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SEPARATING "SPACE" FROM AEROSPACE: A CASE FOR CANADIAN FORCES SPACE DOCTRINE

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AIM

1. Despite the modern way of warfare's critical dependency on space-based capabilities, Canadian Forces (CF) Aerospace doctrine makes virtually no mention of space effects, operations, or basic principles. This runs counter to the very nature of doctrine. The aim of this paper is to highlight this issue and to advocate for the CF to develop robust space operations doctrine.

INTRODUCTION

2. Space-based capabilities have significantly altered military operations over the last forty years. Today's technology-driven, asymmetrical way of warfare is virtually impossible without the integration and application of space-based capabilities. Canada, with a relatively small, yet technically advanced, and highly-capable military benefits greatly from such asymmetrical advantages. In truth, Canada has participated in military space operations for decades, operates military satellites, regularly consumes satellite ISR products, employs space-enabled weaponry, uses Global Positioning System (GPS) data, and has an operational military space operations center. Despite this, CF Aerospace doctrine contains almost no focused discussion on space operations or the employment of space capabilities. In effect, it is mistitled "airpower" doctrine. Space is an inherently distinct environment and should be doctrinally recognized accordingly. Space is also inherently joint because of its global nature and the strategic effects it provides for all environmental services and operating environments, across the spectrum of military operations. This calls for CF space doctrine to exist outside the "aerospace" umbrella.

3. This paper will advocate for the CF to develop robust, organic, distinct space operations doctrine because of unique space attributes, current CF military space capabilities and reliance, and increasing CF space development and integration. United States (US) and United Kingdom (UK) space doctrine significantly inform this paper, which will first address the nature of space doctrine and the absence of space in CF doctrine. Next, the paper will justify the need for CF space doctrine based on current and future CF space operations. Lastly, the paper will make some recommendations for CF space doctrine development. Of note, this paper contains no judgements as to the *quality* of CF doctrine, but purely focuses on the topic of distinct CF space doctrine.

DISCUSSION

Recognition of Space as a Significant and Distinct Force Multiplier

4. Space-based capabilities such as environmental monitoring; communications; precision navigation and timing (PNT); missile warning; and intelligence, surveillance, and reconnaissance (ISR) have fundamentally altered the way modern militaries conduct warfare. US Joint Publication (JP) 3-14, *Space Operations*, emphasizes the impact that space capabilities have as "significant force multipliers when integrated into military operations."[1] To facilitate effective integration, it contends, "joint force commanders and their staffs should have a common and clear understanding of how space forces contribute to joint operations and how military space operations should be integrated with other military operations."[2] Similarly, US Army doctrine highlights the criticality of integrating space into intelligence preparation of the battlespace (IPB): "to provide the G2 [intelligence staff] with a highly detailed analysis of the space medium

[1] Joint Chiefs of Staff (JCS), *Space Operations*, JP 3-14 (Washington, D.C.: Joint Chiefs of Staff, 29 May 2013), I-1.

[2] Ibid.

and its capabilities and effects within the battlespace."[3] The United Kingdom's (UK) joint *UK Air and Space Doctrine* document urges "a greater focus on space power, prompted by [their] growing dependence on space services, to enable military operations and for [their] wider national security."[4] It later states, "About 90% of the UK's military capabilities *depend on space* [emphasis added]."[5] This statement can be applied to virtually any modern, technologically advanced military, the CF included.

5. Space is different than air, land, and sea operating environments. Its physical nature; orbital mechanics; absent geographical boundaries; environmental considerations like space weather, solar effects, and orbital debris; and electromagnetic spectrum dependency significantly alter space system design, control, and employment.[6] Space's uniqueness provides strategic attributes like *global perspective, global access, global presence*, and *strategic depth*, which create additional strengths such as *versatility, ubiquity,* and *persistence*.[7] These characteristics necessitate distinct space doctrine, accounting for such considerations, and advocating distinct military space mission areas. US space mission areas include: *space force enhancement, space support, space control, space force application,* and *space situational awareness.*[8] Space power enables joint functions of *objective, offensive, mass, economy of force,* and *unity of command*, to name a few, but do so differently than air, land, or sea power.[9]

Current CF Doctrine Fails to Adequately Address Space

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[3] United States Army, *Space Support to Army Operations*, FM 3-14 (Washington, D.C.: Headquarters US Army, 18 May 2005), A-3

[4] Ministry of Defence (MoD), *UK Air and Space Doctrine*, JDP 0-30 (Shrivenham, Wiltshire: Development, Concepts and Doctrine Centre, July 2013), vi.

[5] Ibid, 5-1.

[6] JCS, I-8 – I-9.

