CANADIAN FORCES COLLEGE / COLLÈGE DES FORCES CANADIENNES
CSC 31 / CCEM 31

EXERCISE NEW HORIZONS

SPACE BASED RADAR: CAPSTONE TO CANADA'S ISR SYSTEM

By /par Lieutenant Colonel M.J. Barrett
Syndicate 6/Groupe d'études 6

29 April, 2005

Introduction

> "The events of September 11 have underscored the need for an improved Intelligence, Surveillance and Reconnaissance (ISR) capability that is responsive to the needs of the civilian decision makers and military commanders engaged in planning and executing operations in Canada and overseas. Countering the new challenges to our security demand a new level of comprehensive near real time 'Situational Awareness.'"[1]

n dec000nsiv1 T,erscored tllee a[(I tim)9(e)]4f0.0002 2c 0.000(sce,)6(Surve)Tionsdaarens vast.16 T-T0 1 T

Meanwhile, the perceived security threat to Canada specifically, and North America as a whole, has changed drastically since the end of the Cold War. The security climate has evolved significantly from a period of little or no credible military threat to the North American continent (as was the case prior to WWII) to today's situation where potential threats to North America include conventional military attack, and the uncertainty posed by the prospect of further terrorist attacks, perhaps employing weapons of mass destruction.

Although the threats to Canadian security have evolved, particularly since the mid-1900s, the need to conduct surveillance of Canadian territory, ultimately on a continuous basis, has remained a constant security requirement. Numerous Defence White papers and Canadian government policy statements have echoed this surveillance requirement, however, the capability to provide continuous surveillance has been elusive. A number of radar systems have been built since the 1950s that have spanned across Canada to provide coverage of significant portions of Canadian airspace, but these have only served to provide for surveillance of aircraft operating in Canadian airspace, and provided no insight into activities on the surface. Meanwhile, aerial, naval, and ground patrols have been, and continue to be used to conduct surveillance of surface activities, but these efforts are able to cover only small portions of Canada's vast territory, and only at infrequent time intervals. The result is that Canada's territorial surveillance capability has always suffered from very significant temporal and spatial gaps.

The events of September 11, 2001 have led to a security environment wherein surveillance of North American territory and maritime approaches is arguably more crucial than at anytime in history. In addition to this new threat, Canadian military forces continue to be called upon to operate on missions throughout the world, encompassing the full continuum of operations. The Canadian Forces (CF) is in the process of identifying the mix of Intelligence, Surveillance and Reconnaissance (ISR) assets that can best meet the joint requirements of the three Environments.[5] Space based radar,[6] with the potential to provide wide-area, near-continuous, surveillance of moving and fixed targets on a global scale, promises to be the capstone element in a complementary mix of ISR assets necessary to fully satisfy the needs of the CF and other Canadian government departments.[7] Further, space based radar represents a technology that could significantly contribute to Canada's long-stated requirement to provide surveillance of the nation's territory. One of the key strengths of a space based radar system will be the contribution that such a capability can make to one of the tenets of air and space power: Persistence.[8] The ability of a space based radar constellation to provide near-continuous global coverage of ground and maritime moving targets offers the

---

[5] Department of National Defence. *Canadian Forces C4ISR Command Guidance and Campaign Plan – Draft.* (Ottawa: DND, 07 November 2003)

[6] Throughout this paper the term "space based radar" will be used to refer to a satellite-based capability that can provide both radar ground moving-target indication (i.e. detection of vehicle size, and larger, objects with a velocity exceeding a few miles per hour) and radar imagery (i.e. imagery that can be used to detect and identify surface objects with dimensions greater than the resolution of the radar).

[7] Peter B. Teets, "Inaccurate Assertions." Space News, 20 December 2004, 26.

[8] United States. Department of Defence, *AFDD 1 Basic Doctrine* (November 17 2003); available from http://afpubs.hq.af.mil; Internet; accessed January 2005. 31.

prospect of "permanent presence" over virtually any theatre of operation.[9] This attribute will make space based radar an indispensable asset to the CF in conducting its domestic and international missions.

However, there are significant hurdles that must be overcome before Canada can begin to benefit from a space based radar system, including a number of technical challenges. Provided these challenges can be overcome, space based radar promises to become a crucial element of Canada's national security system. In addition to the tremendous surveillance capability that space based radar promises to provide, the pursuit of a space based radar system may have a number of indirect political benefits, including an opportunity for improved coordination between the Department of National Defence and other Canadian government departments, and an opportunity for improved Canada-U.S. relations.

