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EXERCISE/EXERCICE NEW HORIZONS

DISJOINTED CAPABILITY ACQUISITION PROCESS OF UNINHABITED AERIAL VEHICLES (UAV) IN THE CANADIAN FORCES

By/par Maj J.S.R. Mongeon

ABSTRACT

This paper demonstrate that the CF needs to establish a clear policy and joint structure to better integrate the new UAV capability within the Deputy Chief of the Defence Staff (DCDS) framework. Taking into account lessons learned from our American neighbour, a joint fulfilment of the UAV capability could offer significant improvement, be ultimately more effective, and far more economical than the pursuit of individual UAV capabilities amongst the differing environments. The operations of the CF Sperwer TUAV in Kabul during OP ATHENA 'blew out some cobwebs' resulting in the Army and Air Force re-evaluating their present and future positions with regards to UAVs, doctrinally and all. The establishment of a UAV Campaign Plan and a joint UAV support cell capable of responding to a variety of operational challenges, thus, providing flexibility, enhance and bolster issues of economy, responsiveness, simplicity, cooperation, sustainability and survivability for all CF UAV related matters is urgently required.

> *In Afghanistan, the CF has used tactical unmanned aerial vehicles (UAVs) for the first time in [deployed] operations, for intelligence, surveillance and reconnaissance [ISR]. Despite the inevitable teething problems [technical and implementation shortfalls], our UAVs represent a multi-generational leap beyond anything previously used in the CF for those purpose.*[1]
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> Annual report from the CDS 2003-2004

Many countries have struggled in the past and still struggle today, with the introduction of new capabilities within their "acquisition framework." Presently the Canadian Forces (CF) acquisition of new capabilities, in particular joint equipment capabilities, is disjointed as a result of internal stonewalls between service environments. Historians have documented inter-service rivalries; such as the rivalry over the Unmanned Aerial Vehicles (UAV)[2] acquisition capability that was contemplated by the USA during the 1980 era.[3]

UAV research and development is rapidly progressing and is being used in a multitude of applications today. UAVs are employed for intelligence, surveillance, and reconnaissance (ISR), target acquisition and reconnaissance (ISTAR), and also for target prosecution. UAVs have already proven that they are very beneficial in numerous

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[1] The CF is presently experimenting with various UAVs for different roles, such as for coastal or

military and potential civilian applications. Globally, ongoing UAV activities are proceeding slowly and are technically very demanding. UAVs have been acquired by several armed forces including the CF. In the CF, service stovepipes still remain rampant between the distinct environmental groups. Each Environmental Chief of Staff (ECS) is presently carrying out costly research, development, and acquisition of some sort of UAV capability independently of their counterparts.

The objective of this paper is to demonstrate that the CF needs to establish a clear policy and joint structure to better integrate the UAV capability within the Deputy Chief of the Defence Staff (DCDS) framework. The recent acquisition and performance of the CF Sperwer UAV by the Army in the Afghan operational theatre was deemed to be "a multi-generational leap" in the CF Annual Report. By taking into account lessons learned from our American neighbour and the Sperwer TUAV, this paper will demonstrate that a joint fulfillment of the UAV capability could offer significant improvement, be ultimately more effective, and far more economical than the pursuit of individual UAV capabilities amongst the differing environments.

This paper begins with an introduction to UAVs and their 'raison d'être', and then follows with an analysis of the lessons learned during the introduction of the "UAV capability" in the U.S. military. These American lessons will be supported by a summary of a Canadian presentation made by Mr. Marsters in April 2003. The lessons learned from the Army's acquisition of the CF Sperwer UAV compared to the present CF acquisition process will be analysed and will further provide some insights as to how to integrate rapidly growing UAV capabilities into the CF under the DCDS structure. Suggestions and recommendations for the existing options for working towards a "CF

Joint Acquisition Process" for the various types of UAVs will then be provided.

UAV 'RAISON D'ÊTRE'

This section will introduce UAVs, and provide some historical background information to better frame considerations for joint acquisitions. "*The Revolution in Military Affairs: Implications for Canada and NATO*"[4] (RMA) by Elinor Sloan provides some valuable insight in recognizing and identifying the inherent potential and value UAVs have to enable a co-ordinated and joint approach to intelligence gathering. During WWII General Hap Arnold identified that "the greatest lesson of this war has been the extent to which air, land and sea operations can and must be co-ordinated by joint planning and unified command".[5] A unified approach and interoperability between the services can be achieved only through a coordinated effort and top-down approach at the highest levels of government and management. Sun Tzu wrote: "Know the enemy and know yourself, in a hundred battles you will never be in peril."[6] On today's battlefields, the commander who has the best operational picture of the enemy's position, who can assess the theatre and the enemy facing him has the advantage. Simply stated, one can never have too much reliable intelligence.

Sun Tzu's rationale is that carefully calculated plans can be made only on the basis of reliable intelligence. Furthermore, Antoine–Henri Jomini refers to intelligence

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[4] Elinor C. Sloan, *The Revolution in Military Affairs - Implications for Canada and NATO* (Montreal and Kingston: McGill-Queen's University Press, 2002), 6.

[5] Henry H. Arnold, *Third Report of the Commanding General of the Army Air Forces to the Secretary of War* (Washington: War Department Bureau of Public Relations, 1944), 72.

[6] Sun Tzu, *The Art of War*, trans. Samuel B. Griffith (London: Oxford University Press, 1963), 84.

by "The means of acquiring a good strategic coup-d'oeil."[7] In essence, intelligence is analyzing the enemy. Given that, new UAVs technology has the capability to generate tremendous intelligence and provide the commander with a distinct advantage. Essentially, this is an instrument that can gather that highly desired and advantageous clearer picture of the battlefield. UAVs are now an integral part of the toolbox of all commanders and they enable them to see through classic battlefield situations such as those referred to in Clausewitz' 'Fog of War', 'Friction of War' and 'Chaos' with far more clarity and depth of information.

