *Orbital Debris Quarterly News* 13, no. 2 (April 2009): 1. Journal on-line; available from http://www.orbitaldebris.jsc.nasa.gov/newsletter/newsletter.html; Internet; accessed 27 March 2010.

debris from this incident alone will threaten operations for decades. The event was accidental and only the fourth known collision to occur between two catalogued space objects.[11] That said, it is an indicator of problems to come.

On the positive side this event and others like it have pushed a greater appreciation of the collision and debris threats. This has put a greater emphasis on space surveillance to ensure objects are monitored and possible collisions identified. In specific response to the Iridium COSMOS collision the US Joint Space Operations Center "now conducts conjunction assessments for all operational spacecraft in Earth orbit, regardless of ownership nationality".[12] Such actions show a maturing understanding of the debris problem. The concern is that space is "populated with ever increasing new owners and defunct or expiring satellites, the problem is uncontrolled and becoming unmanageable".[13] A cooperative approach appears to be the current solution to managing these manmade but passive concerns, as there are no borders in Earth orbit. The action (or inaction) of one can affect all.

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[11] *Ibid.*, 2.

[12] Leonard David, "Space Junk Getting Messier in Orbit," http://www.space.com/missionlaunches/space-debris-getting-messier-100223.html; Internet; accessed 24 February 2010.

[13] J. Vernikos, "Space Assets Under Attack," *Defense & Foreign Affairs Strategic Policy* 37, no. 3 (2009): 12.

Manmade Active

The active threat to space operations is different, but only in terms of intent. There is the obvious impact to the system targeted, but much like the concerns over collisions discussed above there could a much broader impact to all space users. The key concern that comes out of the idea of neutralizing space systems is again one of debris. A single system destroyed could create the same space hazards as a satellite collision. Considering this point, the intent now is to look at the concept of anti-satellite or ASAT systems, their considered usefulness and the possible repercussions of their use.

The term ASAT will be used here to describe systems used to damage or incapacitate orbital systems. These weapons come in three broad categories: kinetic, directed energy and electromagnetic and radiation. Kinetic systems rely on the impact of the ASAT weapon and the target to generate sufficient destructive power. Due to the fact that there is essentially a collision in space, such systems can generate a significant amount of debris in taking out a target. Directed energy weapons use high intensity light (laser) or radio frequencies in an attempt to blind or physically damage a satellite. Finally electromagnetic weapons generate radiation or electromagnetic pulses meant to destroy unprotected electronics.[14] These last systems, also referred to as High Altitude Nuclear Detonation (HAND), in addition to the immediate impact to electronics also leave long term radiation that would continue to have an effect on other systems beyond

[14] Michel Bourbonnière, *LOAC and the Neutralization of Satellites Or IUS in Bello Satellitis* (Ottawa: Foreign Affairs and International Trade Canada, 2003), 15.

the original attack[15]. In each case these systems create debris or additional affects to future space operations. Even when the effects are not fragmentary, a disabled satellite it as much a threat as COSMOS 2251 was to Iridium 33.

The US and Russia appreciate these issues. These nations having "... a common interest in protecting their respective military systems in space lead them to develop costly and technological anti-satellite systems to limit damage to other satellites".[16] In doing so they have led the way in ASAT technology that localizes the effect. The issue remains that they have the capacity to neutralize a satellite should the need arise. In response other nations may feel a need to demonstrate a comparable capability, a recent example was the case of China's ASAT tests. On 11 January 2007 China launched an ASAT missile at one of its aging satellites.[17] In demonstrating their ASAT capability China also underscored the key concern with such systems. "The Chinese Feng-Yun 1C engagement ... alone increased the trackable space object population by 25 percent".[18] In a single action China had greatly increased the odds of debris collision by adding a debris cloud of 300,000 pieces that affected "...orbits as low as 200 kilometers (124 miles) and as high as 3,800 kilometers (2,360 miles)".[19] This debris cloud will have consequences

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[15] West, *Space Security 2009*, 142.

[16] James Fergusson, "Out of Sight, Out of Mind: Canada, Outer Space & National Security," *Fraser Forum* (May, 2004): 16.

[17] A. Frey, USAF, "Defense of US Space Assets: A Legal Perspective," *Air & Space Power Journal* 22, no. 4 (Winter, 2008): 76.

[18] European Space Agency, "Space Debris Environment."

[19] Frey, "Defense of US Space Assets...," 78.

for years to come, consequences Chinese authorities have begun to recognize as a threat to their own activities.

Returning to the aftermath of the COSMOS-Iridium accident, China was concerned about the effects of debris. “Chinese authorities worry that the new debris may hit their nearby weather and maritime surveillance satellites. At least 17 commercial communication satellites pass directly through the heart of the debris cloud...”[20] This understanding is coming as China increases it reliance on the space effects for both its security and prosperity. In terms of threats to satellite operations the concern over nations like China may be misplaced. The true threat comes from nations that have little reliance or concern for space operations. Fundamentally, “...if a state is not concerned about collateral damage and can launch a payload or deliver a weapon, especially a nuclear weapon, to a target thousands of kilometers away, it can also strike satellites”.[21] As the cost and technological barriers to space access are lowered the threat could become more unpredictable. With that said “there are no reported cases of use of ASAT weapons during international conflict. Nonetheless ASAT technology has been tested”.[22] Should a nation feel sufficiently threatened, even one that understands the impact, “...sustainability of the space environment can potentially conflict with security from threats posed by objects in space”.[23]

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[20] Hotz, “Harmless Debris on Earth is Devastating in Orbit.”

[21] Fergusson, “Out of Sight...,” 16.

[22] Bourbonnière, *LOAC and the Neutralization...,* 14.

[23] West, *Space Security 2009,* 31.

Summary

Space is an unforgiving environment which creates unique challenges for the operations of satellites. Human activity in space further exacerbated these difficulties. All space operations need to take these issues into consideration. Whether it is the effects of solar winds, radiation or meteoroids space systems must be prepared. The true difficulty that burdens orbiting systems is the increasing amount of debris that comes from the space missions themselves. "Dead or alive, these orbiting satellites or their debris are a challenge to other spacecraft..."[24] Satellite operators need to be aware of and be able to react to the existing threats to space systems. They must also be mindful of the effect the byproducts of today's systems will have on the space needs of future generations. This line of reasoning extends to the impact security and space activities could have on the orbital environment. The Chinese ASAT test and the Iridium-COSMOS collision clearly demonstrate the impact even a single incident can have for all players in the space environment. The question that is left is how much of tomorrows space environment can or should be sacrificed for the security of today. This is a question being considered by a number of nations individually and collectively.

[24] Vernikos, "Space Assets under Attack," 12.

INTERNATIONAL CONTEXT

Introduction

Space is a resource that is common to the entire world and therefore belongs to no single nation. Space, being a shared environment requires that nations come to common understandings on how to operate in the environment. This understanding in theory allows the space actors to achieve their goals in space while limiting any interference from or to the activities of another. The core of modern international law as it applies to space is coordinated through the United Nations (UN) under the UN Office for Outer Space Affairs (UNOOSA). For this discussion it is important to understand the international framework, its origins, and limitations in order to appreciate the implications for Canada. It should be noted that this discussion will focus on the nation-state. The international body of law that exists today holds the nation-state accountable for its actions in space. It is acknowledged this may change based on the evolving role of organizations like the European Union and commercial space interests[25]. After a review of international law, the activities of select prominent and rising space users will be looked at, namely the US, Russia and China.

[25] International space law holds the state responsible for its actions and its impact on other nations. This framework may have to evolve to accommodate commercial interests. Virgin Group's Virgin Galactic which is selling suborbital travel, is likely the beginning of a significantly more complex legal environment.

International Law

International space law is based on a series of treaties administered under the UN and currently constitutes the only international legal regime for space. The foundational treaty is the 1967 Outer Space Treaty (OST) as it defined the key concepts for space explorations. The fundamental ideas of the treaty are that space should be used for the benefit of all mankind and that space "is not to be the subject of national appropriation". In addition, the OST specifically prohibits the deployment of weapons of mass destruction (WMD) in space. Subsequent treaties and statements of principle are extensions of the core ideas in the OST.[26] These additional treaties are the Rescue Agreement, Liability Convention, Registration Convention and the Moon Agreement.

The 1968 Rescue and Return Agreement defines the requirement for signatory nations to provide notification and assistance to astronauts and spacecraft in distress. It also contains provisions for the return of space objects and personnel aboard to the appropriate country.[27] The 1972 Liability Convention is an extension of the OST and Rescue Agreement with a focus on responsibility for damage caused by space objects. The convention makes the launching state responsible for damages caused "to people and property on earth or in its atmosphere".[28] Interestingly Canada was not happy with the lack of binding arbitration in the convention and abstained. In 1975 the country acceded,

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[26] Brian MacDonald, ed., *Space Strategy: Three Dimensions* (Toronto: Canadian Institute of Strategic Studies, 1989), 95.

[27] *Ibid.*, 96.

[28] James Fergusson, and Stephen James, *Space Appreciation 2000* (Ottawa: Directorate of Space Development, National Defence Headquarters, 2000), F-7.

indicating that it was in the end a step in the right direction.[29] Next, the 1974 Registration Convention provided a requirement for nations to provide details to the UN on any object launch into orbit or beyond. The details would become part of records held at the UN.[30] This most obviously is an extension of the Liability Convention as liability would be hard to assert without a record of the launching state. The final treaty is the Moon Agreement, which attempt to define a legal framework for usage of the moon and its resources. Unfortunately the Treaty is so broad that it creates "ambiguity about the right and obligations of states and fail[s] to establish effective rules".[31] As of March 2010, there are only four signatories and 13 other parties to the treaty.[32] Aside from perhaps France, the 17 nations listed are marginal players in space.

In terms of Canada's involvement, the country is party to four of the five treaties. The only Treaty that Canada is not a part of is the Moon Agreement, for the reasons discussed above. Canada's agreement to these treaties, either by ratification or accession, defines the nation's baseline policy in terms of space. For the specific question of defending space based assets, the key document for Canada remains the OST, but the OST is limited. Since the signing of the OST there has been an internationally "powerful norm" against the placement of weapons in space. This is supported by an almost annual resolution in the UN General Assembly on this point which is without dissent, though a

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[29] MacDonald, *Space Strategy...*, 97.

[30] Fergusson and James, *Space Appreciation 2000*, F-7.

[31] MacDonald, *Space Strategy...*, 99.

[32] United Nations Office of Outer Space Affairs, "OOSA Treaty Database," http://www.oosa.unvienna.org/oosatdb/showTreatySignatures.do; Internet; accessed 3 April 2010.

small number of nations such as the US abstain from the votes.[33] The problem is that the actual OST does not go as far as the resolutions. “Currently the only legal restraint against space weapons...the OST bans weapons of mass destruction in space, on the moon, or on other celestial bodies, [but] it doesn’t ban the kind of weapons systems now being developed...”[34] The OST is a product of the times when it was created.

The OST was created during the Cold War era where two superpowers with significant space programs were sufficiently concerned about mutual deterrence and maintenance of a strategic balance.[35] The OST was therefore influenced by the compromises required in this environment. While this made an effective document for the time, it is also one lacking the guidance needed today. Compounding the question of weapons in space is the June 13, 2002 withdrawal by the US from the US-Russia Anti Ballistic Missile (ABM) treaty. With the end of the ABM treaty there ceased to be any treaty specifically prohibiting the deployment of space weapons aside from the WMDs included in the OST.[36] In the absence of defined international law, the concept of space weapons and defence is being considered through the lens of existing regimes.

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[33] Jonathon Dean, "Defenses in Space: Treaty Issues," in *Future Security in Space: Commercial, Military, and Arms Control Trade-Offs*, edited by James Clay Moltz, 3-7 (Monterey, CA: Center for Nonproliferation Studies, Monterey Institute of International Studies, 2002), 5.