This paper will argue that space based radar should be pursued by the CF, in cooperation with other Canadian government departments, as a crucial component of an overall ISR system that will provide the near-continuous temporal and spatial surveillance of Canadian territory that has long been articulated as a minimum, albeit unfulfilled, security requirement. The paper will begin with a brief history of space based radar as a concept, and discuss the capabilities of a nominal space based radar system. This will be followed by a review of Canada's long-standing surveillance requirements, and an analysis of how space based radar can contribute to fulfill these requirements.

---

[9] Ibid., 31.

The final portion of the paper will discuss the political aspects that may arise if Canada pursues a space based radar capability, including a number of potential political benefits and challenges.

Space Based Radar: Background and Capabilities

Space based radar has existed as a concept for decades. From the beginning of the space age, the value of using space as a vantage point for observing activity on the earth's surface has been well recognized. Although the earliest earth observation capabilities to be applied to spacecraft were optical sensors on spy satellites, the potential to place radar in space was not ruled out. As early as 1961 there was a plan approved by government of the U.S.S.R that envisioned military spacecraft that could watch NATO ships in the ocean using radar-equipped spacecraft.[10] In 1965 the U.S.S.R launched the first in a series of nuclear-powered radar satellites that continued to be used until the late 1990s. The Cosmos 954 satellite that reentered into northern Canada was one of this series of satellites.[11]

Since the early 1960s the U.S. Navy also conducted a number of studies that looked at radar satellites for ocean surveillance applications, similar to efforts by the U.S.S.R. However, U.S. Navy efforts to field such a capability were hampered by a belief that radar satellites that could only detect surface targets, but not identify them,

---

[10] Anatoly Zak, "Radar Satellites Began With the Space Age," *Space News* (14 Feb 2000) [journal on-line]; available from http://www.space.com/news/spacehistory/srtm_russia.html; Internet; accessed 12 March 2002.

[11] Ibid.

were of little practical use. Despite numerous projects and studies that considered the concept of radar surveillance from space, these efforts ended after nearly three decades with the cancellation of the Navy's Space Based Wide Area Surveillance (SBWAS) program, in 1990.[12]

There is also considerable evidence and conjecture that U.S. intelligence organizations, in particular the National Reconnaissance Office, have fielded radar surveillance satellite systems, including one known as "Lacrosse", but like the U.S.S.R radar satellites mentioned above, these systems are believed to be able to detect stationary targets only, and do not have the moving-target capability envisioned for the space based radar capability that is the subject of this paper.[13]

In addition to the early radar satellite efforts mentioned above, there have been a number of more recent efforts that have put a radar capability in orbit, including Canada's Radarsat 1 which went into operations in 1995 and is scheduled to be replaced by a more capable Radarsat 2 satellite in late 2005.[14] However, none of the radar

---

[12] Gary Federici, "From the Sea to the Stars: A History of U.S. Navy Space and Space-Related Activities Department of the Navy " *Naval Historical Center* (June 1997) [journal on-line]; available from http://www.history.navy.mil/books/space/ ; Internet; accessed 7 March 2005.

[13] David A. Fulghum, "Space-Based Radar Still Key to Future," *Aviation Week and Space Technology Vol. 157 Issue 4* (22 July 2002): 181.

[14] Canadian Space Agency, *Radarsat: Observing the Planet from Space* (St Hubert: CSA Communication Directorate, 2000), 1.

satellites that have gone into operation to date have had the ground moving-target capability that is envisioned for the space based radar concept.

The CF and other Canadian government departments that contribute to the surveillance of Canada are faced with the combined challenges of limited resources and the need to cover Canada's vast and sparsely populated territory. The value of a system that provides a "force multiplying" effect by enabling more focused and efficient surveillance using these limited resources (to include a limited number of patrol aircraft, naval vessels, and surface patrols) is evident. The U.S. Department of Defense (DoD) definition of a "force multiplier" is "a capability that, when added to and employed by a combat force, significantly increases the combat potential of that force and thus enhances the probability of successful mission accomplishment."[15] Given this definition, providing a space based radar capability to the Canadian Forces would have a true force multiplying effect. The potential to provide surveillance data and imagery that can be used to cue other ISR assets like patrol aircraft, naval vessels, and future long endurance UAVs, will allow these valuable (and limited) assets to be employed much more efficiently by providing focused mission tasking, rather than requiring random surveillance missions. The operational and financial burden of conducting surveillance

[15] United States, Department of Defense, "Dictionary of Military Terms", as amended 30 Nov 2004; available from http://www.dtic.mil/doctrine/jel/doddict/data/f/02154.html; Internet; accessed 30 November 2004.

of Canada's maritime environment alone, to include a coastline of 243,772 km and an area of responsibility of over 11 million square kilometres,[16] makes this mission practically unachievable without the benefit of wide area surveillance that a space based radar system could provide.