The U.S. Department of Defense (DoD) selected the UAV Program as a transformational weapon system in order to increase their joint ISR capability, as real world events required a rapid and significant increase in intelligence. Subsequent U.S. military actions, such as Iraq, validated their forward-thinking decision and the need to rapidly field UAVs to augment U.S. ISR capability. To better compare other acquisitions projects of UAVs one must review the U.S. UAV Roadmap.

U.S. UAV ROADMAP

> [The] ability to hide from prying Union eyes [has existed] as long ago as 1862. The addition of airplanes to the lighter than air capability of reconnaissance and spotting was a major factor in denying World War I enemies an offensive potential by peering into rear areas to prevent undetected massing of troops.[8]

The same challenges the CF faces today of coordinating the various services precipitated the requirement for the U.S. to develop the UAV Roadmap back in 2000.

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[7] Baron Antoine Henri de Jomini, *The Art of War* (London: Greenhill Books, 1992), 337.

[8] United States, Office of the Secretary of Defense, *Unmanned Aerial Vehicles Roadmap 2002-2027* (Washington, D.C.: U.S. Government Printing Office, 2003), 116-117.

The Office of the Secretary of Defense released a UAV Roadmap to assist the U.S government in research, development and employment, and to stimulate the planning process for U.S. military UAVs over the next 25 years. The UAV Roadmap provides a defence-wide vision for UAVs and their related technologies. The document is directive in nature and identifies goals for a range of topics that includes: platforms, sensors, communications, technology, small UAVs, interoperability standards, airspace, the intelligence collection process, weapons, and reliability. The UAV Roadmap was produced in order to promote a common vision and encourage a collaborative development, and is widely available to both industry and U.S. Allies.[9] The U.S. UAV programs were inefficient and uncoordinated and sizeable effort and costs were duplicated which forced the development of the UAV Roadmap directive.[10]

Basically, the UAV Roadmap outlines the U.S. Services ongoing efforts, identifies the capabilities required by theatre commanders, and then marries them to emerging technologies and operational concepts. It also provides directives in cross program areas such as standard development, doctrine and other interoperability solutions. The U.S. DoD has in excess of 190 UAVs in the field and expects the

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[9] The UAV Roadmap gives clear direction to the U.S. Services and Departments "… for a logical and systematic migration of mission capabilities to a new class of military tools." Staff Sgt A.J. Bosker, "UAV 'Roadmap' helps Warfighter," *Air Force Print News* (28 March 2003); available from http://www.globalsecurity.org/intell/library/news/2003/intell-030328-afpn01.htm.; Internet; accessed 8 February 2005.

[10] In the UAV Roadmap Dyke Weatherington told members of the House Armed Services Committee on tactical air and land forces that the goal of the UAV Roadmap plan is "[T]o ensure UAV programs proceed in a coordinated and efficient manner in order to move capability into the hands of the war fighter as soon as possible." *Ibid.*

inventory will quadruple by 2010 (2002 figures).[11] The following statement clearly applies to the military forces of today: "In an era of decreasing force structure, UAVs are force multipliers that can increase unit effectiveness."[12] Some of the lessons learned that are relevant to the acquisition of Canadian UAVs includes the fact that prior to the development of the UAV Roadmap the various U.S. departments were all independently expending funds for research, development and employment. They also shared a lack of common vision and lack of desire for collaborative development. The CF currently finds itself in the same predicament that the U.S. was prior to their development of the UAV Roadmap.

CANADIAN VIEW OF UAVs

G.F. Marsters presented "*Ummmm . . . So Where Does the Pilot Sit*?" during the 50th Annual General Meeting of the Canadian Aeronautics and Space Institute in April 2003. This presentation provides a sound introduction, antecedents and descriptions of the current and possible future of UAVs. In particular, the paper discusses the current military classification of UAVs, their potential civil applications, and then further elaborates upon the critical barriers facing widespread use of UAVs. The paper also

[11] The U.S. Air Force Special Forces report that they have presently over 150 UAVs in their own inventory. Furthermore, by the year 2012 the U.S. DoD will potentially be operating UCAVs (F16-size) capable of combat and combat support missions, including Suppression of Enemy Air Defences (SEAD), Electronic Attack (EA), and possibly deep strike interdiction. United States, Office of the Secretary of Defense, *Unmanned Aerial Vehicles Roadmap 2002-2027* (Washington, D.C.: U.S. Government Printing Office, 2003), 150.

[12] For the purpose of this paper, only specific items in the UAV Roadmap have been briefly highlighted, although the document provides a wealth of additional information. Staff Sgt A.J. Bosker, "UAV 'Roadmap' helps Warfighter," *Air Force Print News* (28 March 2003); available from http://www.globalsecurity.org/intell/library/news/2003/intell-030328-afpn01.htm.; Internet; accessed 8 February 2005.

outlines the principle deterrents to early introduction of UAVs into domestic or foreign aerospace.[13] The following paragraphs will provide a snapshot of G.F. Marsters findings.

First, the UAV phenomenon has been of interest to aerial navigation enthusiasts for well over a hundred years. Extraordinary technological advances have taken place during the past two decades due to enabling technologies such as Global Positioning Systems (GPS), miniaturization, massive light weight computing capability, improved command and control links, and enhanced communications.[14]

Second, UAVs should deploy for the so-called "3D-cubed" jobs of dull, dirty and dangerous:

- Dull - long on-station times, measured in days;
- Dirty - crop spraying, chemical and disaster response; and finally
- Dangerous - studying severe storms or military operations that might place a pilot at risk.[15]

Again, the primary requirement today for military usage is improved ISR for filling capability gaps in ISR. The future usage of UAVS will be introduced later in this paper. Mr. Marsters states military classifications of UAVs are as follows:

- HALE (High Altitude, Long Endurance): >45,000 ft, >24 hours;
- MALE (Medium Altitude, Long Endurance): >15,000 ft,>24 hours;
- TUAV (Tactical UAV): <15,000 ft, <24 hours;

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[13] G.F. Marsters, "*Ummmm . . . So Where Does the Pilot Sit*?" The W. Rupert Turnbull Lecture presented at the 50th Annual General Meeting of the Canadian Aeronautics and Space Institute at Montreal on 28 April 2003: 2.