[34] Paul Webster, "The Ultimate High Ground: The US is Weaponizing Space. Canada is Firmly Opposed ... but Not Necessarily," *The Walrus* 1, no. 5 (Jun, 2004): 54.

[35] Gallagher, *A Reassurance-based Approach...*, 15-16.

[36] Dean, “Defenses in Space: Treaty Issues,” 4.

Space is both a national and an international interest, as no one country owns it but a great many recognize its strategic value. In comparison to existing international regimes the Law of the Sea and Law of Armed Conflict (LOAC) are the most relevant. Orbital space is not a satellite's destination but a medium to be transited. Orbit by its definition is a state of motion. It is a fluid environment, unlike the static nature of Antarctica or the sea floor. This links well with the concepts within the Law of the Sea, specifically the high seas. No one owns it, vessels remain sovereign in it and the actions of private or commercial interests are the responsibility of the launching nation.[37] These ideas are captured in the OST, but taking this to the logical conclusion there is currently no basis for the right of safe passage or the right of self defence.[38] These ideas may come from an extension of the existing concepts within LOAC. Beyond the physics, aggression in space is simply aggression.

The LOAC can provide insight into acceptable practice should human conflict enter space. In the interpretations of some, the LOAC if applied would allow for an attack on military space assets if the "military advantage outweighed the collateral harm". In this line of reasoning the concept of dual-use systems becomes a concern.[39] These are systems with both a civil and military purpose. For example some communications or earth observation systems provide service to the public and can also be used for military advantage. The concept of dual-use could make these systems legitimate targets under the

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[37] Fergusson and James, *Space Appreciation 2000,* F-6.

[38] Gallagher, *A Reassurance-based Approach...*, 20.

[39] *Ibid.*, 20.

LOAC. If so, all nations may need to consider these systems a possible target and act accordingly. As international laws and customs evolve, a number of nations are concurrently developing their own approaches to space. These activities have significant consequences for space security.

National Approaches

United States

The following will review the activities of a number of space faring nations as examples of the growing complexity of space security. The intent is to briefly look at the countries involvement in space and their national take on ensuring their right to space. In any such discussion, starting with the largest player can provide broad insight on the domain as well as provide context to the actions of other players. In terms of spending, the US space budget made up 75% of the World's total public (vice commercial) budget on space in 2008.[40] Due to this disproportionate investment the US is the start point for space operations and concepts of space security.

The US has acknowledged its heavy reliance on space capabilities and is well aware of the threats that exist. Economically space is seen as an essential utility to the functioning of the country. This appreciation comes via technical issues that demonstrated the nation's reliance on space. In one case, in 1996 an error was

[40] Wolfgang Rathgeber, *Space Policies, Issues and Trends in 2008/2009* (Vienna, Austria: ESPI European Space Policy Institute, 2009), 14.

transmitted by a single GPS satellite for only six seconds. The result was an outage of over 100 cellular networks in the Eastern US. In 1998, the loss of a single satellite caused pagers, banks, and news outlets to lose the ability to send data.[41] From a military standpoint the US appreciates that "severe degradation or loss of space-based communications and intelligence would have a major and growing impact on global US capabilities and operations, making the prevention of such an occurrence an ever more urgent priority".[42] To further protect US interests the 2006 National Space Policy directs US opposition to "...all new legal regimes or other restrictions on U.S. access to or use of space...".[43] Understanding the need to be ready the US military has developed fundamental concepts that capture the core tenets of military operations in space. These tenets extend the international legal concepts to space security.

Two doctrinal concepts have become core to the US discussion of space power. They are space situational awareness (SSA), and space control. SSA is the monitoring of space to generate a comprehensive understanding "of [the] objects, activities and the environment..." to provide commanders a foundation for planning.[44] The core of SSA is a requirement for commanders to understand the battle space before engaging in any

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[41] Peter L. Hays, "Military Space Cooperation: Opportunities and Challenges," in *Future Security in Space: Commercial, Military, and Arms Control Trade-Offs,* edited by James Clay Moltz, 32-43 (Monterey, CA: Center for Nonproliferation Studies, Monterey Institute of International Studies, 2002), 39-40.

[42] Lincoln P. Bloomfield Jr., "A Space Doctrine for Soldier, Scientist, and Citizen: What it Will Take to Secure the Space Domain," *High Frontier - the Journal for Space & Missile Professionals* 5, no. 4 (August 2009): 18.

[43] Gallagher, *A Reassurance-based Approach...*, 12.

[44] United States Department of Defense, *Air Force Doctrine Document 2-2.1 Counterspace Operations* (Washington, DC. United States Air Force, 2004), 54.

action[45]. From awareness and the ability to act can be established space control, which is the "...operations to ensure freedom of action in space for the United States and its allies and, when directed, deny an adversary freedom of action in space".[46] This idea of space control is derived from the naval concept of sea control which shares the same goals. "As the United States, in conjunction with allies, defends the sea lines of communication, supporting freedom of passage on the high seas, so the United States with its allies can serve the same function of defending the SLOI and supporting freedom of passage on orbit".[47] This concept of space control has also spurred capability development.

The US is expending significant sums of money in relation to the rest of the world and is developing significant new space capability. A number of the experimental capabilities could be considered space weapons. The 2009 budget, beyond missile defence, contained funding for "maneuvering satellites", "proximity operations", "localized SSA" as well as high energy laser research and development.[48] While these capabilities are intended to provide for the defense of the US and its allies it may be having the opposite effect. The concern is that the US will continue to under-appreciate the response of other nations including key allies to its actions. This concern applies even

[45] West, *Space Security 2009*, 127., "A greater capability to monitor satellites in GEO is expected from Canada's space-based space surveillance satellite Sapphire, which will contribute data to the US Space Surveillance Network. The US refers to this capability as Space Situational Awareness, which the US government viewed as having greater importance after the 2007 Chinese satellite intercept. European Union (EU) member states have also discussed the feasibility of developing an independent space surveillance system, based on the existing national capabilities of a few members".

[46] United States Department of Defence, *Air Force Doctrine Document 2-2.1...*, 54.

[47] Fergusson, *Report on Canada...*, 40.

[48] Rathgeber, *Space Policies...*, 42.

when US legal advisors consider an action legally permissible under current space laws.[49] More specifically with US "...efforts to achieve comprehensive space dominance...", other nations including Russia and China will not guarantee they will not target satellites "...without legally binding reassurances..." on how the US will use its space forces.[50] US dominance may be setting up a classic spiral of distrust.

Russia

During the Cold War the US and then USSR remained on par with one another in terms of military space capability. With the fall of the Soviet Union, Russia has fallen behind the US but remains a significant space power.[51] In terms of military satellites in orbit it is second only to the US, with a focus on strategic capability vice support to the tactical level.[52] It has also maintained a significant launch capability, and in terms of total orbital launches it bests the world.[53] These assets and capabilities in conjunction with its international partnerships such as the EU-Russia partnership "on launcher development and uses"[54], has ensured Russia role as a prominent player with significant interests in shaping the international space regime.

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[49] Bloomfield, "A Space Doctrine for Soldier...," 17.

[50] Gallagher, *A Reassurance-based Approach...*, 12.

[51] West, *Space Security 2009*, 104.

[52] *Ibid.*, 108.

[53] Rathgeber, *Space Policies...*, 53.

[54] West, *Space Security 2009*, 75.

With a continued interest in space and recognition of the US space dominance Russia has been working on the diplomatic front to ensure its security. Most notably is the Russia-China proposed "Treaty on the Prevention of the Placement of Weapons in Outer Space, the Threat or Use of Force against Space Objects" or PPW. The proposal would extend a prohibition on "any type of hostile action that interferes with a space objects normal functioning".[55] This proposal, in its very name is a direct challenge to the concepts and systems being considered by the US. Systems that Russia and China believe would be "highly destabilizing".[56] Although Russia has significant military space power, it sees its security in part through international venues.

People's Republic of China (PRC)

The official policy in China in terms of space is that its activities and technology are intended "for exclusively peaceful purposes".[57] This direction for its space program admittedly does not negate the military importance of space. In 2009 China released a white paper on the modernization of its military which included direction for its military space activities. The core idea of the PRC military space strategy it terms as "active defence" with intent to ensure the country maintains "space and electromagnetic security". At the same time the white paper also makes clear China's belief that the current international space regime, based on the OST, is insufficient and indicates the

[55] Gallagher, *A Reassurance-based Approach...*, 10.

[56] *Ibid.*, 11.

[57] West, *Space Security 2009*, 92.

PRC's support for the PPW.[58] In the end, the purpose of the PPW and China's role in supporting it is for security not protection of the environment. In terms of its support of the PPW, it should be noted that PPW as it stands does not prohibit the "testing or possession of debris-generating ASAT weapons" other than those based in space.[59] Where does this place China in terms of space security?

China understands the risk to space operations from debris, but is still willing to test an ASAT capability that creates significant debris, as discussed previously. China also supports the idea of making space weapons free, and at the same time the proposed PPW does not prohibit ground-based ASAT systems. China's space program is defined as one of peace, but the PRC does not draw a line between its military and civilian activities that lead to activities that are dual-use (military-civilian) in nature.[60] These observations form a picture of a nation that knows it does not have the capability to be a peer to a nation like the US on space capability. Accordingly, limiting this advantage in space based ASAT is key to security. At the same time China has developed a credible ASAT threat, be it asymmetrical in nature and damaging to the space environment, but still a credible deterrent. As the US develops new capabilities China and Russia will find a way to respond. In the end it may bet this US-Russia-China relationship that may shape the future of space law.

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[58] *Ibid.*, 61.

[59] Gallagher, *A Reassurance-based Approach...*, 11.

[60] West, *Space Security 2009*, 92.

Summary

"The etymology of the word 'satellite' shows the Latin origin of the word, namely satellitis, which in its incipient use in antiquity meant 'garde du corps' or bodyguard".[61] Yet the discussion being held internationally by space faring nations revolves around the threat to and from these "bodyguards". The body of law that surrounds these systems and their function is out of date or simply lacking. Weapons in space may be discouraged but they are not strictly illegal (aside from WMDs). While similar concepts in terms of the sea and LOAC may show the future for space law these ideas have never been tested or agreed to. Ultimately it is the interaction of individual nations that may be forming the *de facto* law in terms of space operations. Those nations who are ill prepared or simply not involved may simply have the rules written for them.

[61] Bourbonnière, *LOAC and the Neutralization of Satellites...*, 1.

CANADIAN SITUATION

Introduction

In chapter one the near Earth space environment was discussed with a particular focus on the threats to space operations, both natural and manmade. The discussion in chapter two added the current international space policy framework, with a focus on the work being conducted through the United Nations. This was followed in chapter two by an exploration of the specific space endeavors of several key countries. This chapter will now explore the efforts of the Canadian Government and Canadian policy makers in the space domain. What will be argued is that in spite of Canada's long history and modern dependance on space derived capability, there is no single national policy that captures the fullness of its need and intentions. Without such a policy it is not clear how Canada will guarantee it retains access to this finite and increasingly crowded resource.

The discussion will start with an overview of Canada's specific space situation. The country's history and current space dependance will also be presented. Subsequently, the policy and activities within the Government of Canada will be addressed to determine if there is in fact a national space policy that addresses the issue of space security. Finally the chapter will close with a look at the positions Canada has taken in other equally complex and contentious issues to determine the boundaries of any national space policy.