The capabilities of a space based radar system will depend heavily on a number of key variables concerning the design and composition of the system. One of these variables is the number of satellites in a space based radar constellation. If one takes the case of a single radar satellite, as in the case of Canada's experimental Radarsat 1, the revisit time for an area of the earth's surface is approximately one week.[17] A constellation of three such satellites could provide daily revisits to a particular area.[18] In the case of a more robust global surveillance space radar system using 12 satellites, the revisit time drops significantly, with gaps in coverage of about 5 minutes on average, while a 24-satellite constellation would have coverage gaps averaging one to two minutes. It is significant that with coverage gaps on the order of one to two minutes or less, it is possible to differentiate and correlate tracks to individual movers.[19] In other words, tracking the movement of individual targets will be possible, provided the target's

---

[16] Peter Avis," Surveillance and Canadian Maritime Domestic Security", *Canadian Maritime Journal* [journal on-line]; available from http://www.navy.forces.gc.ca/mspa_news/news_issues_e.asp?category=4&title=14#bilateral ; Internet; accessed 15 February 2005.

[17] Canadian Space Agency, *Radarsat: Observing the Planet from Space* (St Hubert: CSA Communication Directorate, 2000), 4.

[18] Jason Bates, "Next Generation Radarsat System Could be Satellite Trio", *Space News*, 11 October 2004.

[19] David A. Fulghum, Space-Based Radar Still Key to Future", *Aviation Week and Space Technology* Vol. 157 Issue 4 (22 July 2002): 181.

dimensions are greater than the minimum resolution of the radar.[20] In order to provide truly continuous coverage on a global scale, with no temporal or spatial gaps, it is estimated that a 108-satellite constellation would be required. Given that the U.S. DoD estimated in 2002 that the price per space based radar satellite would be $100 million, excluding launch costs, the prospects for fielding such a large constellation seems remote.[21] Instead, it is envisioned that a smaller constellation, probably in the range of 24 satellites, will be fielded, and will be used in conjunction with other ISR assets, like unmanned aerial vehicles (UAV) and other airborne and ground-based ISR assets, to provide full coverage in particular areas of interest.[22]

Another key variable, and one of the important decisions that must be made regarding a space based radar system design is the altitude that the satellites will orbit the Earth. In general, the higher the altitude of a satellite, the larger the field of view the satellite will have of the Earth's surface. Therefore, a satellite constellation operating in Medium Earth Orbit (MEO) will require fewer satellites to provide global coverage than one operating in Low Earth Orbit (LEO).[23] However, by virtue of being farther from their targets, the higher the satellite, the greater the power it will require, and the larger the antennae needed in order to transmit and receive sufficient radar energy at the

---

[20] For example, if the resolution of a space based radar system is 1 meter, then a target with a dimension (length or width) of 1 meter or greater will be detected by the radar.

[21] David A. Fulghum, Space-Based Radar Still Key to Future", *Aviation Week and Space Technology* Vol. 157 Issue 4 (22 July 2002): 181.

[22] Peter B. Teets, "Inaccurate Assertions." Space News, 20 December 2004, 26.

[23] MEO satellites orbit the earth between 1,000 and 22,300 miles above the earth's surface, while LEO satellites orbit the earth between 400 and 1,000 miles above the earth (found at http://www.webopedia.com/TERM/L/LEO.html ; Internet; accessed 25 April 2005.)

satellite.[24] In the world of satellite design, satellite power and weight is directly proportional to cost, so fewer more powerful satellites are not necessarily more cost effective than a larger constellation of less powerful satellites. This leads to an important trade analysis that must be accomplished by satellite system designers in order to arrive at the optimal combination of capability and cost.

Regardless the final design and composition of an eventual space based radar system, a number of technical challenges will have be overcome. The U.S. Department of Defense has identified a number of risk areas that must be mitigated in order to bring an effective SBR program to fruition. Among the risks identified are the capability to manage the massive amounts of data expected to be produced, satellite on-board processing capability and reliability needed to process radar data before transmitting to ground stations. Other areas of concern include spacecraft technology areas such as power, structural integrity, communications reliability and system survivability.[25]

Canada's Wide Area Surveillance Requirement

Canada's vast geography, extensive coast line, and immense maritime approaches present a significant challenge for those government departments charged with contributing to the surveillance of these areas. Throughout recent history, Canadian

---

[24] Robert Wall, "New Space-Based Radar Shaped by SBIRS Snags", *Aviation Week and Space Technology Vol 156 Issue 7* (18 February 18 2002): 30.