[14] *Ibid*., 9.

[15] *Ibid*., 4.

- Mini: <15,000 ft, Above ground level (AGL), 10 Km range, man portable; and
- Micro: <500 ft, 5-10 Km range, personal issue.[16]

Third, Mr. Marsters expands his views on the possible Canadian utilization of UAVs such as the Global Hawk, which is the size of a Boeing 737 and probably the most recognizable HALE UAV in the world stating:

> If we had the need and will, two or three Global Hawks, based in southern Canada, could provide extensive surveillance of Canada's Artic regions and sea-lanes, thus establishing our sovereignty over these areas.[17]

This particular recommendation is presently being analysed by the CF. Other candidates for the CF are the Predator and the I-Gnat Class MALE UAV built by General Atomic Aeronautical Systems.[18] The I-Gnat was identified as an excellent system that was successfully employed during the G8 Summit at Kananaskis in 2002 by the Canadian Forces Experimentation Centre (CFEC) and Defence Research and Development Canada (DRDC) under a lease agreement. Writers commenting on the tremendous success achieved by the I-Gnat during the G8 Summit emphasized that: "…the I-Gnat, is a UAV that many of us believe has a place in the Canadian military toolbox, as an affordable and relatively simple contributor to dealing with ISR capability requirements."[19]

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[16] G.F. Marsters, "*Ummmm . . . So Where Does the Pilot Sit*?" The W. Rupert Turnbull Lecture presented at the 50th Annual General Meeting of the Canadian Aeronautics and Space Institute at Montreal on 28 April 2003: 5.

[17] *Ibid*., 6.

[18] The Predator has been employed in Kosovo, Afghanistan and other areas where the U.S. wishes to project power while avoiding risk to pilots. It is capable of carrying and releasing precision guided missiles. This was demonstrated in actual missions where it was utilized as an "offensive weapon". The terminology for such a combat capable UAV weapon system is Unmanned Combat Aerial Vehicles (UCAVs). *Ibid.*

[19] *Ibid*.

The fourth dimension in the presentation is civilian application and the relative acceptance of UAVs in the airspace.[20] The primary deterrents to the implementation of civil UAV service are costs and their airworthiness certification. The UAV system requires: ground control stations, air vehicles, up and downlinks for data transmission, and command and control (C^2) stations. All are initially costly to acquire, however less costly to maintain versus manned aircraft. Mr. Marsters also indicates in his presentation that civil authorities are presently not motivated to introduce UAVs into routine service given that certifications of vehicles or systems are not presently well defined. Safety is and must remain a primary factor for certification.[21]

Finally, the presentation emphasises that the most challenging issue facing both UAV proponents and civil regulators is the question of "see and avoid" which refers to the responsibility of the on-board crew to maintain a lookout and to observe right of way rules. This dependence upon human vision to avoid collisions, whether in the air or on the ground, is problematic. Should "artificial vision systems"[22] be installed they must

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[20] The following civil applications are provided as tasks and the writer reminds us that it is by no means an exhaustive list: pipeline surveillance, power line surveillance, mineral exploration, precision farming, offshore oil pollution/spills, forest fire observation, border patrols, crowd control, communication nodes, crop spraying, disaster response, severe weather observation, ice patrols, hydrological surveys, shoreline erosion, and so on. G.F. Marsters, "*Ummmm . . . So Where Does the Pilot Sit*?" The W. Rupert Turnbull Lecture presented at the 50th Annual General Meeting of the Canadian Aeronautics and Space Institute at Montreal on 28 April 2003: 11

[21] UAV operations must be as safe as manned aircraft operations. They must not present or create a hazard to persons or property in the air or on the ground greater than that attributable to the operations of manned aircraft of equivalent class category. *Ibid.*

[22] Many UAVs operate with a camera mounted in the air platform that gives the operator a "tunneled view" of where the UAV is going. *Ibid*., 12.

still demonstrate an equivalent level of safety to that of human observation.[23] Another breakthrough is emerging from the GPS-based Automatic Dependent Surveillance-Broadcast (ADS-B) Mode–S transponder technology to alleviate the "see and avoid" problem.[24]

In the summary, Mr. Marsters offers the following:

> UAVs are here to stay, UAVs offer some exciting and vexing challenges, UAVs will eventually be flown routinely, but not right away, and UAVs should be introduced into the Canadian military service at the earliest possible time.[25]

All in all, the Marsters' article is an excellent presentation package with which to introduce, provide the concept of UAVs and describe some of their present and future challenges. This section identified the D3 jobs of dull, dirty and dangerous and the military classification for UAVs. Further emphasis was given to the possible civilian application for UAVs and the restrictions envisioned with their civil registration.

CF INTRODUCTION TO UAV RESEARCH

Now, let us look at what is happening in the CF with regards to UAV research. An article published in the Military Aerospace Technology "Finding the UAV Fit" reports that the CF began a project to conduct concept development and experimentation

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[23] The International Civil Aviation Organization (ICAO) rules of the air are presently being challenged by "detect-and-avoid" technologies. They include the Traffic Alert and Collision Avoidance System (TCAS), which is becoming the standard for commercial aircraft. G.F. Marsters, "*Ummmm . . . So Where Does the Pilot Sit*?" The W. Rupert Turnbull Lecture presented at the 50th Annual General Meeting of the Canadian Aeronautics and Space Institute at Montreal on 28 April 2003: 11.

[24] These capabilities for system–based collision avoidance will diminish dependence on pilot see-and-avoid. However, to incorporate these types of systems on UAVs will only tax the already restricted payload capability of the platform. Furthermore, UAVs offers challenges to traditional design approaches: "Designing UAV systems provides almost unlimited opportunities for innovation and creativity, and challenges conventional thinking." *Ibid*., 12.

