PRODUCED BY THE ROYAL CANADIAN AIR FORCE

THE ROYAL CANADIAN AIR FORCE JOURNAL

SUMMER 2014 VOL.3 NO.3

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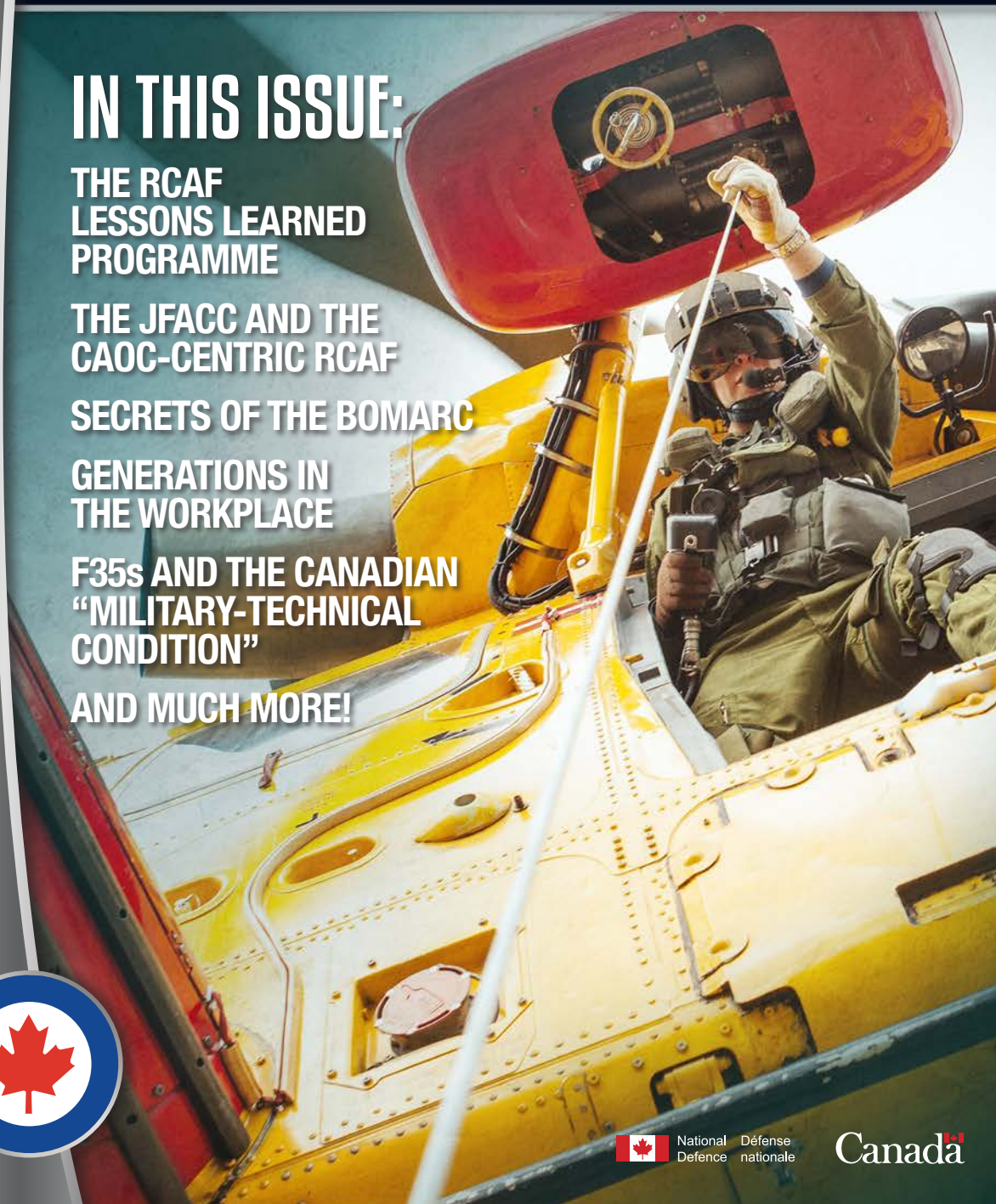