[25] United States, Department of Defense, Director Operational Test and Evaluation: 2003 Annual Report; available from http://www.globalsecurity.org/military/library/budget/fy2003/fy03_DOTE_Annual_Report.pdf; Internet; accessed 12 February 2005.

government policy has acknowledged the need to provide for the surveillance of Canada, while failing to articulate how that surveillance can be accomplished, particularly in light of the limited resources available. The following excerpts from various Canadian government policy documents represent examples of Canadian national policy objectives that could be met, at least in part, by providing Canada with access to space based radar surveillance information.

Canada's 2004 national security policy document "Securing an Open Society" articulates Canada's core national security interests in the post-9/11 environment.[26] This document acknowledges a number of responsibilities that the Canadian government must uphold in order to protect the security interests of the nation. Among these is the responsibility to " . . . defend against threats to Canadian sovereignty, ranging from illegal entry to incursions into our territorial waters".[27] Also acknowledged is the fact that in order to meet Canada's responsibility to contribute to the security of the North American transportation system, Canada needs the ability ". . . to manage the security of our skies, our surface routes and our waters . . ."[28] Consistent with the Canadian National Security policy, recent Strategic Planning guidance for the CF identifies Information and Intelligence as essential capabilities for the military. This guidance includes surveillance and reconnaissance as necessary components of Information and

---

[26] Privy Council Office, *Securing an Open Society: Canada's National Security Policy*, (Ottawa: National Library of Canada, 2004), 5.

[27] Ibid., p.5

[28] Ibid., p.35

Intelligence, and goes on to categorize this capability as a "national level enabler" that is also "a capability needed to support combat operations."[29]

Canadian government policy also identifies sovereignty as a crucial element of the nation-state, and contends "sovereignty means ensuring that, within our area of jurisdiction, Canadian law is respected and enforced."[30] A crucial aspect of establishing and maintaining sovereignty over territory, and ensuring that Canadian law is respected in that territory involves having visibility into activities in that territory. In its most recent International Policy Statement, the Canadian government acknowledges the challenges that the Canadian North poses to Canadian sovereignty and security. This policy statement contends that increased economic activity and commercial traffic in the Arctic region will arise over the next two decades as the result of climate change.[31] In light of these projected trends, the document goes on to identify improving Canada's "maritime, land, air and space surveillance capabilities . . ." and increasing the CF's ability to ". . . monitor and respond to events in the North . . ." as key initiatives of Canadian National Security Policy.[32]

Canada's international policy also recognizes the direct link between the nation's security and economic prosperity. The fact that 80% of Canada's exports go to the U.S.

---

[29] Department of National Defence, *Strategic Capability Planning for the Canadian Forces*, available from http://vcds.mil.ca/dgsp/pubs/rep-pub/dda/strat/; Internet; accessed 8 Feb 05

[30] Department of National Defence. *1994 Defence White Paper*, (Ottawa: Canada Communications Group: Ottawa, 1994), 15.

[31] Department of Foreign Affairs and International Trade, *Canada's International Policy Statement: A Role of Pride and Influence in the World* (Ottawa: 2005), 7.

[32] Ibid.,8.

market[33] means that a major security incident, whether on Canadian or U.S. territory, could have a "potentially devastating"[34] effect on the Canadian economy. This leads to a clear requirement for Canada to ensure it is doing what it can to ensure it is contributing to continental security. Even if Canada manages to avoid any terrorist or other security incidents on its territory, initiatives to improve security will pay dividends. Any effort that Canada makes to demonstrate its resolve to improve national security, and thereby improve North American security, will help to ensure our trade relationship with the U.S. is not jeopardized by the perception that Canada is not doing enough. Participation in space based radar is one such effort.

Space based radar represents a system that for the first time promises to address the requirement for national surveillance that has long been articulated in Canadian government policy. Furthermore, by pursing space based radar, either independently or in cooperation with the U.S., the Canadian government will be taking practical steps toward addressing a broad range of stated policy goals including maintaining sovereignty over Canadian territory, ensuring the economic security of Canada, and improving our relationship with the U.S. by demonstrating clear resolve to improve Canadian national security.[35] If the Canadian government is serious about accomplishing these policy goals, then space based radar should be seriously considered as a potential contributor to their attainment.

---

[33] Ibid.,9.

[34] Ibid.,7.

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

Political Aspects of Space Based Radar.

The surveillance capability that space based radar could provide to Canada would be a quantum leap toward finally achieving the goal of conducting effective surveillance of all Canadian territory. In addition to the direct security benefits that space based radar could provide to Canada, there are a number of less direct political benefits that could be realized by pursuing this capability. By becoming a proponent for space based radar, there is a strong potential for DND to both improve cooperation with other government departments, and to benefit from improved political support from these same departments. From a national perspective, Canadian support for space based radar could be used as a foreign policy tool to improve our relationship with the U.S.