[25] *Ibid*., 14.

with UAVs in late 2002.[26] Doctors Hubfard and Kim from DRDC and Mr. Skeis from CAE Company have been working in partnership with other government departments, companies, universities, and research organizations worldwide, to make extensive use of modeling and simulation technologies to support and improve the eventual CF UAV acquisition process. They warn us "Unless a well defined plan is put into place, the potential exists for militaries to rush into committing to a platform and its related infrastructure that will ultimately fail to meet their objectives."[27] Regrettably, the CF was without such a plan before it acquired the CF Sperwer TUAV system. This will be further explained later on in this paper.

Lieutenant-Colonel Steve Newton from the CFEC worked closely with DRDC and CF officials to establish six areas that need to be addressed when evaluating UAVs on the newly developed UAV Research Test Bed. These are: concepts of operations, payloads, latency, human factors, weapons and platforms.[28] The CF has been proactive in the development of the tools required to assess the UAV capabilities required by the military and has truly taken a deliberate approach to evaluating UAVs and their related systems.[29] What was regrettable in the CF Sperwer TUAV acquisition process was the

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[26] Military Aerospace Technology, "Finding the UAV Fit," HTTP://www.Military-Aerospace-Technology.com/print_article.cfm; Internet; accessed 3 March 2005.

[27] *Ibid*.

[28] The CAE Company was selected to help develop the synthetic environment that would become the virtual world in which evaluations and experimentations are conducted. Mr. Skeis, Director of Technology Application with CAE, reports that the CF UAV Research Test Bed Project has allowed CAE to develop a product called Reconfigurable Vehicle Control Station (RVCS). Synthetic environment, UAV research, training and operations are supported within this RVCS. *Ibid.*

[29] It is well understood that over the next several years, UAVs will see increasing use in variety of military applications. "The basis for this low risqué [sic] approach to UAV evaluation, acquisition and operation is modeling and simulation technology, which is now finding application beyond traditional training systems and is being used extensively throughout program lifecycle." *Ibid*.

absence of an existing clear policy at the time and that it was neither evaluated nor tested by CFEC prior to its selection by the Army. As a result of the numerous UAV trials held by the CF, in conjunction with CFEC and DRDC, numerous lessons learned have been documented. A review of their findings is beyond the scope of this paper; however, some lessons learned will be identified in the following section.

LESSONS LEARNED

Now let's turn our attention to some of the specific impediments to the introduction of UAV into the CF inventory. The CF aeronautical products airworthiness issue, stems from the Aeronautics Act and Canada's Air Force is assigned to oversee military aviation in Canada. The legal responsibilities include overseeing all military aviation activities and airspace control domestically or abroad, including those of UAVs.[30] Airworthiness was not fully resolved prior to the deployment of the Sperwer TUAV. The basic doctrine, ideas, and concepts relating to airspace control remain constant. However, in the development of an airspace control plan, considerations for all active UAV launch and recovery areas and its mission areas must be taken into account and included in the airspace control order.[31] Doctrine is therefore a hard requirement, and it was not available prior to the CF Sperwer UAV deployment. Aerospace doctrine must be written in accordance with national defence policy and must state the means by

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[30] Department of National Defence, *Strategic Vectors – The Air Force Transformation Vision* (Ottawa: DND, 2004), 19.

[31] These areas of defined dimensions are called Restricted Operations Area (ROA). United States, Department of the Army, *Joint Tactics, Techniques and Procedures for Close Air Support (CAS)*, Joint Publication 3-09.3 (Washington, D.C.: U.S. Government Printing Office, 1995), IV-8. "The primary goal of combat zone airspace control is to enhance air, land, maritime and special operations forces effectiveness in accomplishing the Joint Force Commander's objectives." United States, Department of Defense, *Joint Doctrine for Airspace Control in the Combat Zone*, Joint Publication 3-52 (Washington, D.C.: U.S. Government Printing Office, 2004), 15.

which it will accomplish national and departmental strategies. Consequently, there is a requirement to develop strategic, operational and tactical levels of doctrinal manuals for the CF UAVs. Quite simply, friction is reduced when forces work together and draw on standard doctrine and procedures.[32]

From newly developed procedures, interoperability and connectivity of available communications of sensor systems are required to transmit accurate real time data to friendly forces. The optimum employment of UAV weapon systems, in the area of operation, involves the discrimination of friend from foe to avoid fratricide and maximize the beyond visual range engagement. Interoperability is basically more than a black box concept. It means UAV interoperability, in a much wider sense, is required in military culture, training, doctrine, equipment, procedure and command and control.[33] UAVs are now an integral part of C4ISR systems.[34]

In today's environment, the newly appointed Chief of Defence Staff (CDS) for the CF, General Hillier, is directing renewal for the CF of the future not specifically in terms of unification of the services, but of truly Joint Services, with one of the most important factors being "Unified C^2" as a primary enabler. General Hillier is seeking a fully integrated approach in the CF's operational Headquarters in order to meet all types

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[32] Researchers report that the development of doctrine is never complete and must be constantly reviewed-given that innovation has always been a key part of sound doctrinal development. Doctrine also changes as new research and development, new experiences, and advances in technology point the way to the future. The CF Joint Doctrine Manual further stipulates that: "Procedures should be developed from Doctrine so that they will be suitable for use in any operation, with only minor changes to cater to different command structures or variations in force levels, structures and/or capabilities." Department of National Defence, *CF Joint Doctrine Manual- CFP (J) 5(4)* (Ottawa: DND, 2004), Art 105.

[33] Group Captain Stuart Peach, "Coalition Air Operations," in *Perspective on Air Power – Air Power in Its Wider* Context, ed. Stuart Peach, 46-79 (London: The Stationery Office, 1998), 76.