[7] MoD, 5-7 – 5-8.

[8] USAF, *AU-18 Space Primer*, 63-64.

[9] JCS, I-3 – I-6.

6. Despite inherent differences between space and other environments, CF Aerospace doctrine places very little emphasis on space systems or effects. One could likely replace the word "aerospace" with "airpower" or "aircraft" without noticeably changing their meaning. For example, *CF Aerospace Command Doctrine* lists twelve "Aerospace Operations", nine "Operations Support" activities, and eight "Mission Support" activities. Some, such as *electronic warfare*, *meteorology*, *intelligence*, and *communication and information systems* (CIS) should have clear space operations implications, but only one of the 29 activities, *offensive and defensive space*, has a distinct space reference.[10] It then defines detailed roles, responsibilities, and organizational relationships for the Royal Canadian Air Force (RCAF), but does not once mention the space mission area, even when discussing the North American Aerospace Defense Command (NORAD), or operating in a coalition environment.[11]

7. *CF Aerospace Sense Doctrine* should address space more prominently than other doctrine documents, due to the vital role of satellites in the sense function. The following is the *entirety* of its space discussion, however, found near the end of the document:

> Space-based systems. Satellites typically can carry limited payloads comprising either multispectral, electro-optical/infrared (EO/IR), radar, and/or ELINT sensors. Their strength is their wide coverage and ability for unimpeded over flight of denied territory. Their weaknesses include potentially discontinuous coverage, sensitivity to surface weather (for EO/

[10] Department of National Defence, B-GA-401-000/FP-001, *Canadian Forces Aerospace Command Doctrine* (Ottawa: DND Canada, March 2012), 14-16.

[11] Ibid, 18-37.

IR systems), and difficulty in detecting irregular forces.[12]

This rudimentary paragraph leads the reader to expect further discussion on space-based ISR platforms. Unfortunately, there is none, despite Canadian assets like RADARSAT, or the fact that many US and commercial intelligence products used by the CF come from satellites. *Aerospace Shield* doctrine makes no mention of space, and its description of how shield mitigates the vulnerabilities inherent in aerospace characteristics is exclusively focused on aircraft and airbases.[13] *Aerospace Electronic Warfare* makes a passing reference to space systems, but provides no amplification.[14] The reality that there is only one paragraph dedicated to space systems in the *Aerospace*, *Command*, *Sense*, *Shape, Move, Shield, Sustain,* and *Electronic Warfare* doctrines is striking. Ultimately, little emphasis is placed on space in CF "aerospace" doctrine. Current doctrine, though robust and of significant value for airpower applications, pays little attention so the "space" component of "aerospace".

Space and Airpower Doctrine Should Be Separate and Distinct

8. The CF must develop space doctrine, separated from airpower for the same reasons that airpower doctrine is distinct from sea and land doctrine. CF Aerospace Doctrine blends the air and space environments into "Aerospace", which it defines as "the environment that surrounds the Earth and extends through the air into space from the Earth's surface."[15] A flaw in combining air and space into one term is revealed in the next sentence: "This environment is *unique* and demands a *distinct and considered approach* to operations within it [emphasis added]." Space is

[12] Department of National Defence, B-GA-402-000/FP-001, *Canadian Forces Aerospace Sense Doctrine* (Ottawa: DND Canada, August 2012), 45.

[13] Department of National Defence, B-GA-405-000/FP-001, *Canadian Forces Aerospace Shield Doctrine* (Ottawa: DND Canada, February 2012), 13-15.

[14] Department of National Defence, B-GA-403-002/FP-001, *Canadian Forces Electronic Warfare Doctrine* (Ottawa: DND Canada, March 2011), 1-3.

[15] DND, *CF Aerospace Doctrine*, 25.

as distinct an environment from air, as sea is to land, and land is to air. The greatest similarity between air and space is that neither of them is sea or land. As such, space demands a distinct and considered approach to operations, just as air, sea, and land do.

9. Early on, the US military thought in a similar manner as current CF doctrine, but has since ceased using the term "aerospace". The US Air Force (USAF) Air University *Space Primer* proposes that, in the absence of comprehensive space theory, air and sea models could be used as a baseline for developing space doctrine and strategy, but that "the assumption that air and space power are inextricably linked—that the same theories which apply to airpower also apply to space power—is faulty."[16] It criticizes early thinkers considering space forces as, "simply 'high-flying air forces.' For example, USAF space doctrine was first established merely by replacing the word 'air' with the coinage 'aerospace' in the literature."[17] CF doctrine falls into this same trap; it simply assumes that air and space are linked, and that precepts pertaining to one are valid for the other. Furthermore, the doctrine defines "Aerospace Power" as: "that element of military power applied within or from the air and space environments to achieve effects above, on, and below the surface of the Earth," but fails to identify air and space power differences, the unique effects that they offer, and their specific challenges.[18]

Canada's Growing Prominence in Military Space Operations

10. Perhaps the CF does not require distinct space doctrine because it does not possess or employ robust, organic space capabilities? This premise is incorrect and ignores the fact that the CF heavily employs space capabilities, has for a long time, is developing Canadian military

[16] United States Air Force, *AU-18 Space Primer* (Maxwell Air Force Base, AL: Air University Press, September 2009), 31.