The 1994 White paper notes that responsibility for many of the Government's activities aimed at surveillance of Canadian territory and maritime areas lies not only with DND, but also with other government departments, among them the Department of Transport (Transport Canada). [36] While Transport Canada has a vested interest in surveillance of Canada, many other Canadian government departments are also potential customers for the information that could be provided from a space radar constellation. For example, the Department of Fisheries and Oceans has increased on-water patrols and aerial surveillance activities in order to be better positioned to interdict and board ships

---

[36] Department of National Defence. *1994 Defence White Paper*, (Ottawa: Canada Communications Group: Ottawa, 1994),15.

that may threaten Canada,[37] or carry illegal immigrants. However, this increased surveillance is done with limited air and maritime resources. The information provided by a space based radar constellation would significantly increase the effectiveness of both on-water and aerial patrols by providing timely ship position information that would allow surveillance missions to be directed at specific targets, rather than being conducted on a target-of-opportunity basis.

In addition to the departments mentioned above, a June 2000 report published by the Directorate General Strategic Plans titled "Arctic Capabilities Study" provides an indication of other Canadian government departments that are potential customers for space based radar data. The report arose from a study conducted to determine the challenges facing the CF and other government departments concerning surveillance and awareness in Canada's Arctic regions. Based on this study, it is clear that all of the following departments could be beneficiaries of space based radar data: Environment Canada (EC), Royal Canadian Mounted Police (RCMP), Canadian Coast Guard (CCG), Citizenship and Immigration (CIC), Canadian Security and Intelligence Service (CSIS), Canada Customs and Revenue Agency (CCRA), Indian Affairs and Northern Development (DIAND), and Foreign Affairs and International Trade (DFAIT).[38]

---

[37] Ibid. p.39

[38] Department of National Defence, *Arctic Capabilities Study* 1948-3-CC4C (DGSP). Ottawa: DND Canada, 2000), 14.

The fact that the Department of National Defence is not the only Canadian government department that would benefit from access to space based radar data provides DND with an opportunity to pursue a solution to its long-standing surveillance gap, while at the same time demonstrating a clear intention to improve inter-departmental cooperation, consistent with Canadian government policy.[39] By taking the lead on efforts to pursue space based radar, either through fielding a Canadian system or by access to data from another nation(s), the Canadian Forces could significantly improve its capability to execute its surveillance and reconnaissance missions,[40] while also making a clear effort to work more closely with other government departments that share in the surveillance mission. While the inclusion of other departments in the process will entail more complex, and potentially conflicting, system requirements the prospect of broader government support that could come with involving multiple government departments in the space based radar process could prove to be a significant benefit to the CF.

In addition to the domestic political benefits that the CF could realize by pursuing space based radar, Canada would also stand to enjoy international political benefits. Although space based radar represents a potential solution to Canada's wide area and persistent surveillance needs, the cost of implementing and maintaining a space based radar constellation capable of global target tracking, or even limited to tracking in Canadian territory, would likely make it impractical for Canada to take on such a

---

[39] Government of Canada, "Securing an Open Society: Canada's National Security Policy", Privy Council Office: National Library of Canada (2004).

[40] Government of Canada, "Strategic Capability Planning for the Canadian Forces", http://vcds.mil.ca/dgsp/pubs/rep-pub/dda/strat/; accessed 8 Feb 05

program alone. It will therefore be essential that Canada gain access to space based radar data through cooperative agreements with other nations, and most likely with the United States as the lead. At the moment, the United States is the only country that is actively pursuing the development of a global-coverage space based radar system. Arguably, the U.S. is also the only nation with sufficient resources to field and maintain such a constellation on its own, and the former Undersecretary of the U.S. Air Force, Peter B. Teets is convinced that the U.S. could field "an affordable Space Radar capability in the next decade."[41] The U.S. Air Force is pursuing a concept, referred to as Space Radar,[42] that calls for a constellation of satellites that will have global coverage and provide three products to users: synthetic aperture radar (SAR) imagery, ground moving-target indication, and high resolution terrain information.[43] Notwithstanding the fact that cooperation with the U.S. may be Canada's only realistic prospect to gain access to the space based radar surveillance data it needs, cooperation with the U.S. in this effort could also provide important political benefits for the Canadian government. Fortunately, there are a number of motives that could drive the Canadian government to seek to join the U.S. in fielding Space Radar, and yet other motives that could prompt the United States to agree to cooperation with Canada on a Space Radar constellation.

---

[41] Peter B. Teets, "Inaccurate Assertions." Space News, 20 December 2004, 26.

[42] Jeremy Singer, "U.S. Air Force Seeks to Double Funding for T-Sat, Space Radar," Space News (February 2004); available from http://www.space.com/spacenews/archive04/tsatarch_020904.html; Internet; accessed 27 April 2005.