[34] Should UAVs be managed by the CF under the ISTAR program or by another organization? More detailed information is required before such a question can be answered and C^2 for CF UAVs is still not resolved.

of missions at home and abroad.[35] Within this new view of Joint Services, UAVs are considered a common and necessary capability to each of the environmental elements. UAVs will require substantial support from all the environmental elements and the DND structure to achieve a joint integration. As demonstrated with the Sperwer acquisition by the Army, and joint Army and Air Force operations, more than one environmental element is required to ensure complete integration. Effects-based planning is considered the nucleus of true joint planning and C^2. With regards to which capability is required to reach the desired effect; UAVs can provide the required intelligence necessary to achieve this joint planning.[36]

Various works of leading air power theorists, such as Douhet, Trenchard, Mitchell, Slessor, Seversky, Warden and others, all agree that the basic premise of air power employment is 'centralized control and decentralized execution.'[37] To assist this requirement, a single commander responsible for all air assets in his area of operations should be appointed. The C^2 for the Sperwer TUAV operations in theatre had to be developed on site. That being said, new developments in the CF indicate that centralized control will be performed by the Air Force for all UAVs in the future and that TUAVs will be under decentralized execution by the Army or Navy.

Doctors Ross Pigeau and Carol McCann have also presented research with

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[35] Graham Fraser, "Forget the Bear – now, it's 'snakes'," *The Toronto Star*, 19 March 2005, 1.

[36] Colonel (USAF) John A. Warden III, *The Air Campaign*, (Washington: National Defense University Press, 1988), 3.

[37] Colonel (USAF) Phillip S. Mellinger, "10 Propositions Regarding Air Power" (Colorado Spring: Schoold of Advance Air Power Studies, 1995), foreword.

regards to C^2.[38] They focussed on the lessons learned from the CF C^2 database and reported that difficulties with innovation, deficiencies in NDHQ procedures and knowledge levels of the staff, doctrinal deficiencies, structural deficiencies and capabilities deficiencies all contributed to poor C^2. Devised by command, the CF uses control for its structures and processes by command in order to enable its operations and manage risk. This paper focuses only on the equipment portion of C^2. CF acquisition of UAVs has provided an extreme boost in its C^2 capability and knowledge base. Clearly the question of the CF Sperwer TUAV ownership and C^2 is still being debated at the highest level in the CF and will not be entertained here. Suffice to say that like many organizations the CF also has its share of stovepipes.

The Army contact cell for the Sperwer TUAV operations incurred many delays due to their requirement of seeking resolution of airworthiness issues, which were out of their control from the NDHQ matrix. One of the benefits to the establishment of joint UAV support cells would be having a single point of contact for all CF UAV issues that would be capable of responding to a variety of different operational challenges. This would provide flexibility to the end users and bolster issues of economy, responsiveness, simplicity, cooperation, sustainability and survivability for all UAV related matters. Learning from the daily experiences of the US with the various UAV platforms, a dedicated joint UAV team provides the Task Force Commander (TFC) with visibility of the common picture throughout the theatre of operations (both at home and deployed). The establishment of UAV Teams in the CF will yield the same benefits.

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[38] Ross Pigeau and Carol McCann, "What is a Commander?" in *Generalship and the Art of the Admiral: Perspective on Canadian Senior Military Leadership*, ed. Bernd Horn and Stephen J. Harris, 79-104 (St. Catharines, ON: Vanwell Publishing Limited, 2001).

CF SPERWER TUAV

The CU-161 Sperwer TUAV system acquisition was initially done in isolation, by the Directorate of Land Equipment Procurement and Management (DLEPM) for an urgent operational requirement (UOR) for OP ATHENA in Kabul, Afghanistan. The operations of the Sperwer TUAV in Kabul 'blew out some cobwebs' resulting in the Army and Air Force re-evaluating their present and future position with regards to UAVs, doctrinally and all. In the final analysis, the technical, doctrinal, and organizational lessons learned with the deployment of the Sperwer remained ambiguous, primarily due to the fact that the Army and Air Force had different interpretations of airworthiness and flight safety. Further testing is required before the Sperwer TUAV system can be certified to fly in Canadian airspace.

Even with the contractual support provided by the Sperwer original equipment manufacturer personnel in theatre this "off the shelf' TUAV was more complex to operate and maintain than was anticipated. To manage its airworthiness issues, the Sperwer TUAV has been recently, and reluctantly been handed over to the Air Force by the Army.[39] Furthermore, the resident airworthiness expertise remains in the NDHQ Matrix within the Directorate of Aerospace Equipment Procurement Manager (DAEPM). As of March 2005, the C^2 issue of the Sperwer TUAV is not yet resolved and is awaiting a decision from the Joint Capability Requirements Boards (JCRB). Unquestionably the successful and rapid deployment of the Sperwer TUAV into theatre was due in no small part to the excellent cooperation at all levels, but most especially the hard work from the

[39] This is rightfully so, as previously explained, all airworthiness regulations stem from the Aeronautics Act and are assigned to Canada's Air Force, not the Army. Department of National Defence, *Strategic Vectors – The Air Force Transformation Vision* (Ottawa: DND, 2004), 19.

DLEPM PMO staff.

Besides the airworthiness issues inherent with the TUAV weapon system design, the lessons learned during its operation in Kabul were affected by a plethora of technological, political, cultural, and local environmental factors. More importantly, many lessons learned could be attributed to TUAV staff, operators, maintainers and/or system design. Specifically, the Sperwer TUAV was acquired by DLEPM even though other types of specialized UAV platforms were available 'off-the-shelf' already tested and proven.[40]

On the positive side, the avionic suite is a key strength on the Sperwer TUAV system. The weapon system payload is also very reliable and its performances met and even exceeded the CF requirements at the time. The Electro Optical (EO) and Infra Red (IR) sensors were integrated and performed extremely well during the whole deployment. The design for the interfaces with the various data links worked well in the difficult environmental conditions such as sand storms, high altitude and high temperatures of Kabul. Although limited mainly by its flight envelope at high altitude and temperatures, when it could fly it was considered a formidable asset for the Brigade.[41] The Chief of the Air Staff (CAS) in February 2005 released a letter entitled "Tactical Uninhabited Air

[40] The system was not tested by CFEC prior to initiating the acquisition process. The specific problems encountered with the Sperwer TUAV post delivery are well documented and available through either of the newly formed UAV Weapon System Manager cell in DAEPM or the TUAV Project Management Office in DLEPM.