[17] Ibid.

[18] Department of National Defence (DND), B-GA-400-000/FP-000, *Canadian Forces Aerospace Doctrine* (Ottawa: DND Canada, December 2010), 18.

space capabilities, and strengthening partnerships with friendly space forces. Canada signed the Combined Space Operations (CSpO) memorandum of understanding between the "Five Eyes" (FVEY) nations in September 2014, an effort to move from cooperation, to collaboration, and ultimately integration of FVEY military space capabilities and operations centers.[19] It would behoove Canada to have space doctrine to inform its participation in such an enterprise. Also, Canada may not have the international reputation of a "leading space nation" like the US, Russia, or China, but within the FVEY and NATO communities, Canada boasts the longest history of military space operations and some of the most robust space capabilities [next to the US]. Andre Dupuis, president of Space Strategies Consulting Ltd., and former Director of Space Requirements, Department of National Defence states that within FVEY, "Canada has perhaps the most robust space operations capability [behind the US]".[20] In fact, the Polar Epsilon project, leveraging RADARSAT data, provides the Royal Canadian Navy (RCN) with unparalleled near-real time ship positions, and "the most accurate and reliable maritime surveillance picture of any country in the world."[21]

11. The CF has been actively growing its space organizations for years. DND appointed a Director General (DG) Space position, a brigadier general, reporting directly to the Vice Chief of the Defence Staff and overseeing space strategy, strategic plans, operations, readiness, requirements, and all Out of Canada (OutCan) space operations (approximately 35 positions in the US).[22] The Canadian Space Operations Centre (CanSpOC), established in 2012, operates 24/7 providing space support to CF operations worldwide. Its 24 personnel provide GPS dilution

[19] Andre Dupuis, "An Overview of Canadian Military Space in 2014 - Part 1," SpaceRef Canada (9 February 2015), http://spaceref.ca/military-space/an-overview-of-canadian-milspace-in-2014---part.html.
[20] Ibid.
[21] Ibid.
[22] Ibid.

of precision predictions, space weather satellite impacts, space situational awareness and collision avoidance support, and real-time downloading and processing of satellite imagery via the Unclassified Remote-sensing Situational Awareness (URSA) system, and more.[23] The CF also deploys two-person Joint Space Support Teams (JSST) to integrate with and "educate brigades in all regions on space capabilities that will benefit their specific operations."[24] This is all done without dedicated CF space doctrine. The future CF space operational concept, adapted from a DG Space Strategic Plans and Readiness presentation, is in figure 1:

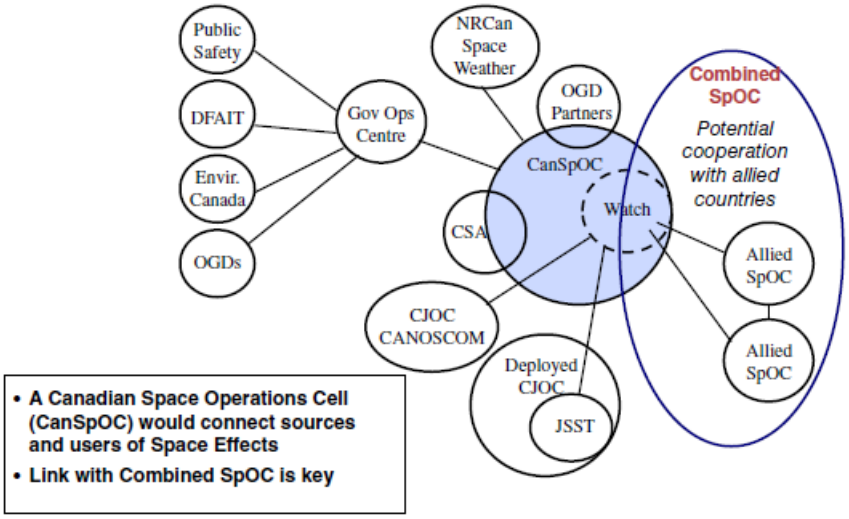

Figure 1 – Canadian Forces Space Operational Concept
Source: Perron, 24.