Canada has had a long history in space which started not long after the Russian launch of the world's first manmade satellite, Sputnik. Canada's foray into space began with the launch of Alouette I in 1962, making Canada only the third nation to have a satellite in orbit. In doing so it also set the standard for success, "in an era when satellites lifetimes were measured in months, Alouette I continued to work until it was turned off 10 years later". Subsequent systems developed by Canada helped to develop the nation's "international reputation and credibility in space".[62] A number of the systems that followed were also world firsts. These included the first national communications satellite and the first direct broadcast satellite. Subsequently the country has developed a well earned reputation for space robotics, astronautics, earth observation and remote sensing. In addition Canada has contributed greatly to scientific disciplines "as diverse as astrophysics, life sciences and the dynamics of the atmosphere".[63] Canada's history of success in these space activities stems in part from government intervention early on that continues to shape the Canadian space program.

A report entitled the Upper Atmosphere and Space Programs for Canada of 1967, was a report commissioned by the Government to look at the impact emerging space capabilities would have on Canada. Commonly referred to as the Chapman Report for its chair John Chapman, it argued that the Canadian space program should be refocused on "communications and natural resource surveying". The reasoning went that space

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[62] W. M. Evans, "The Canadian Space Program - Past, Present, and Future [A History of the Development of Space Policy in Canada]," *Canadian Aeronautics and Space Journal* 50, no. 1 (Mar, 2004): 21.

[63] Canadian Space Agency, *The Canadian Space Strategy - Serving and Inspiring the Nation* (Ottawa: Canadian Space Agency, 2005), 10.

infrastructure would be crucial to the future of the country much as the railroad had been before. Complimentary to the Chapman Report that same year, an independent report from the Science Council made the same case for focusing Canada's space efforts. In addition to the points from Chapman, the report included the need for industrial benefit, international cooperation and reinforced a need for a coordinating agency.[64] The ideas contained in these two reports became the very basis of Canadian space activity and their legacy is still the conceptual basis of the program today.

A search of the outer space registry managed by the United Nations Office for Outer Space Affairs (UNOOSA) currently lists Canada as the county/organization responsible for 30 satellites[65] launched since 1972[66]. A review of the systems listed in the register by the "function of space object" underscores the role the Chapman report has had on the very function of Canadian space assets. As registered, a significant majority are listed as telecommunications or direct broadcast systems, through the UNOOSA Registry's period of record. Even today, a majority of the current, active Canadian satellites are telecommunication or direct broadcast systems.[67] These systems provide a core capability to Canadians and when complimented by the systems of other nations play a vital role in modern society.

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[64] Evans, "The Canadian Space Program...," 21.

[65] United Nations Office of Outer Space Affairs, "Online Index of Objects Launched into Outer Space," http://www.oosa.unvienna.org/oosa/osoindex.html; Internet; accessed 11 February 2010.

[66] The Convention on Registration of Objects Launched into Outer Space did no come into effect until 1976. Space objects are self reported by the registering and/or launching nation.

[67] Union of Concerned Scientists, "UCS Satellite Database," http://www.ucsusa.org/nuclear_weapons_and_global_security/space_weapons/technical_issues/ucs-satellite-database.html; Internet; accessed 11 February 2010.

In Canada's case the benefit derived from space is even more important. Canada's increased space requirements are a direct result of the size of the Canadian landmass. Due to the size of the country, the curvature of the Earth itself creates a natural obstacle.[68] No nation on the Earth's surface is perfectly flat but due to the size of Canada both east and west, north and south the curvature has a significant impact. The value of space is the height Earth orbit provides. From a carefully selected orbit and the right satellite configuration the constraints dictated by the curvature of the planet are rendered moot.

The capabilities and conveniences derived from space are a requisite part of a knowledge based society. Whether it is the functioning of international finance, the core of world wide navigation, the time synchronization of the critical systems or the remote sensing of world events, space is critical to Canada.[69] The value to the country can be broken out into three key area: remote sensing, satellite communications, and satellite navigation and timing. First, remote sensing is crucial as it permits the monitoring of the environmental conditions. Nation wide weather prediction as it exists today would not be possible without the view from space. Additionally the ability to monitor ice flow, forest fires, or crop damage would be extremely limited. The accuracy of modern cartography would also not exist across large uninhabited expanses within the country. Finally from a military and security perspective satellites provide the unique ability to gather

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[68] Fergusson, *Report on Canada...*, 6.

[69] Fergusson, "Out of Sight...," 16.

intelligence, monitor coastlines and borders, and even conduct arms verifications that would be otherwise impossible without them. [70]

The second key area where space is critical is in the provision of satellite communications. Satellite operations are an essential component to global communications and are incredibly important to Canada. As a measure of their importance,"...Canada has the largest space transponder use per capita of any country in the world", except for the United States.[71] Satellite communications afford an opportunity to extend the reach of information anywhere in the country regardless of the infrastructure. For example, this facilitates the provision of specialist medical or educational services where in the past they would otherwise not be available. Satellite communications also ensures a communications path in times of emergency or natural disaster. These uses are in addition to the equally important bulk transmission of communications in support of telephone, data, radio and television. This same ability to move information rapidly, independent of terrestrial capacity, makes space communications an essential component of military operations.[72]

The third and final key area where space is critical to Canadian interests is satellite navigation and timing. These services are derived primarily from the current US Global Positioning System or GPS. The satellites of GPS use a synchronized and highly

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[70] Fergusson, *Report on Canada...*, 54. Examples are taken from Table 4.9.

[71] *Ibid.*, 54-55. Examples are taken from Table 4.10.

[72] *Ibid.*, 55. Examples are taken from Table 4.11.

accurate time signal in the process of calculating a location on the Earth's surface. Due to the accuracy of the time signal across the global fleet of satellites it is often used in situations where an accurate and consistent timestamp is required. Today, for example communications and financial activities around the world are reliant on GPS time for synchronization of individual transactions. More traditionally GPS facilitates the flow of everyday life. The capacity for worldwide navigation, tracking (ie animals, vehicle fleets, or packages) and the increased accuracy for mapping and surveying make GPS invaluable to a modern society.[73]

The area of navigation and timing is unique in the Canadian context as it is an area that the country currently has no national capacity to replicate. What this means for Canada is that these critical services are provided by another nation. Therefore the functions of the country that rely on these services are intimately linked to the actions and interests of the US. This is not to infer that the US would use GPS to influence Canada, but it is important to recognize that a dependency exists. A failing of the GPS service as highlighted by the previously mentioned 1996 timing error has equally significant consequences for Canada. There may be alternative sources of timing and location in the future to mitigate any risks. These sources could include the Russian GLONASS, once restored or the European Galileo project once completed.[74] Of note, Canada is

[73] *Ibid.*, 56.

[74] *Ibid.*, 55.

participating in the development of the European project.[75] Having access to an alternate source for such a key service is simply prudent.

Existing Policy within the Government of Canada

At this point it is important to appreciate that Canada is a modern information-based society, with a heavy dependance on space technologies required in order to function. Due to the level of integration of space derived capabilities, a loss of these services would have significant economic, industrial and societal impacts. The difficulty with space assets is that their presence is invisible to daily life. Therefore the ubiquitous nature and importance of these systems is often over looked. "Overall, space-based systems have become the unseen and poorly understood backbone of a modern information based society"[76]. With this idea taken in concert with an understanding of the of the hazards to space operations developed in previous chapters it is now appropriate to look at Canada's space policy base. Of particular importance to this discussion is policy that exists to ensure a defence of Canada's space services and access.

Government of Canada

The exploration of Canada's policy framework for space activities will begin with the direction provided by the Government of Canada. The focus here is the political

[75] Canadian Space Agency, *Canadian Space Agency Departmental Performance Report- Detailed Performance Information* (Ottawa: Canadian Space Agency, 2009), 84.

[76] Fergusson, "Out of Sight...," 16.

direction that is in place to guide the departments, agencies and bureaucracy in their related space functions. It is acknowledged that the individual departments and agencies have a hand in the development of government strategy but it is ultimately the agreement of the government that makes the strategy a valid direction. Starting from a broad perspective, acknowledgement of Canada's current status with respect to international treaties on space is an essential. Canada's relationship to these treaties defines a key aspect of any national space policy framework.

In chapter two of this paper, the five UN treaties on space were discussed and Canada's status in relation to them presented. These treaties provide an international legal framework that defines where Canada is legally constrained and restrained in terms of its activities in space. In the review of the treaties it was clear that the key in terms of defining Canada's policy limits for defending its space capabilities is the Outer Space Treaty (1967) or OST. The OST "established the fundamental premise on which all law in outer space is based, that outer space should be utilized for the benefit of mankind generally and is not to be the subject of national appropriation". [77] In terms of defending space assets this guiding international space document has little to say. The OST has its limits, in part due to its origins at a time when there were primarily two nations in space who were focused on mutual deterrence.[78] Ultimately, there is "no clear-cut guidance about where the right of safe passage for peaceful purposes ends and the right of self defenses takes over". Some space faring nations have also noted that the only specific

[77] MacDonald, *Space Strategy...*,95.

[78] Gallagher, *A Reassurance-based Approach...*, 15.

prohibition is on "orbiting weapons of mass destruction".[79] Canada has taken a more general interpretation.

Canada has made it very clear that it does not see the weaponization of space as a way forward for the nation. Most recently in 2004, during discussions on whether Canada should participate in the US National Missile Defense (NMD) program then Prime Minister Paul Martin made it clear in the Parliament that Canada would not participate in the weaponization of space. Additionally, Canada's lead negotiator on the file, Jim Wright, stated before a Senate committee in February 2004 that "Canada makes 'a clear distinction between the military in space and the weaponization of space,'" and that government policy was to ensure it remain a "weapons-free environment".[80] Beyond ratification these statements reinforce Canada's current support for the contents of the treaties. Accordingly, the treaties provide a basis for Canada's principles on the usage of space. Policy developed within Canada with respect to space must ensure compliance with these treaties. From here the discussion becomes what Government policies or strategies currently define how it will ensure access to space now and into the future? In answer to the question, the Canada First Defence Strategy and the Canadian Space Strategy will be discussed.

The Canada First Defence Strategy (CFDS) was announced by Prime Minister Harper on 12 May 2008, and was followed up with the release of the written document

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[79] *Ibid.,* 20.

[80] Webster, "The Ultimate High Ground...," 49.

on 19 June 2008. The intent of the CFDS was to provide the Department of National Defence and the Canadian Forces renewed direction along three main priorities. These priorities were to strengthen domestic capability, meet North American defence commitments and participate in a meaningful way to international security.[81] The actions designed to meet these priorities were broken out over four pillars, seen in the CFDS as the basis of military capability. The pillars were personnel, equipment, readiness and infrastructure.[82] Overall the document provided a plan for reinvesting in Defence, provided general guidance to the Department, and defined a way forward. The CFDS also served as notification of investment in the "industrial, knowledge and technology sectors". The deliverables from the CFDS were intended to contribute to the development of those sectors over the plan's 20 year lifespan.[83] In providing this direction what did the Strategy have to say about space?

Simply put, space, as an issue or area of concern, is not in the CFDS. That is not to say it is not there at all, but its inclusion is tangential to the other activities outlined. To find space in the document one has to be looking with it in mind. The CFDS states that it will allow the Canadian Forces to "... address the full range of defence and security challenges facing Canada now and into the future".[84] This statement would seem to point to space as one of many future challenges the Forces will face, but only if the reader has

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[81] George MacDonald, *The Canada First Defence Strategy - One Year Later* (Calgary, Alberta: Canadian Defence & Foreign Affairs Institute, 2009), 1.

[82] Privy Council Office, *Canada First Defence Strategy* (Ottawa: Privy Council Office, 2008), 14.

[83] *Ibid.,* 20.

[84] *Ibid.,* 4.

knowledge of space operations. The Strategy in its discussion of the level of ambition states that Canada requires "core capabilities ... to successfully address both conventional and asymmetrical threats, including terrorism, insurgencies and cyber attacks".[85] Again, conventional and asymmetrical attacks could be directed at Canadian or partner space segments, but the threat to space is not explicit.