[41] Regarding the future of the Sperwer TUAV, this could be one of the rare cases where the payload could drive the design or redesign of the air vehicle platform. While there might be large economies in adapting the proven payload technology into another airframe, this payload package could be easily modified and mounted on other existing CF weapon systems. These scenarios should be pursued

Vehicles (TUAV) Way Ahead"[42] expressing the Air Staff's intent to support the implementation of the Sperwer TUAV and to field this capability for the Army's Brigade Training Exercise (BTE) in September 2005. This renewed cooperation between the Land and Air environmental staff demonstrate the CF's overall objective of the re-introduction of the Sperwer TUAV operational capability. This new approach further supports this paper's intent to establish a clear policy and joint structure to better integrate UAVs in the CF. The acquisition process will now be reviewed.

ACQUISITION

While researching acquisition within the CF, the article written by Colonel H.F. Jaeger "*Getting what we need: confronting structural speed bumps on the road to improve Defence capability*" identifies some of the deficiencies within the NDHQ organization. His abstract provides focus on the background deficiencies and more importantly provides support to the follow-on suggestions and recommendations outlined in his paper:

> In order to optimize [defence capability process] output in the face of constrained resources inputs, the process must be highly effective. The process in turn is largely determined by the underlying structure that it serves. In the Canadian context, there is a need to pursue a change in the specific components of defence capability in… that progress towards improving our defence capability is hampered by the current structure of NDHQ and the resultant defence management process, which does not provide adequate strategic direction and which continues to favour **equipment-focussed single-service projects** [emphasis added].[43]

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[42] The CAS made the following statement: "Our success in this endeavor will not only provide an operational capability initially to the Land focus but will also provide foundation for the cooperative introduction of a broader CF UAV capability." LGen K.R. Pennie, *Tactical Uninhabited Air Vehicles (TUAV) Way-Ahead* (National Defence Headquarters: file 11500-1 (CAS), 23 Feb 05).

[43] Colonel H.F. Jaeger, "Getting What We Need: Confronting Structural Speed Bumps on the Road to Improved Defence Capability," (Toronto: Canadian Forces College National Security Studies Course Paper, 2003), abstract.

Colonel Jaeger's paper argues that the current structure of the Department of National Defence (DND) and the CF is not an ideal framework in which to create defence capabilities and that those who are responsible for joint capabilities are particularly disadvantaged primarily because all acquisition is performed in the NDHQ matrix.[44] The processes for introduction of completely new capabilities are in a top down fashion, either from a technological point of view or from the need for new and different functions for operations, such as the acquisition of the CF Sperwer TUAV as an UOR for OP ATHENA.[45]

The planned introduction of UAVs implies far more than a new piece of equipment for the CF. Therefore several questions need to be considered. Who will operate the UAV, and who will command and control it? How will it be maintained and by whom? How will the training be provided and conducted? Regrettably, many of these items were not fully addressed at the start of the CF Sperwer TUAV acquisition project due to the short time frame for its operational deployment. It is now apparent from our experience with UAVs that there could be a need for an entirely new occupation to be created, or new specialty area formed within already existing occupations.[46] The Defence Management System also recognizes that an equivalent process to standard

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[44] He also acknowledged "significant recent improvements to process have been made, notably the adoption of capability-based planning, the development of the Canadian Joint Task List (CJTL), and the introduction of the Joint Capability Requirements Boards (JCRB), but more remains to be done." Colonel H.F. Jaeger, "Getting What We Need: Confronting Structural Speed Bumps on the Road to Improved Defence Capability," (Toronto: Canadian Forces College National Security Studies Course Paper, 2003), 3.

[45] The Sperwer TUAV should have been introduced via a clear policy and joint structure within the DCDS framework versus the CLS, ADM (Mat) and DLEPM.

[46] The personnel structure must also change to accommodate the new UAV CF Team concept. The Army is presently building-up their TUAV Team concept within the Artillery Regiments. The Air Force is augmenting their capability in Tactical Helicopter Squadrons.

project management needs adjustment in order to introduce such defence capability. Since UAVs are a relatively new acquisition there is regrettably little formal guidance on exactly how to proceed. Hopefully, the proposed CF UAV Campaign Plan will answer all the questions above and provide directives for all future UAV capability acquisition for the CF.

ECS' continue to carry out the functions described in the Project Management Volumes 1, 2 and 3 and the DCDS carries out the functions for most joint capabilities.[47] Colonel Jaeger's paper further argues that capabilities are easily managed as a joint approach rather than an environmental one therefore, acquisition should be more focused on a Joint Project Office (JPO) than on a specific environmental one. Where should we manage UAV capabilities, in individual environments or jointly? UAVs are by *de facto* joint assets and must be handed over to the DCDS group. As identified in this paper, today's environment offers key employment for such UAV technology and UAVs can meet this mitigation capability head on for the CF of today and for the CF of tomorrow.[48]

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[47] Department of National Defence, *Project Management Volume 1- Project Management Environment* (A-LP-005-000/AG-001), (Ottawa: DND, 1988). Department of National Defence, *Project Management Volume 2 - Establishing a Mandate* (A-LP-005-000/AG-002) (Ottawa: DND, 1988). Department of National Defence, *Project Management Volume 3 - Project Organization* (A-LP-005-000/AG-003) (Ottawa: DND, 1988).