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THE ROYAL CANADIAN AIR FORCE JOURNAL is an official publication of the Commander Royal Canadian Air Force (RCAF) and is published quarterly. It is a forum for discussing concepts, issues and ideas that are both crucial and central to air and space power. The *Journal* is dedicated to disseminating the ideas and opinions of not only RCAF personnel, but also those civilians who have an interest in issues of air and space power. Articles may cover the scope of air force doctrine, training, leadership, lessons learned and air force operations: past, present or future. Submissions on related subjects such as ethics, technology and air force history are also invited. This *Journal* is therefore dedicated to the expression of mature professional thought on the art and science of air warfare and is central to the intellectual health of the RCAF. It serves as a vehicle for the continuing education and professional development of all ranks and personnel in the RCAF as well as members from other environments, employees of government agencies and academia concerned with air force affairs.

Published by Canadian Forces Aerospace Warfare Centre
ISSN 1927-7601

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THE ROYAL CANADIAN AIR FORCE JOURNAL

SUBMISSION REQUIREMENTS

THE ROYAL CANADIAN AIR FORCE JOURNAL welcomes the submission of articles, book reviews and shorter pieces (which will be published in the Letters to the Editor, Points of Interest, Pushing the Envelope and Point/Counterpoint sections) that cover the scope of air force doctrine, training, leadership, lessons learned and air force operations: past, present or future. Submissions on related subjects such as ethics, technology and air force history are also invited.

JOURNAL SECTIONS

ITEM	WORD LIMIT*	DETAILS
LETTERS TO THE EDITOR	50-250	Commentary on any portion of a previous *Journal*.
ARTICLES	3000-5000	Written in academic style.
BOOK REVIEWS	500-1000	Written in academic style and must include: • the book's complete title (including sub-title); • the complete names of all authors as presented on the title page; • the book's publisher, including where and when it was published; • the book's ISBN and number of pages; and • a high resolution .jpg file (at least 300 dpi and 5 by 7 inches) of the book's cover.
POINTS OF INTEREST	250-1000	Information on any topic (including operations, exercises, and anniversaries) that is of interest to the broader aerospace audience.
PUSHING THE ENVELOPE	250-2000	Forum for commentary, opinions, and rebuttal on *Journal* articles and/or issues that are of interest to the broader aerospace audience.
POINT/ COUNTERPOINT	1500-2000	Forum to permit a specific issue of interest to the RCAF to be examined from two contrasting points of view.

* Exclusive of endnotes

AUTHORS ARE ASKED TO NOTE THE FOLLOWING GUIDELINES

Submissions may be made in either official language.

- Authors must include a brief (one paragraph) biographical sketch which includes current appointment/position, telephone number, and email address. Please include all professional and academic designations as well as military decorations.
- Selected articles that have been peer reviewed have a  to the left of the title.
- The Senior Editor will notify contributors on the status of their submission. It may not be possible to publish all submissions.
- All text submissions must be digital, in Microsoft Word or rich text format. Files must not be password protected and must not contain macros. Files may be submitted by mail or email at the addresses provided below.
- All supporting tables, images and figures that accompany the text should be sent in separate files in the original file format (i.e., not imbedded in the text). Original vector files are preferred; high resolution (not less than 300 dpi) .psd or .jpg files may be submitted.
- Authors are now required to provide "alternate text" with detailed description for all figures. The alternate text is to be labelled as such and placed below the caption.
- Copyright permissions are required for all material that is not Department of National Defence or author originated. It is the author's responsibility to obtain and submit the necessary written permissions which must include the author's/artist's name as well as the publisher's name and location. Any material not meeting these requirements may be omitted from the article.
- The Senior Editor may select images or have graphics created to accompany submissions.
- Authors should use *Oxford English* or *Petit Robert* spelling. When required, reference notes should be endnotes rather than footnotes and formatted in Chicago style. For assistance refer to *The Chicago Manual of Style, 16th Edition, Le guide du rédacteur,* or CFAWC Production Section at CFAWCProd@forces.gc.ca
- Acronyms and abbreviations should be used sparingly:
  - If they are required in the text, the term is to be written out in full the first time it is used and then followed by the abbreviated form in parentheses.
  - A list of all abbreviations (and their terms) used in the text will be included at the end of each submission.
- The Senior Editor reserves the right to edit submissions for style, grammar, and length, but will not make editorial changes that will affect the integrity of the argument without consulting the author.