Within the CFDS there is only one explicit statement on space capability and no reference to space as an area of concern. The only point where it addresses space directly is through the stated need for "radars and satellites to improve surveillance capabilities, especially in the arctic".[86] While this is valid direction in terms of achieving a greater degree of visibility over the arctic or more generally terrestrial surveillance, as an example it also highlights the current perception of space. Space at the moment is thought of in terms of being a solution to other interests or concerns, not as an issue itself. Fundamentally, the CFDS through its terrestrial focus does not provide the guidance or strategy necessary for Canada to address defending access to its space based assets. The CFDS has moved the Canadian Forces forward in a number of areas, but space and more importantly the defence of space is not amongst them.

The Canadian Space Policy Framework on the other hand is keenly focused on Canada's involvement in space. The Framework was put in place in 1994 by the Government of Canada to guide the Canadian Space Program. In its narrative it

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[85] *Ibid.,* 7.

[86] *Ibid.,* 18.

acknowledged space as strategically important to Canada's economy and interests. The focus of the Framework is on the social, economic, regional and industrial benefits space can provide the country. To achieve this a program of specialized capabilities was put in place to derive maximum benefit in areas that best fit Canada's "needs and policy objectives". The four areas of the program are robotics, remote sensing, communications and science. Other areas that were resource intensive or did not fit the selected niches, such as launch and satellite navigation were to be accessed through international partnership.[87] The intent of the Policy Framework was to provide a capable space sector that could meet Canadian needs and compete commercially. As a comparison to the CFDS, what does the Framework have to say about defending space capability?

Much as the CFDS spoke little of space, the Canadian Space Framework speaks little of defence, let alone defence of space. The Framework's focus on industry, science and niche capabilities make for a well thought out approach to develop interest and capacity in Canada. At its heart it is a practical document which defined a way ahead for Canada to exploit value in space and technology while focused on Canadian interests. What it lacks is acknowledgment of the threats in space environment that can impact any and all activities in space. Ultimately, the Canadian Space Policy Framework has moved the CSA forward in a number of areas, but defence and more importantly the defence of Canada's space activities is not amongst them. As the implications of space protection or defence is profoundly a national security concern it is important to consider the Canada's National Security Policy.

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[87] Canadian Space Agency, "The Canadian Space Policy Framework," http://www.asc-csa.gc.ca/eng/industry.policy.asp; Internet; accessed 26 January 2010.

Securing an Open Society: Canada's National Security Policy, was developed in 2004 to provide "an integrated approach to security issues across the government".[88] In doing so it became a consolidation document for the high level threats and responses of the Government of Canada. This consolidated policy defined eight threats to Canada and Canadians. The threats as listed were, terrorism, proliferation of weapons of mass destruction, failed and failing states, foreign espionage, natural disasters, critical infrastructure vulnerability, organized crime and pandemics.[89] Throughout the entire policy, there was only one reference to space and it was to reaffirm Canada's "long-standing opposition to the weaponization of space", specifically in relation to the country's role in national missile defence.[90] Outside this single reference space, its threats and impact on society did not make the document. Even in the consideration of critical infrastructure, an area of concern, space was not included. What was included was an action item for the Government of Canada to begin development of a "Critical Infrastructure Protection Strategy" that would involve all levels of government, industry and international partners. Progress on the action items contained within the National Security Policy was released in a follow-on document the next year.

Securing an Open Society: One Year Later, was produced by the Government of Canada to document the progress on initiatives created under Securing an Open Society:

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[88] Privy Council Office, *Securing an Open Society: Canada's National Security Policy* (Ottawa: Privy Council Office, 2004), vii.

[89] *Ibid.,* 6-8.

[90] *Ibid.*,49.

Canada's National Security Policy.[91] With little in the initial policy on the matter of space protection, there was obviously little within the follow-on report. In this report the only mention of the word space was in terms of cyberspace. Canada's decision to stay out of national missile defence was not mentioned in the report as it had been in the original. The only area of interest in this discussion of space asset protection was an update on critical infrastructure, though again not specifically mentioned. Simply, the Government was making progress in terms of developing a National Critical Infrastructure Protection Strategy. A position paper on the proposed strategy was produced by Public Safety and Emergency Preparedness Canada (now simply Public Safety Canada) and this paper was used in discussions that were happening across the depth and breadth of government.[92] The issue of critical infrastructure would continue within Public Safety Canada, but Securing an Open Society: One Year Later was the last direct evaluation of progress against the National Security Policy.

The three current Government of Canada or national policies that border the concept of space asset protection are disconnected and provide no guidance when in comes to the defence of Canadian space assets. CFDS provides Canada's defence focus for the next 20 years but for the most part excludes the protection of space. The Canadian Space Policy Framework on the opposite extreme provides the clear objectives for the nation's involvement in space but excludes consideration of protecting the country's capability. Finally the National Security Policy provides no detail on space

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[91] Privy Council Office. *Securing and Open Society: One Year Later* (Ottawa: Privy Council Office, 2005), 2.

[92] *Ibid.*, 22.

infrastructure as a critical infrastructure or otherwise. In essence the three domains defined in these strategies are addressed except where they overlap. Essentially there is a national strategic gap, made clear by the lack of a single definitive policy or reference to Canada's approach to ensuring Canadians access to space derived services. This point was echoed by former astronaut, and former Head of the Canadian Space Agency, Marc Garneau when concerns were raised about the sale of Canada's Radarsat 2 and the associated technology to an US company. Fundamentally, Canada has no national space policy.[93] With the acknowledgement of the fact that there is no national policy umbrella for space it is important to look at the work being done within the individual departments.

Canadian Space Agency (CSA)

The Canadian Space Strategy was developed and approved by the Canadian Space Agency in 2003 as its internal guidance for the management of Canada's space program. It was designed to capture in one document the details needed by planners, stakeholders and partners on Canada's strategic space direction.[94] In February 2005 the Strategy was subsequently approved by the Government of Canada so it could be used "in focusing decision making at CSA and aligning all space related program activities through its strategic outcome and long term priorities".[95] The Space Strategy largely

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[93] Canadian Broadcasting Corporation, "Sale of MDA Units Leaves Canada's Space Ambitions in the Air: Garneau," http://www.cbc.ca/technology/story/2008/01/11/tech-mda-space.html; Internet; accessed 4 February 2010.

[94] Canadian Space Agency, *The Canadian Space Strategy...*, 5.

[95] Canadian Space Agency, *Canadian Space Agency 2008-2009 Departmental Performance Report* (Ottawa: Canadian Space Agency, 2009), 4.

follows in the footsteps of the Space Capability Framework. The Strategy's main thrusts were now termed earth observation, space science, communications and education. The document, like the Framework, has at its heart a focus on the development of and support for the Canadian space sector. That said, beyond the ideas it shares with the Framework it does expand and refine the vision to the Canadian Space Program.

The CSA vision articulated within the Strategy is expanded to include a role in bringing the value of space to the rest of government. Specifically the CSA will "integrate space fully and completely in Government of Canada Departments and Agencies as an invaluable tool to help fulfill their mandates...".[96] From the perspective of defence the Strategy goes so far as to provide "Target Results" that focus on security and foreign policy. CSA sees as part of its role support for surveillance related to national security and sovereignty as well as surveillance in support of Canada's foreign policy initiatives around the world.[97] That is where the expanded vision and the strategy end in terms of defence. Security continues to be defined exclusively as an application of space, but even then it is only touched on briefly. Protection of Canada's space segment seems to remain outside the CSA mandate.

Within the CSA guiding documents there is a keen focus on commercialization, building industry and technology spinoffs. Some have suggested that this is likely due to

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[96] *Ibid.,* 7.

[97] Canadian Space Agency, *The Canadian Space Strategy,* 7.

the agency's subordination to Industry Canada.[98] The point being that the Industry portfolio of the government would have significant influence on decisions and approvals within the CSA. Recognizing this relationship the question still remains on how to best protect Canadian industry which includes its interests and the space assets it relies upon. Such considerations are not clear in the Strategy. Going beyond the Strategy documents to the Departmental performance reports provides a more detailed insight into the activities of the Agency. What is clear within the Performance Report is that some threats to space operations are being considered.

Debris in space is the main standout in the CSA's 2008-2009 Departmental Performance Report. The document recognizes it as a concern for space operations, but one that "favour[s] increased cooperation between nations with common goals".[99] The Report is also clear on a significant rise in the use of space, stating that there are an increasing number of countries using space with "close to a thousand satellites ... expected to be launched in the next ten years".[100] While the document does not go into great lengths to detail the current efforts on these issues it is important to recognize that they are part of the considerations within the CSA. A further appreciation of the CSA's activities can be gained by reviewing the missions listed in the 2009 Detailed Performance Report.

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[98] Fergusson, *Report on Canada...,* 65.

[99] Canadian Space Agency, *Canadian Space Agency 2008-2009 Departmental Performance Report,* 16.

[100] *Ibid.,* 8.

There are a number of missions listed in the Detailed Performance Report that demonstrate there is activity within the CSA to look at the protection of space based assets. Their presence highlight that some protection issues are being considered. None of the missions listed are exclusively defensive in nature, and are more appropriately labeled dual-use but that does not negate their value in this area. Of particular note are the ORBITALS, NEOSSat and CANSOC missions. ORBITALS is a satellite based physics mission that will explore the space weather and radiation of near-earth space. This mission is of value to all space operators as the knowledge gained will help to minimize the impact of space weather in the future. The second mission, NEOSSat, is a joint venture between CSA and DND. Its purpose is the tracking of asteroids in the inner solar systems as well as the tracking of satellites in high-Earth orbit to update their orbit details.[101] NEOSSat provides an excellent example of what cooperation between government organizations can provide. A final example on the horizon is the Canadian Satellite Operations Centre (CANSOC). The value in this mission is that it affords Canada a facility "for end-to-end operations and management of satellite missions".[102] While still a concept under review[103], its implementation would also provide a capability that could unify space operations across the government.

Taking the activities within CSA into account it is clear that the Agency has the awareness and the capacity to help address the issue of defending Canadian space assets.

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[101] Canadian Space Agency, *Canadian Space Agency ... Detailed Performance Information*, 94.

[102] *Ibid.,* 81.

[103] *Ibid.,* 6.

What is lacking is a specific mandate which defines its role in relation to defence of space assets. From the time of its creation the CSA's mission was defined in terms of "the peaceful use and development of space".[104] This philosophy has worked for Canada and the Agency and would continue to as long as space remained a new frontier. Now with space becoming congested and contested the requirement to defend space assets is becoming an essential ingredient of space operations. This burden is not the CSA's alone. In the current portfolio structure the defence of space falls into the territory of a number of government organizations.

Department of Foreign Affairs and International Trade (DFAIT)

Department of Foreign Affairs and International Trade is Canada's face to the world. It exists to project Canada's influence. Its mandate, in part, is to ensure "that Canada's foreign policy reflects true Canadian values and advances Canada's national interests". It does this by working with "partners inside and outside government to achieve ... enhanced security for Canada ...". [105] This responsibility extends equally to the Department's involvement in space and space defence just as it would to any other area of Canadian interest. As an outward facing department what role does DFAIT play in terms of policy for defence of Canadian space assets?

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[104] Canadian Space Agency, *The Canadian Space Strategy*, 3.

[105] Department of Foreign Affairs and International Trade, "About the Department," http://www.international.gc.ca/about-a_propos/index.aspx; Internet; accessed 22 February 2010.