12. The CF is actively developing, investigating, or contributing to the following satellite capabilities:

a. A follow-on to the Sapphire system, which detects and tracks orbiting space objects as a contributor to the US Space Surveillance Network;

[23] Alycia Coulter, "Supporting Operations Through Space," National Defence And the Canadian Armed Forces (25 March 2014), http://www.forces.gc.ca/en/news/article.page?doc=supporting-operations-through-space/ht6x4r56.
[24] Ibid.

b. The RADARSAT Constellation Mission of three satellites that will aid RCN and civil authorities via highly-accurate maritime and Arctic surveillance;

c. A multi-satellite Arctic communications constellation;

d. Enhanced military satellite communications through the Protected Military Satellite Communications (PMSC) project;

e. The production of a new US Wideband Global SATCOM (WGS) satellite to increase access to secure global communications.[25]

DND also supports the Canadian Space Agency's constellation of polar communications and weather (PCW) satellites, which will "provide continuous communication services and weather observation throughout the Arctic."[26]

13. Doctrine should, ideally, inform procurement, as stated in *CF Aerospace Doctrine*: "Doctrine is also instrumental in establishing priorities for procurement and acts as a critical sounding board for testing and evaluating new concepts and policies."[27] Developing space systems without space doctrine equates to getting a capability without knowing its intended purpose, or how it should be integrated in the larger CF effort. Sound space doctrine would provide a guidepost, as well as justification, for CF members working on space projects at the National Defence Headquarters (NDHQ). An additional danger is the possibility of developing space systems in accordance with *someone else's* doctrine (i.e. the US), or possibly according to their needs, vice capabilities in line with Canada's needs and the Canada First Defence Strategy (CFDS).

[25] Jane's, "Strategic Weapons Systems, Canada," Jane's Sentinel Security Assessment - North America (18 March, 2015), https://www.ihs.com/products/janes-weapons-strategic-systems/canada.html.

[26] Ibid.

[27] DND, *CF Aerospace Doctrine*, 1.

The Right Space Doctrine for Canada

14. The CF should initially develop a single-volume "Canadian Forces Space Operations Doctrine" that baselines off of existing space doctrine from allies like the US and UK, but is informed by documents like the CFDS and existing Canadian space policy. The doctrine should recognize the distinct and unique character of space operations, outline CF "space mission areas", describe command and control of space forces, the role that space plays in the military functions (i.e. command, sense, act, shield, sustain, and generate), and explain how Canadian military space capabilities and personnel should be integrated into joint operations as necessary force multipliers in the future security environment. This document could be very similar to the *Canadian Forces Aerospace Doctrine* document in size, scope, and style, with great effect.

15. As space inevitably becomes further integrated into joint CF operations, the need for greater understanding will only grow. To that end, the CF should develop a primer, much like the *UK Military Space Primer*, or Air University's *AU-18 Space Primer*, that could be disseminated throughout defense forces and civil agencies to increase awareness and understanding of space operations in a Canadian context, and the critical role they play in the modern CF. Topics like the effects of space weather on GPS or communications, space mission areas, organizations like the CanSpOC, and the function of JSSTs, should be addressed. This document would be informative, not authoritative.

CONCLUSION

16. In conclusion, Canada has a long history of conducting military space operations and utilizing military space effects, is currently growing and institutionalizing military space operations in the CF, and is a founding CSpO member nation. Despite this natural evolution of

Canadian space power, CF Aerospace doctrine places virtually no emphasis on the space environment, space-based effects, or the integration of space into CF operations across the spectrum of military operations. This places CF space forces, policy makers, and procurement officials in a doctrinal "no-man's land", without the foundational guideposts that are "essential to the effective functioning and evolution of military forces."[28] The CF should embrace this opportunity to develop focused and robust space operations doctrine; baselined off of space doctrine from the US, UK, and Australia; appropriate for Canadian military aspirations and national values; and with a view to enhancing understanding and integration of space capabilities into joint CF operations.

RECOMMENDATIONS

17. The following recommendations are made to the CF:

    a. Create a distinct, overarching "CF Space Operations" doctrine document;

    b. Create a "CF Military Space Primer" for CF members, similar to the USAF Air University's *AU-18 Space Primer*, or the UK MoD's *UK Military Space Primer* to enhance overall CF member understanding of space operations, effects, and potential for integration in CF operations;

    c. Ensure that these documents are written with a Canadian context, informed by the CFDS, extant CF doctrine documents, and CF space capabilities, but not limited in scope to current capabilities, since doctrine should drive procurement and developing strategies;

    d. Leverage existing US and UK space doctrine to ensure consistency between allies and to avoid "recreating the wheel".

[28] Ibid.

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