[43] Global Security.org. "Space Based Radar"; available from http://www.globalsecurity.org/space/systems/sbr.htm; Internet; accessed 27 April 2005.

The need to demonstrate Canadian resolve to improve Canadian and North American security has been increased by the recent decision by the Martin Government to remain out of the U.S. Ballistic Missile Defense (BMD) system. This decision has lead to widespread speculation that increased tension will be placed on the U.S. Canada relationship.[44] Regardless what political imperatives forced the Martin government to decline participation in BMD, it seems clear that the impact will be to further erode Canada's reputation for pulling its weight on North American security. A move by the Canadian government to join the U.S. in fielding Space Radar, coupled with both financial and technical support, could go a long way to putting the BMD issue behind us, and provide a means for the Martin government to improve its relationship with the U.S. administration. This would be accomplished by participating in a program that would be much more palatable than BMD to both the political opposition, and the Canadian public, since the system will have no offensive or "weaponization" component. Political commentators have speculated that cooperation in others areas of defence and security, most notably in the area of maritime security, may prove to be more important to future Canada-U.S. defence and security relations than participation in BMD.[45] Canadian support for U.S. Space Radar would provide one avenue for such cooperation.

While the Canadian political and financial support for a Space Radar effort could prove to be welcomed by the U.S. government, it is unlikely that either of these forms of support would prove to be decisive in determining whether Canada will be invited to

---

[44] "Missile Spat Chills Canada U.S. Relations"; available from http://www.abc.net.au/news/newsitems/200503/s1314159.htm; Internet; accessed 12 April 2005.

[45] Joel Sokolsky, "Warning: The coast is clear" *Globe and Mail*, 10 March 10 2005. A23

participate, or not. However, there is reason to believe that Canadian technical contributions to a Space Radar effort could prove very valuable to the U.S.. With the launch of Radarsat 1 in 1995, Canada became a world-leader in space radar technology,[46] and there are plans to place a ground moving-target indicator (GMTI) sensor in space for the first time, on the Radarsat 2 satellite scheduled to go into orbit in late 2005. [47] This GMTI demonstrator will further push Canada's technological lead in this area, and will provide invaluable technical data that could be used by the U.S. in the development of Space Radar satellites.[48]

There are a number of indications within U.S. government policy to indicate that Canada may have success in joining U.S. Space Radar efforts. From the U.S. government perspective, participation by Canada in SBR would be consistent with many aspects of recent U.S. policy initiatives in the area of security cooperation and partnerships. A number of U.S. policy directives encourage cooperation with allies in space related activities for the "achievement of foreign policy… or national security benefits for the nation"[49] and recognize the opportunity to "enhance U.S. industrial competitiveness and security through foreign access to remote sensing data and

---

[46] Canadian Space Agency, *Radarsat: Observing the Planet from Space* (St Hubert: CSA Communication Directorate, 2000), 1.

[47] Shen Chiu, "A Constant False Alarm Rate (CFAR) Detector for Radarsat 2 Along-Track Interferometry," *Canadian Journal of Remote Sensing;* available from http://pubs.nrc-cnrc.gc.ca/cjrs/m04-057.html; Internet; accessed 15 April 2005.

[48] Dennis Margueratt and Dr. Allan English ed., "Historical Background of Canada in Space" *Space in the 21st Century: Air Symposium 2000,* Winnipeg: CFTPMC, 2000. 51.

[49] United States. National Science and Technology Council. *National Space Policy: Fact Sheet;* available from http://www.fas.org/spp/military/docops/national/nstc-8.htm; Internet; accessed 2 January 2005.

technology."[50] Meanwhile, U.S. Department of Defense Space Policy specifically calls for the pursuit of "international cooperation and partnership in space activities . . . with the United States' allies . . ." that is based "on the principles of reciprocity and tangible, mutual benefit . . ." [51] More directly concerning security and defense issues, the U.S. Department of Defense 2001 Quadrennial Review states that the U.S. defense strategy "is premised on efforts to strengthen America's alliances and partnerships and to develop new forms of security cooperation."[52] There has also been speculation that, unlike the case of BMD where the U.S. may have "desired" Canadian participation, the U.S. is "counting on" Canadian cooperation to assure maritime security.[53] To the extent that Space Radar would provide invaluable data necessary to provide surveillance of Canadian maritime approaches, it may prove highly beneficial for the U.S. to ensure Canadian access to the Space Radar program in order to fully contribute to maritime security. Meanwhile, there are indications from high level within the DoD that cooperation with allies on space systems is an important goal. This includes a recent statement by Major General Robert Kehler, director of the National Security Space

---

[50] United States. White House Office of the Press Secretary. *Foreign Access to Remote Sensing Space Capabilities: Fact Sheet*; available from http://www.fas.org/irp/offdocs/pdd23-2.htm; Internet; accessed 25 January 2005.