While DFAIT by mandate would not define a national space policy itself, its activities in international fora as well as its research activities make it an important player in national policy development. Canada has a history of involvement in the development of space law. DFAIT has been Canada's voice in the negotiation of the international space treaties. It effectively targeted areas where the country can make the greatest contribution, but also areas of great national interest. One such example was the advancement of principles on nuclear power sources in space where Canada took a lead role in response to the crash of the nuclear powered COSMOS 954 on Canadian soil.[106] The work being conducted in the area of treaties and international agreements on space is important. By signing on to any one, Canada is essentially defining its space policy both internationally and domestically. With that said, it must be understood that International agreements are about compromise and therefore may not reflect the totality, but only a threshold of a nation's position in an applicable field. Accordingly, while they do shape it, Canada's acceptance of international agreements does not replace a need for national policy.

DFAIT has provided a litmus test in terms of a national space policy. Its work in the past on international space treaties is but one aspect. The 2005, *Canada's International Policy Statement - A Role of Pride and Influence in the World*, provides some insight into the international interests of the Government. In terms of space its focus is on two aspects, the weaponization of space and the space application in surveillance. Surveillance is discussed as part of its terrestrial role in the defence of

[106] MacDonald, *Space Strategy...*,108-109.

Canada and North America with the US. The second aspect, Canada's "policy against the weaponization of space"[107] is a traditional role that relates back to its past treaty work and focus on arms control and disarmament.[108] In the end the most recent Policy Statement provides no clear direction on space outside of these traditional concerns.

Acknowledging the contents of the policy statement it should be made clear that DFAIT is going beyond the contents of the Policy Statement and considering the broader issues of space and space defence. In part it has begun to promote "multi-lateral measures to manage a range of pressing space security questions, such as launch notification, debris mitigation and orbital slots".[109] These additional activities will help further the discussion on these key areas and develop a body of knowledge on the issues. Additionally the Department has been developing policy ideas and discussion through its International Security Research and Outreach Programme (ISROP). ISROP through the engagement of academic organizations and think-tanks has developed policy ideas in a number of areas including space security.[110] This work is important to developing knowledge of the issues and in DFAIT's role being able to address the international considerations of space. The activities of DFAIT could play a role in the development of a national policy but they do not replace one.

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[107] Department of Foreign Affairs and International Trade, *Canada's International Policy Statement [A Role of Pride and Influence in the World]* (Ottawa: Department of Foreign Affairs and International Trade, 2005), 8-9.

[108] Fergusson, *Report on Canada...*, 64.

[109] *Ibid.*, 65.

[110] Department of Foreign Affairs and International Trade, "International Security Research and Outreach Programme (ISROP)," http://www.international.gc.ca/arms-armes/isrop-prisi/; Internet; accessed 25 February 2010.

Public Safety Canada

Public Safety Canada is the lead Department for domestic security in Canada. Its role is to unify and coordinate the efforts of "federal organizations dealing with national security, emergency management, law enforcement, corrections, crime prevention and borders".[111] Through this function the Minister of Public Safety defines the policy and mechanisms used to protect the country. This role includes the policy for and the protection of Canadian infrastructure. Having recognized above the importance of space assets or space infrastructure, what is the role that Public Safety Canada plays in terms of protecting these assets?

To answer this question one has to go back to the National Security Policy discussed above and recognize that space is not defined as a security issue. The closest the Policy comes to touching the issues of space operations is in consideration of critical infrastructure. At the time critical infrastructure was not specified except as an action item to develop a National Critical Infrastructure Protection Strategy. That Strategy is still not published but a Public Safety Canada draft document entitled Working Towards a National Strategy and Action Plan for Critical Infrastructure (2008) underscores by its absence that space as a domain is not a consideration in critical infrastructure. The sectors that are listed in the draft are energy and utilities, communications and information technology, finance, health care, food, water, transportation, safety,

[111] Public Safety Canada, "Who are we?" http://www.publicsafety.gc.ca/abt/wwa/index-eng.aspx; Internet; accessed 22 February 2010.

government and lastly manufacturing.[112] Each of these areas are then assigned to a responsible federal department. The departments are the Federal lead in terms of advancing a "collective national approach to protecting critical infrastructure".[113] As close at this draft gets to the protection of space assets is through the assignment of the Communications and Information Technology sector to Industry Canada. In consideration of the complexity and implications of operations and protection in the space environment this allocation of communications only captures a portion of the space derived services. The implications of losing space assets or capability are significant to all the defined sectors, when the breadth of space derived services is considered. That is not to say other aspects are not being taken into account, but the breadth of the space capability is too large to not be a specifically documented area of concern.

In terms of space infrastructure, what is left for Public Safety Canada is a role for "coordinating and facilitating" should an incident arise. What is lacking is the capture of all the space services and infrastructure that are critical to the country. The critical services could then be worked through to determine alternative paths to providing the same service.[114] It is important to acknowledge that space capability goes beyond the single service of communications and the pervasiveness of space services need to be managed as a whole. If that is not well understood Public Safety Canada will not be able to fulfill its emergency management mandate. Interestingly, the equally broad concerns

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[112] Public Safety Canada, *Working Towards a National Strategy and Action Plan for Critical Infrastructure - Draft for Consultation* (Ottawa: Public Safety Canada, 2008), 23.

[113] *Ibid.,* 15.

[114] Ferguson, *Report on Canada...,* 61.

of cyberspace warrant significant consideration in the National Security Policy and related documents. In response Public Safety Canada operates the Canadian Cyber Incident Response Centre (CCIRC) which monitors and coordinates Canada's response to cyber incidents against critical infrastructure.[115] A similar function in support of space infrastructure would be a logical extension, but only when space becomes critical infrastructure in its own right. Until that occurs, Public Safety Canada's role in protection of space assets will be limited.

Department of National Defence (DND)

Canada's Department of National Defence had a significant role in space very early on. As time went on though, the government took a wider focus on space and the military benefits decreased in priority. The origins of Canada's space program can be traced to DND. In fact, Alouette was produced through the work of the Defence Research Telecommunications Establishment (DRTE), then a part of the Department. The reductions in Defence involvement occurred over a number of years starting in the late 1960's. Through the years "Canada's space programs were transferred to civilian and private-sector organizations except for a handful of personnel assignments within [NORAD]". [116] The withdrawal of DND from space began with the removal of DRTE from Defence in placement within the newly formed and civilian run, Department of

[115] Public Safety Canada, "Canadian Cyber Incident Response Centre," http://www.publicsafety.gc.ca/prg/em/circ/index-eng.aspx; Internet; accessed 24 February 2010.

[116] James, "Space is Becoming Crucial...," 65.

Communications as the Communications Research Centre.[117] This, and subsequent changes, clearly signaled Canada's involvement in space would be primarily a civilian endeavor. This decrease in military programs continued on through to the 1980's where military involvement was "only 10 per cent of the Canadian government's space-related spending".[118] As was shown in previous chapters space is becoming an increasingly contested and congested domain. Canada has enjoyed the benefits of space through an increasing number of systems and services and accordingly has a national interest in maintaining access.

Accordingly, "space interest inside DND is on the rise".[119] Knowledge of the importance of space in terms of its economic, scientific and military importance "now resonate within Canada's Department of National Defence".[120] "Space is also of growing importance to the Canadian Forces..." itself, as nations who can not use it will be left behind, unable to exploit the capability for their own needs and ultimately will find it exceedingly difficult to remain interoperable with partner nations, in particular the US.[121] DND has also recognized that the threat goes beyond military operations, and includes risks to Canada's domestic infrastructure. In response to the increasing concern over space operations the Department has developed an updated National Defence Space

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[117] Evans, "The Canadian Space Program...," 22.

[118] James, "Space is Becoming Crucial...," 65.

[119] *Ibid.*, 65.

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

[121] James, "Space is Becoming Crucial...," 66

Policy and with it an associated National Defence Space Strategy. As of the writing of this paper both were still in draft but permission from Directorate Space Development was received to use the material.

The National Defence Space Policy[122] is a significant document as it addresses the key issues that affect space operations. It also is careful to make clear the Department's role relative others in government. From the beginning, the document underscores the importance of the space environment to both Canadian Forces and the Canadian Public. It also points out a number of threats that must be addressed including the space environment itself, collisions and debris, and the vulnerability of the systems to attack. In response to the current environment DND has set out three goals. They are: to ensure access to space, to use the unique capabilities afforded by space and to protect critical space systems. Interestingly, the protection of space systems is specifically limited to those assets that are "... critical to National Defence, both national and allied...".[123] To achieve these goals the Policy defines a series of capabilities required by the Department, a number of these have application to the protection of Canadian space assets.

The two key capabilities in the Space Policy which will contribute to the protection of space assets are: space domain awareness and, command and control. First, space domain awareness will provide the Canadian Forces the capacity to monitor objects

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[122] Department of National Defence, *National Defence Space Policy 2009 - DRAFT* (D Space D Version 5), 1.

[123] *Ibid.*, 3.

in Earth orbit be they natural or manmade in order to avoid collisions. This capability would also extend an awareness of "man-made interference" that would allow for the determination of the actors involved. The second capability is the development of a "comprehensive command and control system" with the associate infrastructure required to track, manage and control systems in orbit. This capability is acknowledged to require a partnership with the other government users.[124]

Beyond the discussion of threats and capability the Policy recognizes the larger framework within which it must function at the same time providing focus to DND's efforts. Explicit in the document is that the Policy is the centerpiece of DND's efforts in space, and all space related initiatives will be governed by it. It is also clearly stated in the document that DND's space capabilities "will be in accordance with this Policy and relevant international law, including space treaties and international space agreements ratified by Canada or otherwise supported as part of Government of Canada policy...".[125] It is also clear in the document that interdepartmental cooperation is essential to Defence efforts to maximize value of "versatile multi-purpose missions" but also ensure national defence and security aspects are part of any discussion. This need for cooperation is further extended in the guidance to include Canada's international partners predominantly the US (including NORAD), NATO and traditional allies such as "the United Kingdom,

[124] *Ibid.,* 4-5.

[125] *Ibid.,* 2.

Australia and New Zealand".[126] The National Defense Space Strategy adds specifics to the concepts in the Policy.

The National Defence Space Strategy[127] starts out by again reaffirming the importance of the space derived services, the natural difficulty of the environment and the threat posed by ease of space access for an increasing number of actors. It then makes the policy connection to the CFDS and National Defence Space Policy. Access to space derived capability is an essential component to the success of the CF mission. The focus is on what space delivers terrestrial operations and again there is no mention of a requirement to protect space systems in relation to the CFDS.[128] That said, the real heart of the Strategy is in its assignment of key tasks and activities. This is where the DND's space actions over the next couple years are defined and where ideas on addressing the defence of space assets are contained.

DND believes there is a need to strengthen the CSA's infrastructure and capabilities from a launch capacity through to the management of space assets. To do this DND will build on the existing relationship between the departments defined in a series of MOUs and update the relationship to demonstrate this strategic focus for the two.[129] As an extension of the need to strengthen space infrastructure the strategy

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[126] *Ibid.,* 7-8.

[127] Department of National Defence, *National Defence Space Strategy - DRAFT* (D Space D Version 4.4), 1.

[128] *Ibid.,* 2.

[129] *Ibid.,* 5-6.

outlines the CF need for a Canadian Space Operations Centre whose functions would include "apportion, control and protect" Canadian capability.[130] Complimentary to the needs for command and control space assets is the requirement for space domain awareness. The strategy lays out a need for a Canadian capability to bring together information on space weather, systems status, along with detection, tracking, and analysis. This would be done again in concert with other Government Departments and allies.[131]

Ensuring access to space derived services has also been identified within the National Defence Space Strategy. DND will work with US partners to ensure that information on threats to space assets are disseminated. In addition, the Strategy notes there is an active threat from other nations that "field offensive counterspace [sic] capabilities" and that critical national satellites "will need to possess self-defence capabilities". Taken to its logical conclusion the Strategy also provides for DND to explore "active protection measures" that would deny space capability to others. This concept would be restricted to actions "that are temporary, reversible and localized".[132]

While hitting the high notes on protection of Canadian infrastructure the restriction to those that are specifically necessary to the CF, highlights the issue in Government. There is no single organization charged with taking a holistic approach to

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[130] *Ibid.,* 7.