[48] Colonel Jaeger identified that the present situation is very complex and volatile. "The renewed focus on the Defence of Canada and the Defence of North America in the face of the current asymmetric threat calls for a new approach to continental operations. This is the most obvious in the need for much closer surveillance of Canada's vast territory, coastline, airspace and ocean approaches but it is also apparent in the need to provide for a relevant mitigation capability for a variety of asymmetric attacks that could now conceivably take place in Canada." Colonel H.F. Jaeger, "Getting What We Need: Confronting Structural Speed Bumps on the Road to Improved Defence Capability," (Toronto: Canadian Forces College National Security Studies Course Paper, 2003), 9.

CF UAV CAMPAIGN PLAN

As described previously with the CFEC and DRDC experimentation, the CF has taken proactive steps to develop a common vision for all future UAV related efforts. The CF recognizes the need to use a document equivalent to the U.S. UAV Roadmap under the same premise and is presently drafting a document called the CF UAV Campaign Plan.[49] Furthermore, the DCDS initiated a multi year Capital Equipment project entitled Joint Uninhabited Aerial Vehicle Surveillance Target Acquisition System (JUSTAS).[50] JUSTAS is categorized as a strategic major crown project for the concept development and experimental work on UAVs.[51] This project was initiated through a Capability Deficiency that was identified in the CF Strategic 2020 goal document.[52] The JUSTAS project directly supports this papers statement that a clear policy to better integrate the UAV capability under a joint structure within the DCDS framework is required.

SUGGESTIONS/RECOMMENDATIONS

The CF UAV Campaign Plan must identify the "way ahead" for UAV interoperability and outline the systematic development of joint architectures essential to

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[49] The DCDS oversees the planning, coordination and conduct of all CF operations and is actively involved in the development of joint Army, Navy and Air Force capabilities, such as UAVs.

[50] At the outcome of this project CF UAV doctrine, techniques, tactics and procedures, concept of operations and individual training processes will also be developed. Furthermore, with the appropriate UAV knowledge and expertise gained at the UAV JPO, JUSTAS will also position the CF to establish an operational MALE UAV capability by 2012. Contract Information Data (CID) 23 on the Capital Equipment Project - Joint Uninhabited Aerial Vehicle Surveillance Target Acquisition System (JUSTAS) dated 11 April 2004.

[51] The 250 million dollar project will focus initially on establishing a joint UAV Battle Lab and Test Bed, acquiring a MALE UAV system and possibly a vertical UAV for the Navy. *Ibid*.

[52] Department of National Defence, *Shaping the Future of the Canadian Forces: A Strategy for 2020* (Ottawa: DND, 1999).

the development of interoperable C4ISR.[53] Situational awareness, tasking, control, collection, processing and dissemination must also be standardized.[54] To further enhance the CF UAV Campaign Plan, Standardization Agreements (STANAGS) should be used when available. NATO developed the NATO ISR Interoperability Architecture (NIIA) in order to maintain interoperability with systems of other nations and for internal use between the nation's joint operation services; these should be reviewed for their applicability.

UAV processes must be compatible with military Air Tasking Orders and therefore must file a flight plan. UAVs must be able to communicate data with manned aircraft and must not impede other aircraft from sharing airspace with unmanned assets.[55] Joint acquisition through the DCDS must be developed with joint teams preparing the project documentation. These project teams should include staff from each of the three environmental groups and structured as follows:

- Project Director - UAV Joint Project Office under DCDS
- Project Manager - under ADM (Mat)
- Weapon System Manager (WSM) - under ADM (Mat) DAEPM
- JUSTAS project - under DCDS

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[53] All of the Joint Operational Architecture (JOA), Joint Systems Architecture (JSA) and Joint Technical Architecture (JTA) must be included in the CF Campaign Plan. United States, Office of the Secretary of Defense, *Unmanned Aerial Vehicles Roadmap 2002-2027* (Washington, D.C.: U.S. Government Printing Office, 2003), 150.

[54] UAVs are, for the most part, only extensions of existing ISR sensors and platforms. ISR standards are in place today and should be mandated in the campaign plan as a baseline acknowledging that standards are usually selected for implementation by the development program. *Ibid.*

[55] United States, Office of the Secretary of Defense, *Unmanned Aerial Vehicles Roadmap 2002-2027* (Washington, D.C.: U.S. Government Printing Office, 2003), 153.

- Formation Battle LAB for UAV - in CFEC under DCDS[56]

CONCLUSION

> Unless a well-defined plan is put into place, the potential exists for militaries to rush into committing to a [UAV] platform and its related infrastructure that will ultimately fail to meet their objectives.[57]

As illustrated throughout this paper a real potential exists for the UAV capability and there is an urgent need for a cohesive joint approach. The CF has learned invaluable lessons with the acquisition and deployment of the Sperwer TUAV and must leverage them in order to improve the system. Essentially, UAVs are tools to gather intelligence. Mr. Marster's paper provided a Canadian perspective and identified the D3 jobs of dull, dirty and dangerous and the military classification for UAVs. Further emphasis was then given to the civilian application for UAVs and the potential restrictions associated with their civil registration. The CF has been proactive in the development of tools required to assess UAV's capabilities and has truly taken a deliberate approach to evaluating their related systems; regrettably the Sperwer TUAV was not tested prior to its acquisition.

There is a need to develop strategic, operational and tactical levels of doctrinal manuals for the CF UAVs and again such doctrine was not available prior to the Sperwer TUAV deployment in Kabul. New developments in the CF have identified that centralized control will be performed by the Air Force for all UAVs in the future and that TUAVs will be under decentralized execution by the Army or Navy. The establishment of a joint UAV support cell capable of responding to a variety of operational challenges,

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[56] Present events in NDHQ are creating changes in the basic structure and implementing suggestions and recommendations identified in this paper.