[51] United States. Department of Defense. *DoD Directive 3100.10 Space Policy* (July 1999); available from http://www.au.af.mil/au/awc/awcgate/dod-spc/dodspcpolicy99.pdf; Internet; accessed 28 April 2005.

[52] United States, Department of Defense *Quadrennial Defense Review Report*"(Washington, D.C.: U.S. Government Printing Office, September 30, 2001), 14.

[53] Joel Sokolsy, "Warning: The coast is Clear," *Globe and Mail.* 10 March 2005, A23.

Office of the Undersecretary of the Air Force that "nothing is off the table, at our level anyway" when it comes to cooperation with allied forces.[54]

Although there are clear policy motives that would drive the U.S. government to agree to Canadian involvement in SBR, there are nonetheless issues that could stand in the way of Canadian involvement. The issue with the strongest potential to stand in the way of Canadian involvement concerns the sensitivity of the data provided by a Space Radar system, and the resistance that might be made by some U.S. government agencies, like the National Reconnaissance Office (NRO) that are potential customers for Space Radar data. Recent announcements from within DoD reinforce the intent to make the U.S. Space Radar program a collaborative effort with stakeholders from the Department of Defense and intelligence communities.[55] This effort could complicate efforts to share Space Radar data with allies, including Canada.

Conclusion

Canadian government policy documents, past and present, consistently indicate that in order to provide national security and oversee Canadian territorial sovereignty, a capability to provide national surveillance is essential. Despite this common refrain, little has been done to provide Canadian government departments, including the Department of

---

[54] Peter B. deSelding, "Trans-Atlantic Military Space Cooperation Faces Hurdles", Space *News.* 18 October 2004, 18.

[55] Secretary of the Air Force Public Affairs, "New Program Office established in Washington D.C. area", available from http://www.af.mil/mediacenter/pressrelease_print.asp?prID=123009701; Internet; accessed 28 Jan 2005.

National Defence, with the means to practically provide surveillance of Canada, except on a sporadic basis. In large part this has resulted from the fact that, until recently, the technology necessary to provide a practical and economical means of conducting surveillance over Canada's vast territory did not exist. However, in recent years there has been significant technological development that has lead to progress in the development of space based radar technologies. A solution to Canada's long stated surveillance requirement is at hand.

Access to data from a space based radar system would go a long way toward fulfilling Canada's surveillance requirements, and providing a capstone system within a complementary mix of intelligence, surveillance and reconnaissance assets. The potential for satellites to provide persistent surveillance of Canadian territory and maritime approaches provides a unique opportunity for Canada to gain visibility into activities throughout its areas of concern, for the first time. Further, by providing this valuable information, Canada will stand to benefit from increased efficiency when employing complementary ISR assets like patrol aircraft and naval vessels. Access to space based radar data that can be used to provide cueing information to limited manned and unmanned aerial and surface assets will greatly improve Canada's ability to achieve its national security goals.

In addition to the direct national security benefits that would be realized by gaining access to this data, both the Canadian Forces and the Canadian government stand to realize indirect political benefits by pursing and supporting space based radar efforts.

By championing efforts toward space based radar, the CF can fulfill its obligation to work more closely with other Canadian government departments by pursing a capability that will provide benefits to multiple government departments. This effort has the further potential to translate into increased goodwill from these other departments that could result in improved political support for the CF in general. For the Canadian government, a genuine effort to work with the U.S. on their Space Radar program would produce political dividends in the form of better political relations with the U.S. government. By supporting Space Radar, a system that the U.S. judges to be key to their national security interests, Canada would provide a clear signal that it is serious about North American defence.

Bibliography

Avis, Peter. " Surveillance and Canadian Maritime Domestic Security", *Canadian Maritime Journal*. Journal on-line; available from http://www.navy.forces.gc.ca/mspa_news/news_issues_e.asp?category=4&title=14#bilateral; Internet; accessed 15 February 2005.

Bates, Jason. "Next Generation Radarsat System Could be Satellite Trio", Space News, October 2004.