CALL FOR SUBMISSIONS

For the **Winter 2015** issue: **30 October 2014**
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For the **Fall 2015** issue: **30 July 2015**

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VOL. 3 | NO. 3
SUMMER 2014


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ARTICLES

BOOK REVIEWS

POINTS OF INTEREST

POINT/COUNTERPOINT

EDITOR-IN-CHIEF'S MESSAGE

Over the past few years I have had the pleasure of reading various issues of *The Royal Canadian Air Force Journal* (*RCAFJ*), and for the most part, I consider it a first-class publication. Still, I have occasionally felt that as a professional publication *The RCAFJ* had the potential to contribute so much more to our collective understanding of our business, and from time to time I pondered: how would I approach the mandate of the *Journal*? The "Fates" move in mysterious ways, as I now find myself as the Commanding Officer of the Canadian Forces Aerospace Warfare Centre and the Editor-in-Chief of the object of my past musings.

Air power is a complex subject. This is a simple fact to state and, yet, extremely difficult to explain in a succinct manner, as air power (or airpower for our American readers) means different things to different people and is so broad a concept as to defy an easy definition. Nor is it a stationary target, as air power to a flyer from World War I—where the focus of air operations was predominantly support to ground forces—would not be viewed in the same manner by an airman or airwoman contemplating the employment of unmanned aircraft in the 21st century. The collective experience—both ours and what we have gleaned from other air-power practitioners over the decades—has combined to produce an intellectual, cultural, practical, institutional and philosophical "understanding" or "misunderstanding" of air power. In short, air power is a complex subject; one that requires constant study to ensure its effective application and debate to spur its ongoing development.

From a Royal Canadian Air Force (RCAF) perspective, a relative paucity of deep, searching articles on air power in the *RCAFJ* could lead one to conclude that meaningful air-power debate is, if not completely moribund, limited to a few keen individuals. Past copies of the *Journal* include many good articles, especially the historical ones, but very little on some of the broader aspects of modern air power (e.g., the impact of the changing nature of operations on the rationale of independent air forces; the quality versus quantity question in the face of defence cost inflation; the implications of air-power developments in significant countries such as India, China, etc.). This type of thought and analysis is critical for defining both the future of air power in Canada and how we engage with other air-power practitioners.

As well, the letters to the editor have been a bit thin. They tend, in general, not to further discussion but, rather, to correct errors or omissions. This may be symptomatic of a lack of cutting-edge or forward-thinking material that would arouse a reader sufficiently to place finger to keyboard in order to refute the argument or to discuss the merits of the points therein.

This type of debate is not only healthy but also necessary for us as a service to improve our understanding of air power.

Personally, I feel that at times the *Journal* comes across as something of a stand-alone organ, which we need to correct. It needs to be recognized as being one element of a wider body of work that includes the upcoming air-power symposium (November 2014, Toronto), the general-officer reading list, Canadian Forces College papers, etc. We collectively need to work at making the related activities more coherent, visible and vibrant so that people become more engaged. Bottom line is: we need to encourage, and give an outlet to, our putative Wardens, Tedders and Boyds.

The level of air-power debate in Canada is not what it could, or should, be. Therefore, as your Editor-in-Chief, I will seek to build upon what the *Journal* does well (historical articles and technology / process-themed pieces) by emphasizing material that provokes thought, discussion and, perhaps, the occasional slightly uncomfortable feeling. With this goal in mind, I urge air-minded individuals, in and out of uniform, to critically examine air power writ large and how it impacts the RCAF and Canada.

This is a group effort, and we ALL need to "up our game" by engaging in an active air-power debate. I anticipate adding a few articles / editorial comments of my own and actively participating in the discussions to follow. I look forward to including some contentious views, and to get the ball rolling, I challenge the readership to look at Robert M. Farley's book, *Grounded: The Case for Abolishing the United States Air Force* and the United States Air Force's School of Advanced Airpower Studies *Small Wars, Big Stakes: Coercion, Persuasion, and Airpower in Counter-revolutionary Warfare* and see how their arguments might be applied to the RCAF. I look forward to your submissions.