[57] Military Aerospace Technology, "Finding the UAV Fit," HTTP://www.Military-Aerospace-Technology.com/print_article.cfm; Internet; accessed 3 March 2005.

thus, providing flexibility, enhance and bolster issues of economy, responsiveness, simplicity, cooperation, sustainability and survivability for all CF UAV related matters is required. Furthermore, the JUSTAS project directly supports this paper's statement that a clear policy to better integrate the UAV capability under a joint structure is required.

The current EPM process is built in single service stovepipes and does not allow strategic direction for the introduction of new joint capabilities like UAVs. The CF must take a leadership role in the introduction of the UAV potential, not only in military applications, but more so in the civilian applications available to respond to the ever changing threat environment that we face today. The CF may become the "employer of choice" to deliver the full UAV potential to our nation and allies.

This paper demonstrated that the CF needs a clear policy to better integrate the UAV capability under a joint structure within the DCDS framework. To resolve this, the acquisition functions currently under the individual ECS and ADM (Mat) EPM should be altered or somewhat amalgamated to be responsive to the UAV JPO under the DCDS. The acquisition of joint capability projects must be centrally coordinated to encourage more effective management for all project sponsors and environments, ultimately creating a better process and capability. The reorganization of the DCDS group to cater to the acquisition process in the matrix will also require reorganization in the ADM (Mat) EPM division. The DCDS group must be established to perform the acquisition of either common technology capability or a common function basis for the CF. It is only in the DCDS group that you best can foster a cadre of professional managers, maintain the knowledge base and CF vision of UAVs in consultation with the JCRB. Reinforcement and where necessary, implementation of the aforementioned suggestions and

recommendations within the CF UAV Campaign Plan and NDHQ will ensure a clear policy and joint structure to better integrate the UAV capability into the CF.

BIBLIOGRAPHY

Arnold, Henry H. *Third Report of the Commanding General of the Army Air Forces to the Secretary of War*. Washington: War Department Bureau of Public Relations, 1944.

Bosker, Staff Sgt A.J. "UAV 'Roadmap' helps Warfighter." *Air Force Print News* (28 March 2003); available from http://www.globalsecurity.org/intell/library/news/2003/intell-030328-afpn01.htm.; Internet; accessed 8 February 2005.

Canada. Department of National Defence. *2003-2004 Annual Report of the Chief of the Defence Staff*. Ottawa: DND, 2004.

Canada. Department of National Defence. *CF Joint Doctrine Manual- CFP (J) 5(4)*. Ottawa: DND, 2004.

Canada. Department of National Defence. *Project Management Volume 1- Project Management Environment* (A-LP-005-000/AG-001). Ottawa: DND, 1988.

Canada. Department of National Defence. *Project Management Volume 2 - Establishing a Mandate* (A-LP-005-000/AG-002). Ottawa: DND, 1988.

Canada. Department of National Defence. *Project Management Volume 3 - Project Organization* (A-LP-005-000/AG-003). Ottawa: DND, 1988.

Canada. Department of National Defence. *Shaping the Future of the Canadian Forces: A Strategy for 2020*. Ottawa: DND, 1999.

Canada. Department of National Defence. *Strategic Vectors – The Air Force Transformation Vision*. Ottawa: DND, 2004.

Contract Information Data (CID) 23 on the Capital Equipment Project - Joint Uninhabited Aerial Vehicle Surveillance Target Acquisition System (JUSTAS) dated 11 April 2004.

Fraser, Graham. "Forget the Bear – now, it's 'snakes'." *The Toronto Star*, 19 March 2005.

Jaeger, Colonel H.F. "Getting What We Need: Confronting Structural Speed Bumps on the Road to Improved Defence Capability." Toronto: Canadian Forces College National Security Studies Course Paper, 2003.

Jomini, Baron Antoine Henri de. *The Art of War*. London: Greenhill Books, 1992.

Marsters, G.F. "*Ummmm . . . So Where Does the Pilot Sit*?" The W. Rupert Turnbull Lecture presented at the 50th Annual General Meeting of the Canadian Aeronautics and Space Institute at Montreal on 28 April 2003.

Mellinger, Colonel (USAF) Phillip S. "10 Propositions Regarding Air Power." Colorado Spring: Schoold of Advance Air Power Studies, 1995.

Military Aerospace Technology. "Finding the UAV Fit." HTTP://www.Military-Aerospace-Technology.com/print_article.cfm; Internet; accessed 3 March 2005.

Peach, Group Captain Stuart. "Coalition Air Operations." In *Perspective on Air Power – Air Power in Its Wider Context*, edited by Stuart Peach, 46-79. London: The Stationery Office, 1998.

Pennie, LGen K.R. *Tactical Uninhabited Air Vehicles (TUAV) Way-Ahead*. National Defence Headquarters: file 11500-1 (CAS), 23 Feb 05.

Pigeau, Ross and Carol McCann. "What is a Commander?" In *Generalship and the Art of the Admiral: Perspective on Canadian Senior Military Leadership*, edited by Bernd Horn and Stephen J. Harris, 79-104. St. Catharines, ON: Vanwell Publishing Limited, 2001.

Sloan, Elinor C. *The Revolution in Military Affairs - Implications for Canada and NATO*. Montreal and Kingston: McGill-Queen's University Press, 2002.

Tzu, Sun. *The Art of War*. Translated by Samuel B. Griffith. London: Oxford University Press, 1963.

United States. Department of Defense. *Joint Doctrine for Airspace Control in the Combat Zone*, Joint Publication 3-52. Washington, D.C.: U.S. Government Printing Office, 2004.

United States. Department of the Army. *Joint Tactics, Techniques and Procedures for Close Air Support (CAS)*, Joint Publication 3-09.3. Washington, D.C.: U.S. Government Printing Office, 1995.

United States. Office of the Secretary of Defense. *Unmanned Aerial Vehicles Roadmap 2002-2027*. Washington, D.C.: U.S. Government Printing Office, 2003.

Warden III, Colonel (USAF) John A. *The Air Campaign*. Washington: National Defense University Press, 1988.