Burney, Derek H. "Foreign Policy – More Coherence, Less Pretense", Simon Reisman Lecture in International Trade Policy, (14 March 2005) p.1-25

Chiu, Shen "A Constant False Alarm Rate (CFAR) Detector for Radarsat 2 Along-Track Interferometry," *Canadian Journal of Remote Sensing;* available from http://pubs.nrc-cnrc.gc.ca/cjrs/m04-057.html; Internet; accessed 15 April 2005.

deSelding, Peter B. "Trans-Atlantic Military Space Cooperation Faces Hurdles", Space News, 18 October 2004 p.18

Federici, Gary. From the Sea to the Stars:A History of U.S. Navy Space and Space-Related Activities Department of the Navy – Naval Historical Center (June 1997) http://www.history.navy.mil/books/space/

Fulghum, David A. Space-Based Radar Still Key to Future", Aviation Week and Space Technology Vol. 157 Issue 4 p.181 22 July 2002.

Margueratt, Dennis and Dr. Allan English ed., "Historical Background of Canada in Space" *Space in the 21st Century: Air Symposium 2000,* Winnipeg: CFTPMC, 2000.

Sokolsky, Joel. "Warning: The coast is clear" *Globe and Mail*, March 10 2005.

Teets, Peter B. "Inaccurate Assertions." *Space News*, 20 December 2004.

Wall, Robert. "New Space-Based Radar Shaped by SBIRS Snags", *Aviation Week and Space Technology Vol 156 Issue 7* (18 February 2002): 30.

Zak, Anatoly, Radar Satellites Began With the Space Age, 14 Feb 2000 http://www.space.com/news/spacehistory/srtm_russia.html

Global Security.org. "Space Based Radar." http://www.globalsecurity.org/space/systems/sbr.htm; Internet; accessed 27 April 2005.

"Missile Spat Chills Canada U.S. Relations"; available from http://www.abc.net.au/news/newsitems/200503/s1314159.htm; Internet; accessed 12 April 2005.

Canada. Canadian Space Agency. *Radarsat: Observing the Planet from Space.* St Hubert: CSA Communication Directorate, 2000.

Canada. Department of National Defence. *Arctic Capabilities Study 1948-3-CC4C (DGSP)* Ottawa: June 2000.

Canada. Privy Council Office. *Securing an Open Society: Canada's National Security Policy.* Ottawa: National Library of Canada, 2004.

Canada. Department of Foreign Affairs and International Trade. *Canada's International Policy Statement: A Role of Pride and Influence in the World.* Ottawa, 2005

Canada. Department of National Defence. *White Paper on Defence*. Ottawa: Queen's Printer and Controller of Stationary, 1964.

Canada. Department of National Defence. *Canadian Forces C4ISR Command Guidance and Campaign Plan – Draft.* Ottawa: DND, 07 November 2003.

Canada. Department of National Defence. *Intelligence, Surveillance, Target Acquisition and Reconnaissance (ISTAR). B-GL-352-001/FP-001 (Draft)*, Ottawa: DND, 2003

Canada. Department of National Defence. *Strategic Capability Planning for the Canadian Forces*, http://vcds.mil.ca/dgsp/pubs/rep-pub/dda/strat/ accessed 8 Feb 05.

Canada. Department of National Defence, *Defence in the 1970s: White Paper on Defence*. Ottawa: Information Canada, 1971.

Canada. Department of National Defence, *1994 Defence White Paper.* Ottawa: Canada Communications Group, 1994.

United States. Department of Defense, *Quadrennial Defense Review Report.* Washington D.C.:U.S. Government Printing Office, September 30, 2001.

United States. Department of Defense, *DoD Directive: Space Policy*, *Number 3100.10.* Washington D.C.: U.S. Government Printing Office, July 1999.

United States. National Science and Technology Council. *National Space Policy: Fact Sheet;* available from http://www.fas.org/spp/military/docops/national/nstc-8.htm; Internet; accessed 2 January 2005.

United States. White House Office of the Press Secretary. *Foreign Access to Remote Sensing Space Capabilities: Fact Sheet*; available from http://www.fas.org/irp/offdocs/pdd23-2.htm; Internet; accessed 25 January 2005.

United States. Department of Defense. *DoD Directive 3100.10 Space Policy* (July 1999); available from http://www.au.af.mil/au/awc/awcgate/dod-spc/dodspcpolicy99.pdf; Internet; accessed 28 April 2005.

United States. Department of Defense, *Dictionary of Military Terms*, available from http://www.dtic.mil/doctrine/jel/doddict/data/f/02154.html; Internet; accessed 30 Nov 2004.

United States. Secretary of the Air Force Public Affairs, *New Program Office established in Washington D.C. area*; http://www.af.mil/mediacenter/pressrelease_print.asp?prID=123009701; Internet; accessed 28 Jan 2005.

United States, Department of Defense, *Director Operational Test and Evaluation: 2003 Annual Report;* available from http://www.globalsecurity.org/military/library/budget/fy2003/fy03_DOTE_Annual_Report.pdf; Internet; accessed 12 February 2005.