[131] *Ibid.,* 8.

[132] *Ibid.,* 9.

the defence of Canadian space infrastructure. DNDs approach in its Policy and Strategy make it clear there is a need for a focused "whole of government" approach to space activities, including defence of national infrastructure. CF documents acknowledge this by outlining the need for cooperation with other agencies, departments and allies. The missing component seems to simply be one of mandate. The fact that the National Defence Space Policy goals specifically focus on DND, is likely an intentional decision. The statement leaves a question that point to a need to engage other departments. It should not be taken as a statement where the Department is not interested in the protection of the other Departments and commercial assets. The statements of the former Director Space Development, Colonel François Malo show this is simply not the case. He states, "the military mandate is to protect the homeland - that now includes Canadian civil, commercial and military space".[133] So where does sum of Canadian policy leave the concept of protecting space assets?

Canada's Policy Situation

After a review of Canada's space related policies and strategies it is clear that Canada currently has no comprehensive national strategy for space. By extension the Government has no core policy or strategy to deal with the protection of its space assets as well as ensuring national access to space derived services from industry and allies. Government level documents view space as a solution to other, mainly terrestrial, concerns not as a problem space unto itself. What is also clear is that some government

[133] Malo, "Schriever V: Lessons Learned...," 31.

departments are involved in defining Canada's role in space but do so exclusively within their area of responsibility. The point is not to condemn or condone these activities as they are important in their own right, but to simply highlight the lack of a singular national focus on space. Due to the gaps between initiatives key issues such as ensured safety and access to national (including commercial) space assets are missing from the discussion. Canada is not alone in terms of not having a comprehensive strategy. Even the US arguably the most advanced nation in this regard has had difficulty in generating a truly comprehensive space strategy that captures all facets of space as a strategic asset.[134] What the US has that Canada lacks is a national strategy that includes protection of its space assets.

What is clear is that this is an area the Canadian Government needs to consider. In military parlance space has become a Centre of Gravity (CoG), which is both a national strength and a weakness.[135] The definition of a CoG being "characteristics, capabilities or localities from which a nation, an alliance, a military forces or other grouping derives its freedom of action, physical strength or will to fight".[136] The increasing space dependency by information based societies and their militaries has provided significant advantages to nations, but that same dependence has also become an Achilles heel. Protection of this weak spot is absolutely vital to the wellbeing of the nation as a whole as much as it is for the success of a modern armed force.

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

[135] James, "Space is becoming crucial...," 67.

[136] Department of National Defence. B-GJ-005-500/FP-000 *Canadian Forces Operational Planning Process (OPP)* (Ottawa: DND/MDN Canada, 2008), 2-1.

"We cannot afford a day without space - our global economy is fuelled [sic] by space effects". Infrastructure and economies would take the brunt of the impact as it would take months or years to replace what was lost.[137] A pan-government approach is needed to bring the issue of space protection in from the periphery of policy, but this will require recognition of the threat and genuine interest in meeting that threat.

Canadian space policies, as they stand, will not protect the nation's interests in space until the reason behind them moves beyond satellite effects to a full appreciation of the space environment. There is no explicit or unifying guidance from the Government of Canada that deals with the specific aspects of ensuring the safety of these systems and the vital functions they support. The problem is that space as an area of concern is "out of sight and out of mind", which will require a strategic re-think by the whole of government.[138] This is a tall order considering the dynamics of current Canadian politics, the state of the economy, and a general lack of interest from the Canadian people. The implications of losing space assets are simply not a concern on the public's and therefore the Government's mind. Without an impetus to change space will remain "... buried within the governmental process itself, its access to cabinet constrained and its message diluted".[139] Acknowledging the need for a spark for the Government to rethink space, where would one come from?

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[137] Malo, "Schiever V: Lessons Learned...," 31.

[138] Fergusson, *Report on Canada...*, 59.

[139] *Ibid.*, 60.

In the most severe circumstances such motivation could come in the form of destruction of, or damage to, a country's infrastructure. Attacks like those in New York, Washington, and rural Pennsylvania on September 11, 2001 can have a profound effect on government. The attacks motivated governments such as the US and Canada to change the way they viewed domestic threats. Further back, the Japanese attack on Pearl Harbor had a similar effect on the US government, causing it to react and ultimately leading to the US involvement in World War II. The US has learned from the past and has recognized the threat to space operations. "As early as 2001 the Report of the Commission to Assess United States National Security Space Management and Organization warned that US dependence on space systems made it uniquely vulnerable to a 'space Pearl Harbor' ...".[140] The US has been looking at space as a threat environment of equal importance to terrestrial concerns and is reacting accordingly. The threat to space assets is real and Canada is as equally dependent on space derived services.

Canada needs to focus its divergent departmental efforts in part on ensuring the national space assets and services are not disturbed. An attack on or major outage of space systems, whether national or shared would have a significant and immediate effect on the country. In addition, collateral damage from new debris that could result from such an event would have a longer term impact on all space users in that orbit and lower, regardless of nation. The issues as discussed previously do not stop with active targeting of space assets but also includes accidental collisions with existing debris, other satellites

[140] West, *Space Security 2009*, 107.

and the natural effects of space environment itself. If the effect of any such damage to space segments Canadians depend on is significant enough the population, commercial industry and ultimately the Government will be interested but by then all solutions will be reactions.

Without a definitive statement from the Government of Canada that defines Canadian intentions in space it is exceedingly difficult for the various departments and agencies to synchronize their efforts. Furthermore without clearly defined roles or leads in this domain, important areas of policy and action will be hindered or remain dormant as it is not clear where the authority lies. Often it is only when crisis strikes or a problem lands in the back yard do nations react. Canada itself is an excellent example. In 1978 when, then Soviet, COSMOS 954 returned to Earth scattering debris and radioactive material across the Canadian north, only then did Canada react to space based nuclear power sources, and take an international lead role in this area.[141] Hopefully the development of a comprehensive national space policy will not require such an event. In considering the future of Canadian space policy, whatever its engendering spark, the best answers may come from a review of the past. The intent is not to provide a definitive answer but to define the outer limits a Canadian policy would be bound by in terms of protecting national space interests.

[141] MacDonald, *Space Strategy...*, 101.

OPTIONS FOR CANADA

Introduction

It is exceedingly difficult to predict the direction a nation will go in terms of policy, with any degree of accuracy. The political consequences of unforeseen events such as recession, natural disaster or terrorism can lead governments in directions not anticipated. Beyond the reaction to such events, there are ideas or concepts that are relatively constant through a nation's policy. These are often revealed through the lens of past government action, and may help define the likely limits of future policy. Canada's nuclear debate from 1963 and the ballistic missile defence debate in 2004 will be used to discuss the broader defence and security considerations that arise. The issues surrounding the CSA's Radarsat program will also be discussed as it shows the effect some alliances can have in terms of shaping Canada's defence and security policy as well as the interplay of globalization. These situations will be evaluated through the lens of Douglas Bland's five ideas that define the Canada's national interest and the results extended to the space environment. This approach will help define key aspects and the likely limits of Canadian space policy.

Nuclear

"The election of 1963, in which Diefenbaker's Conservatives were defeated by Pearson's Liberals, was essentially a referendum on Diefenbaker's handling of the

questions of nuclear weapons".[142] The end result of the nuclear question in Canada was not a debate on the weapons themselves but on the government's handling of the Canada-US relationship. The debate began in the late 1950's when the Canadian government purchased the CF-104 Starfighters, CF-101 Voodoo fighters, Honest John rockets and the BOMARC-B missile system for use by Canadian forces. Each of these systems was designed to be used with nuclear warheads. It was felt at the time that these nuclear weapons systems were necessary for Canada to meet its NATO and NORAD commitments to help defend North America and Europe from the Soviets.[143]

So important was the perceived need for nuclear capable forces that US President Kennedy was directly involved in the discussions. The President was concerned that NORAD's defence would be weakened if Canada did not also have a nuclear capability to thwart an attack over the pole.[144] For the Canadian government the US pressure was in addition to that coming from within the bureaucracy itself. "Diefenbaker later wrote that bureaucrats had railroaded him into accepting the BOMARC and that the defence establishment conspired with its American counterparts to push him into deploying nuclear weapons".[145] As the pressure mounted the situation became worse for the Prime Minister as a rift was also forming within his party over the issue.

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[142] Brian Bow, "Parties and Partnership in Canadian Defence Policy," *International Journal* 64, no. 1 (Winter 2008-09): 71.

[143] Mark A. Eaton, "Canadian Editorial Opinion and the 1963 Nuclear Weapons Acquisition Debate," *The American Review of Canadian Studies* 35, no. 4 (Winter 2005): 643.

[144] *Ibid.,* 644.

[145] Bow, "Parties and Partisanship...," 81.

Diefenbaker's reluctance in making a definitive decision on the deployment of nuclear weapons was in part due to a fundamental division in his party. This division was personified in his Defence and External Affairs Ministers. In Defence, Douglas Harkness saw the accepting of nuclear weapons as the fulfillment of a commitment Canada had made under NORAD. On the other side of the debate, the Secretary of State for External Affairs Howard Green opposed the move as it might damage "Canada's international reputation as a leading advocate of nuclear arms control".[146] It should be acknowledge that the warheads although available to compatible Canadian systems would remain in U.S. custody.[147] This nuance was insufficient to change the views of those against the nuclear warheads and therefore left the Prime Minister little room to maneuver. Then with a minority government handed to him in the June 1962 election, PM Diefenbaker decided that making no decision was in the best interest of the staying in power.[148] This approach did little to appease everyone.

In January 1963, the US, fed up with delays from the Canadian Government openly questioned Canada's sincerity in terms of NORAD and NATO. The US' public statements brought the issue to a head in cabinet and in the end the MND and two other ministers resigned. Pearson, then leader of the opposition, put forward a non-confidence vote that ended the Diefenbaker government.[149] What had occurred was the misreading of the public's interest. In 1962, a small majority of Canadians supported the deployment

[146] *Ibid.,* 81.

[147] Eaton, "Canadian Editorial Opinion...," 646.

[148] Bow, "Parties and Partisanship...," 81.

[149] Eaton, "Canadian Editorial Opinion...," 646-7.

of nuclear weapons. This was not from an increased interest in the weapons system, but over concerns the country was not living up "to alliance obligations, and the damage evidently done to the bilateral relationship with the US".[150] In the end, under the new Liberal government an agreement was reached that saw Canadian systems with nuclear warheads.[151]

Missile Defence

In December 2002, then President Bush announced the US would deploy a Ballistic Missile Defence (BMD)[152] to protect the country from new nuclear threats such as China, North Korea and possibly Iran.[153] This announcement obviously created a great deal of discussion within Canada on the merits of the systems. The particular areas of concern were a new arms race, and the weaponization of space, balanced against the security it could provide and Canada's security relationship with the US. Initially, on the political front Canada's support and likely involvement seemed assured. Paul Martin, prior to becoming the Liberal Party Leader, had supported the idea of BMD.[154] More

[150] Bow, "Parties and Partisanship...," 82.

[151] Eaton, "Canadian Editorial Opinion...," 647.

[152] James Fergusson, "Shall we Dance? the Missile Defence Decision, NORAD Renewal, and the Future of Canada-US Defence Relations," *Canadian Military Journal* 6, no. 2 (Summer 2005): 18.

[153] Eaton, "Canadian Editorial Opinion...," 659.

[154] Kim Richard Nossal, "Defence Policy and the Atmospherics of Canada-US Relations: The Case of the Harper Conservatives," *The American Review of Canadian Studies* 37, no. 1 (Spring 2007): 25.

broadly, a motion was passed in the House of Commons in 2003 that expressed Canada's desire to have NORAD involved in BMD.[155]

In August 2004, Prime Minister Paul Martin approved the signature of an amendment to the NORAD agreement that would allow the organization to share its missile warning information in support of missile defence activities. At the time of the signing the Canadian government made clear that this only permitted the sharing of tracking data and did not mean that NORAD was going to take on missile defence responsibilities.[156] More importantly, this also did not mean that Canada had committed itself to BMD. Then Minister of National Defence Bill Graham stated that the decision on the sharing of information had been made to ensure the relevance of the bi-national NORAD partnership, because "the Americans were on the verge of building an airspace defence system that would have made Norad [sic] obsolete".[157] In essence the change in the NORAD agreement had less to do with the BMD, and more to do with the preserving a politically important defence relationship.

At the time of the original 2003 motion in the House, some Liberals voted against because they felt the wording of the motion could allow for weapons in space as part of the BMD initiative. At the time "...Paul Martin said Canada should be involved in missile defence to represent Canadian interests, but that he didn't support putting

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[155] Canadian Broadcasting Corporation, "In Depth Canada's Military: NORAD," http://www.cbc.ca/news/background/cdnmilitary/norad.html; Internet; accessed 18 March 2010.

[156] Nossal, "Defence Policy and the Atmospherics...," 25.

[157] Canadian Broadcasting Corporation, "In Depth Canada's Military: NORAD."

weapons in space".[158] These statements defined the position the government and underscored the difficulty the Prime Minister faced as he tried to move this file forward. In the end he could not overcome interests in caucus that included strong opposition to BMD from his Quebec MPs.[159] In February 2005, without prior warning, Prime Minister Paul Martin announced that BMD was simply "not in Canada's interests", much to the surprise and dismay of the US government.[160]

RadarSat

The development and launch of the Canadian Radarsat satellites provides another crucial piece of Canada's unwritten space policy. In particular it highlights the potential pitfalls that exclusive dependency can bring. In defence and security matters, such dependency could have another nation determining Canadian capabilities or defining tenets of national policy. The Radarsat scenario demonstrates the fine balance at that often must be struck in the Canadian defence and security arena. Two aspects will be highlighted; the first is US' concerns over the systems' capability and second Canada's concerns over the possible sale of the Canadian parent company to a US firm.

The Radarsat satellites were perceived as a threat to US interests, the threat being derived from concerns over the imaging resolution of the system. The Radarsat satellites

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[158] *Ibid.*

[159] Nossal, "Defence Policy and the Atmospherics...," 25.

[160] *Ibid.,* 26.

are based on a version of synthetic aperture radar (SAR) technology developed in Canada that provides "...all weather, day and night imagery..." at resolutions from 100m down to 10 meters.[161] This resolution increases to 3 meters for Radarsat-2.[162] It was ultimately the level of detail these systems could provide in conjunction with the fact that imagery would be sold commercially that had the US concerned. Two reasons are given for the US concern: national security and commercial interests.

In terms of national security the US was concerned the resolution of the system provided too much detail. In addition the commercial availability of the imagery could facilitate it falling into the wrong hands. The US was so concerned about this fact that domestic US law prohibited non-military or non-intelligence imaging satellites from having resolutions comparable to those of the Radarsat satellites. This may have also led to industry concerns in the US over the Canadian project. In fact, a lobby was formed by US aerospace companies who felt that the countries involvement in Radarsat amounted to support of foreign competition in Earth imagery.[163] The implications of these concerns were significant to the Radarsat-2 project.

Although the Canadian made imaging technology was immune other parts of the project were affected. The main satellite structure (known as a bus) was denied export to

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[161] Roger Handberg, "Dancing with the Elephants: Canadian Space Policy in Constant Transition," *Technology in Society* 25, no. 1 (January 2003): 36.

[162] MDA, "Radarsat 2: Features and Benefits," http://www.radarsat2.info/about/features_benefits.asp; Internet; accessed 19 March 2010.

[163] Peter Calamai, "Canada Ready to Dump NASA for Space Launch; may Go to Europe to Build and Send $305 Million Radar Satellite into Orbit." *Toronto Star*, December 8, 1999.

Canada by the US State Department on the grounds "that sensitive technology could fall into non-American hands". Additionally, NASA at the request of intelligence agencies would also not facilitate the launch of the system.[164] In response to the US closing the door on the project, CSA and MacDonald, Dettwiler and Associates Ltd (MDA) the prime contractor worked with the Europeans to acquire a satellite bus and to have the systems launched.[165] If this option had not been open the project would likely not have been completed.

The US had tried to stop the system from achieving flight, but once in place recognized the importance of the capability. "In 2008 the US Department of Defense bought $5-million worth of commercial synthetic aperture radar imagery from the Canadian Radarsat system".[166] This recognition also attracted interest from US companies interested in the technology and in 2008, MDA announced it had decided to sell its aerospace division to US weapon maker Alliant Techsystems (ATK). This sale would have included the ownership of Radarsat-2. The sale caused a stir in space circles and opposition to the sale was fronted by former astronaut and head of CSA Marc Garneau. [167] In the end, after significant debate within government, Industry Minister Jim Prentise blocked the sale stating that it was not of benefit to Canada and that

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[164] William Boei, "Radarsat Launch Delayed a Year After US Security Concern Forces Canadian Firm to Find New Contractor," *Canadian Press Newswire*, December 17, 1999.

[165] Hanberg, "Dancing with the Elephants...," 36.

[166] West, *Space Security 2009*, 99.

[167] Canadian Broadcasting Corporation, "Sale of MDA unit leaves Canada's space ambitions in the air: Garneau."

concerns over the "application of foreign law" would affect operation of satellite in terms of Canada's interests.[168]

Lessons Learned

Douglas Bland in his article "Canada's National Interest: Alliance with the United States" examines five ideas that have been at the core of Canada's defence and security policy. Although his title describes his conclusion, the following will use the five ideas he has proposed and arrive at its own conclusions using the examples above and then extending the idea to the concept of space defence. The ideas that define Canada's national interest as proposed by Bland are: Canada as a sovereign country, Canada as naturally secure, Canadian's belief in the traditional concept of war, Canada's national interests are best served by alliances and finally, Canada's competing visions and directions.

Bland's ideas are a valuable approach as they capture the thoughts of a number of other authors in this area and provide a guide to the discussion. In addition the concepts proposed by Justin Massie will also be included. In particular his idea of "...three concurrent and coexistent strategic cultures: continental soft-bandwagoning, defensive internationalism, and soft-balancing Atlanticism".[169] The value of Massie's work in this

[168] Canadian Broadcasting Corporation, "Govt. Confirms Decision to Block Sale of MDA Space Division," http://www.cbc.ca/money/story/2008/05/09/alliant-sale.html; Internet; accessed 4 February 2010.

[169] J. Massie, "Making Sense of Canada's 'Irrational' International Security Policy: A Tale of Three Strategic Cultures," *International Journal* 64, no. 3 (Summer, 2009): 627.

area is that it is a counterbalance to the realist perspective put forward by Bland. Massie's article "Making sense of Canada's 'irrational' international security policy" introduces the "importance of constructivist, or cultural, factors" and the way they shape the national interests.[170] The following will explore the three cases above and then extend the ideas to Canada's interests in space. Bland's five ideas that define the national interest will be used as a structure for the discussion.

The first idea proposed by Bland is that "Canada as a sovereign country - is the cardinal idea that underlies all aspects of our national interest". In this idea he captures the protection of the physical entity, political freedom and ideals of the nation.[171] During the nuclear debate, the issue was first about protecting the nation, but beyond that it was about a perception of Canada in the world. The sticking point was between commitments made and a reputation for arms control. In terms of BMD, it became a cost-benefit analysis of the security offered against domestic and world perception. "The benefits of formal participation in missile defence would be marginal, but the political costs of appearing subservient to the United States would be high". The missile warning role alone, that Canada was able to keep under NORAD, at the same time maintained Canada's relevance in the aerospace defence of North America.[172]

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[170] *Ibid.,* 626-7.

[171] Douglas L. Bland, "Canada's National Interest: Alliance with the United States," *Policy Options* 28, no. 10 (November 2007): 63.

[172] Massie, "Making sense...," 635.

These events show the constant balance required between sovereignty and the Canada-US relationship. Massie's terms this "continental soft-bandwagoning". The concept goes beyond the exclusive concern over Canada as a sovereign state. Instead it is the importance of the friction between sovereignty and the need to be a "reliable neighbour to the United States".[173] It is this friction that defines the decisions taken in the BMD and in the nuclear debate. Each were not exclusive matters of Canada's physical security. Canada in each case had to decide on the balance between sovereignty and ensuring Canada played a sufficient security role to satisfy the US. In striking the correct balance, the country is able to achieve both aims.

The events surrounding the Radarsat satellites also demonstrated the sovereignty balance and leads to the fundamental issues that space brings to that discussion. Radarsat at first was hampered by US restrictions on imaging resolutions. These restrictions, due to Canada's dependence on the US for both the satellite bus and launch services could have changed the capability the nation wanted in the system. This was a system designed in part to monitor Canada's sovereignty. Additionally, the possible sale of the system to a US company highlights the issue that comes with international companies. Outside the concerns of access restrictions on imaging, the purchase of the system would bring to light questions on who would be responsible to protect the system. This becomes more concerning the greater a countries reliance on the space asset. If a system was essential to the national interest, would that nation not want to protect it? How is this done when the asset belongs to another nation?

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[173] *Ibid.,* 632.

The US on the other hand sees space as a sovereignty issue and is reacting to it accordingly. As space becomes increasingly more crucial to the functioning of US, it will see "...space as a vital and vulnerable medium to be controlled and defended". This change will make space a prominent security issue in the Canada-US relationship.[174] Canada needs to be prepared for this discussion or it may lose fundamental control over its space capabilities. This will be another debate that will require the balancing of sovereignty with reassuring the US. In the absence of a Canadian Government that appreciates the importance of space, the nation's interest will rest exclusively with the decisions of the US.[175]

The second idea put forward by Bland was that Canada is naturally secure. Bland considers both the geographical aspect and the Canada's need for others to assist in the nation's defence. Bland singles out the Canada-US relationship and the security it provides the nation.[176] Again, the explanation fits Massie's concept of continental soft-bandwagoning. The nuclear and BMD debates emphasize his point. In both cases they centered around how much defence responsibility Canada needed to take on to convince American interests that Canada was sufficiently involved in continental defence. In essence, "...Canada benefits from America's involuntary security guarantee, provided it

[174] James, "Space is becoming crucial...," 65.

[175] Fergusson, "Out of Sight...," 17.

[176] Bland, "Canada's National Interest...," 64.

contributes only modestly to continental defence and security".[177] How do the ideas of being naturally secure and soft-bandwagoning now apply to space?

Domestically, understanding space in terms of security is important. "Protected by three oceans, the only feasible means by which nations can realistically threaten the safety of Canadians is by using the medium of air, or space".[178] Space is an access point into Canada that needs to be protected, not only in terms of systems transiting space to get to Canada but in terms of securing the space systems the nation relies on. There is also no need to hit a nation directly if you can achieve sufficient effect by attacking critical services in space.

The landscape of strategic defence has changed with a refocus on space that will require Canada's attention. Simply, Canada needs to offset the decline in importance of air defence to the US, relative to space.[179] The country therefore needs to find new defence aspects to contribute to and maintain relevance to the US. One current example is the DND's Sapphire satellite project which is intended to contribute to the US Space Surveillance network by tracking objects in higher orbits. This is a necessary part of both nations space situational awareness. The project is an important step in redefining Canada's contribution and maintaining its relationship with the US. But it is only one step.

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[177] Massie, "Making sense...," 633.

[178] Fergusson, *Report on Canada...*, 6.

[179] James, "Space is becoming crucial...," 67.

The third idea is that Canadian's believe in traditional ideas of war and thus security interests are tailored accordingly. War is between two states and that actions are controlled and scheduled.[180] In 1963 the concern was the Soviet Union and in 2003 the concern was "rogue" states, these defence concepts were based on known threats by state controlled activities. As time moves on there is an increasing presence of asymmetrical or irregular warfare, a label generally put on war fighting that does "... not follow regular patterns and Western doctrine...". Ultimately Bland states these will be the regular wars of tomorrow.[181] In terms of space, the opening position is that a war has never been fought there.

The fact that there has not been a war in space to this point it fortuitous, but as the technology becomes more commercialized and readily available the option opens to a greater number of actors. This means space needs to be considered in terms of defence, including the assets in it. The only guidance on war in space comes from the OST but it is lacking when it comes to acknowledging broader space threats. It is limited, by its age, to the prohibition of weapons of mass destruction providing no guidance on the systems envisioned today.[182] The OST, as addressed earlier, also does not provide for the concepts of safe passage and self-defence. Even "customary international laws ... most relevant to space conflict are also very subjective and permissive".[183]

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[180] Bland, "Canada's National Interest...," 64.

[181] *Ibid.*, 65.

[182] Webster, "The Ultimate High Ground...," 54.

[183] Gallagher, *A Reassurance-based Approach...*, 20.

With that said Canada has been clear, when confronted, that there should be no weapons in space. Most recently, the BMD debate brought this affirmation temporarily back into the public discourse. Politically and philosophically the country cannot accept the idea of the placing of weapons in space or being part of a system that does. Ultimately that may be in the interest of all concerned with space operations. Nations who have space programs have come to understand that the implications of space warfare to existing and future space operations may simply not make it worthwhile.[184] While valid for those who rely on it, the threat remains that space is just as vulnerable to attack from those with nothing to lose.

The fourth idea of what drives Canadian policy is that Canada's national interests are best served through alliances. Be they binational or multinational, Canada has a history of seeking out these alliances.[185] The essence of the Nuclear and BMD issues were predicated on this same assertion. The debate over the Radarsat build, launch and purchase on the other hand alludes to the downside of alliances when one party becomes exclusively dependent on another. In Canada's case the need for alliances is clear. "Canada's small size in terms of population and production, relative other to the other major advanced economies," necessitate the country take a more collaborative approach in defence and security matters.

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[184] Bloomfield, "A Space Doctrine for Soldier...," 17.

[185] Bland, "Canada's National Interest...," 66.

Massie also agrees with Canada's need for alliances in terms of national security but he sees as a strategy of soft-balancing Atlanticism. Due to the country's historical identity derived from Britain, France and the US, the truth behind its decisions are based on the balancing of this North Atlantic quadrangle. He uses the example of the Iraq invasion where Canada did significant work in trying to bridge the gap between France and the others. It's postulated that had there been an agreement with France, Canada would have been in Iraq.[186] Applying soft-balancing Atlanticism to space is significantly more difficult as there is currently no immediate crisis affecting all four nations to drive the narrative. These specific relationships may shape Canada's take on the defence of space, as it does terrestrial issues, but they are currently not a substantial influence. At the moment, it is Canada's geographic isolation and proximity to the US that has instead shaped a "profound dependence on its southern neighbour".[187] This dependence leads to areas of safety and concern in terms of space defence.

The US sees space as a national center of gravity that requires "legitimate monitoring and security measures" to ensure its protection. Accordingly, "Canada will cautiously support U.S. controls because it will ultimately be in its interest to do so". By doing so it maintains two national interests, the safe guarding of allied and civilian assets and maintaining security relevance in areas where it cannot or will not follow. Canada's influence in this bilateral relationship is light. Canada "...will seek to safeguard [its] national interests by investing a requisite amount in national capability and then trying to

[186] Massie, "Making sense...," 641.

[187] Bow, "Parties and Partisanship...," 69.

leverage the capability inside a larger bilateral arrangement".[188] The US relationship remains key to Canadian space interests even after events such as Radarsat. A tangible example again is Canada's return to participate in space monitoring under the US SSN by DND's SAPPHIRE project. In the end collective engagement and space control are essential to Canada's interest.[189] An interest best served through alliance.

The fifth and final defining idea put forward by Bland, is that Canada has a number of competing visions and directions. The competition is based on where Canada can best find its security. Is it in a close relationship with the US, Europe, or in the broader construct of the UN?[190] Just as in the discussion of alliances the crux of each of example is a debate on where Canada could derive the security it needs. Space makes this same discussion exceedingly difficult, as stated before, space law be it the OST or customary international law has significant latitude. At the same time space has moved from a pristine environment to one crowded by a number of state and commercial players seeking the benefits of space. "Space was once perceived as a sanctuary but is increasingly like the high seas in the 1900s - an international territory...".[191] Accordingly an international approach to regulations and security will be required.

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[188] James, "Space is becoming crucial...," 68.

[189] Malo, "Schriever V: Lessons Learned...," 30.

[190] Bland, "Canada's National Interest...," 66.

[191] James, "Space is becoming crucial...," 68.

"Canada has been caught between two conflicting roles: as a world leader in disarmament efforts, and as a player in the drive for continental military integration".[192] These pressures have generated a great deal of tension within the country as evidenced in the effects on government during the nuclear and BMD debates. This pressure has created a climate where "...Canadian Officials seek to formulate policy that satisfies Washington that is not perceived as destabilizing by other members of the international community and also assuages domestic anxiety about the unavoidable relationship with the U.S.".[193] These ideas, for better or for worse, have become the fundamental tenets of Canadian defence and security policy. To achieve true balance on many of these issues Canada has to maintain good standing in both the continental and international arenas.

This posits well with the Canadian external identity of being a "good international citizen" through Massie's concept of "a defensive internationalist strategic culture". This identity is defined by "multilateralism (negotiation, compromises), humanitarian interventions, reluctant uses of forces, and economic aid and sanctions".[194] This approach has allowed Canada to balance its interests with those of its allies with sufficient success for the country. It has also built Canada a reputation on the diplomatic front, one that it could use to advance its own goals. In terms of space it understands the Russian and Chinese concerns over space weapons, European concerns on protecting the

[192] Webster, "The Ultimate High Ground...," 52.

[193] Eaton, "Canadian Editorial Opinion ...," 641.

[194] Massie, "Making sense...," 637.

orbital environment and US interest in space for legitimate military purposes.[195] From a purely realist perspective this need not be out of genuine concern for other nation's interests but simply a manner of managing Canada's dependance on other nations. Canada may best find its security in maintaining this multi forum approach. This leaves Canada not completely beholden to anyone and therefore able to leverage multiple fronts in advancing its goals.

Summary

Space defence policy is about what the country is willing to accept and what it is willing to risk. The fundamental question in the policy domain is if there will there be a trade-off between defence and values. By extension in the Canadian context it is also a discussion of the trade-off between autonomy and security. The answer will never be a simple yes or no; it is an appreciation of balance. In the review of the 1963 nuclear debate, 2003 BMD debate, the issues surrounding Radarsat, and by extension the lessons in terms of space defence highlight a number of concepts. The first and foremost being Canada's crucial relationship with US. While this relationship magnifies Canada's defence it often comes as a trade off in terms of sovereignty or autonomy. Canada's autonomy and credibility in international fora also has significant influence in decisions in terms of defence. The Canada-US relationship and Canada's perception in the world have specific implications to space.

[195] Gallagher, *A Reassurance-based Approach...*, 9.

Canada can really only achieve a depth in space defence through strong partnerships with the US. Canada's contributions to these partnerships also provide a voice in continental defence and extend the umbrella of US security over Canada's interests. There are limits to this for Canada as some US policy would not be permissible in the Canadian context. Much like the Radarsat solutions, Canada also needs to maintain international involvement in the areas it holds important in part to influence the domestic security construct. The best example is the question of the weaponization of space, which Canada has been consistently opposed to. Bi-laterally there is little Canada can do. It can participate to a point such as its involvement in space surveillance or simply opt out. Internationally though it may be have greater influence to strengthen international law when working with like minded nations. Additionally if Canada can not deploy weapons in space, even defensive weapons, then the international multilateral approach is the only way to go.[196] Where this leaves Canada in terms of space defence options is best summarized by Dr. James Fergusson when he stated "in the end, looking is fine, but acting is not. The same may be said about space itself. Looking into space is fine, but acting upon the information is up to the United States".[197]

[196] Fergusson, "Out of Sight...," 16.

[197] Fergusson, *Report on Canada...*, 41.

CONCLUSION

There is a significant national security policy gap for Canada in terms of space that needs consideration. Canada as an advanced information based economy is highly dependent on the effects derived from space based technologies, yet the country has no central government policy on how to protect these systems. More generally, the country has no single policy that defines Canada's approach to ensuring the nation simply retains access to this crucial environment. This is an environment to which the prosperity and security of the country deeply depends. In the absence of a clearly articulated whole-of-government approach, individual departments are exploring the issues of space within the silos of their mandates. The problem is that space security transcends the unique mandates. Even considering the sum of the departmental mandates there are still gaps that remain. This occurs when issues fall outside individual mandates or just as concerning where mandates overlap and it is not clear who has the lead.

The requirement remains for broad national guidance to synchronize government efforts. Without this pan-government approach the activities of individual departments will either miss or ignore crucial aspects in the defence of Canada's space capabilities and goals. That said this will not be an easy task for a government to achieve. The fact that space is not generally perceived as a threatened domain in part ensures there will be little movement in this area. This is because space derived effects are not readily visible to the public, although they are a driving factor in everyday life. So long as the infrastructure functions and the capabilities are delivered, space security will not be an issue the government will be encouraged to address. Fundamentally, Canada has no

capstone space security policy to defend its interests in space and without an igniting spark in the form of a crisis or significant external pressure is unlikely to develop one.

Regardless of the existence of Canadian security policy on space, international developments will continue to shape the way space is used. These actions may ultimately define the rules for Canada. The UN Treaties on space currently provide the only international legal regime that exists for space and nations have already begun to explore the limits. Countries, like the US, read the OST literally indicating that its only prohibition is on the placement of weapons of mass destruction in orbit. Other nations take a broader view in interpreting the documents and see in them a restriction on all weapons in space. Nations like China and Russia see the future in additional frameworks beyond the OST that explicitly eliminate aggressive acts in space while at the same time ensuring their own offensive capability. In attempting to define concepts of acceptable practice in space, the Law of the Sea and the Law of Armed Conflict are being considered. These frameworks may help develop parallel concepts such as the right of safe passage in space as well as concerns over dual-use systems. Beyond these ideas, future consideration will need to be given to the burgeoning private space industry currently offering LEO tourism, but which may develop additional capacities in the future. The role of larger political unions, or regional interests such as the European Union may also shape the way space law is interpreted as currently all responsibility remains with the nation-state.

Regardless of the legal framework, what remains certain is that space is an environment under threat. The mere act of accessing space threatens future operations in the terms of debris. ASAT systems, defunct satellites and human error are further complicating the environment. If these issues are not specifically addressed future access to space could be lost to all. Unfortunately, this is an issue that is out of sight and out of mind, and is not currently a public or government concern. With a threat that is hard to demonstrate it becomes exceedingly difficult to have a policy generated that reflects the reality of space security. The public mindset needs to change. Space is not longer a pristine sanctuary but a finite resource, and an environment in need of protection. These considerations are essential if Canada and the rest of the world are going to continue to benefit from space, now and into the future.

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