Colonel Kelvin Truss
Editor-in-Chief

Abbreviations

RCAF	Royal Canadian Air Force
RCAFJ	*The Royal Canadian Air Force Journal*

THE ROYAL CANADIAN AIR FORCE

LESSONS LEARNED PROGRAMME

BY MAJOR DAX CHAMBERS

Introduction

In the spring 2011 issue of *The Canadian Air Force Journal*, an article titled "Lessons Learned: The Air Force on Its Way to Continuous Improvement"[1] provided its readership with a background and summary of what was then a recently achieved, coherent Lessons Learned Programme (LLP). That article, complete with flow chart, organizational diagram, and colourful graphic, described in deliberate detail a number of subjects: the five-step process of the LLP and its components; the roles and responsibilities of the Canadian Forces Aerospace Warfare Centre (CFAWC); programme governance; and finally, a summary of the Operation (Op) HESTIA Project. As one may recall, Op HESTIA was Canada's contribution to humanitarian relief in support of the nearly one-third of Haiti's citizens in the aftermath of the disastrous earthquake and its associated aftershocks in January 2010. A post-operation analysis of lesson observations conducted by CFAWC personnel revealed a number of areas for improvement. Without going into too much detail here, lesson findings revealed problems in airlift command and control as well as in doctrine and operating processes.[2]

This article will provide a brief overview of the status of the Royal Canadian Air Force (RCAF) Lessons Learned Programme. It is intended as an informative piece more so than the educational-themed report of 2011. Imagine, if you will, this article like a sequel to a good film; while the former blockbuster was enjoyed by many, movie goers will not be disadvantaged should this be their introduction to the franchise.

The act of change

Much has happened in the RCAF during the past three years. Command teams have rotated into and out of office, and organizational charts have been revisited and modified. The Air Force has again proven its value as a versatile force generator as demonstrated in the contributions to the North Atlantic Treaty Organization–led arms embargo and no-fly zone imposed on Libya (Op MOBILE) and in facilitating humanitarian support to the Philippines during Op RENAISSANCE 1301. And, not the least of recent developments, we have firmly reprised our heritage simply by adding the term "Royal" to our title; thus, discussions surrounding the likelihood of rejuvenating associated ranks and insignias are in the news. The simple fact is change is inevitable, it is ongoing, and we are all affected by it.

Why lessons learned?

The Canadian Armed Forces (CAF) is a sizeable organization employing tens of thousands of men and women. The role of the CAF is vital to the defence of Canada and to our government's ability to project its influence both at home and abroad. Considering its political importance, span of operations, and the number of resources necessary to sustain it under present conditions, the CAF is arguably an ideal organization within which to institute a lessons learned programme. Who in their right mind would not agree with the potential benefits of identifying and understanding problems, and taking the necessary actions to mitigate their recurrence, while also promoting best practices?

The RCAF, the Canadian Army, and the Royal Canadian Navy maintain lessons learned programmes. Although these programmes are unique to each environment, all rely on the chain of command to steer implementation and execution, assisted by qualified lessons learned staff officers (LLSOs). The goal of these lessons learned programmes is also the same: the pursuit of organizational cultural change so as to become effective learning organizations, with a Canadian Forces warfare centre in the middle, focused on taking an active role in joint lessons learned processes.

Programme implementation

In December of 2011, an implementation directive towards operationalizing the RCAF LLP was published by the Commander RCAF. This document marked the transition from planning and concept building to "doing." The Air Division commanders now had the necessary direction and guidance to deliver their orders and so on down the chain of command. Finally there was focus, a need for establishing lessons learned staff structures as well as developing strategic- and operational-level plans for collecting information commensurate with the Commander RCAF's needs. CFAWC, as the RCAF lessons learned centre of excellence, provided on-call mentoring assistance to the cadre of wing LLSOs, through its Analysis and Lessons Learned (A&LL) Branch. Efforts were focused towards developing collection plans / communication strategies and emphasized the importance of sharing information across communities.

Challenges

Implementation of the RCAF programme has not been all smooth sailing. As one reads further, it is necessary to acknowledge that, with any considerable organization, cultural transition will take time. Often in this regard we have witnessed parallels drawn between the lessons-learned programmes and flight-safety programmes. So what are these so-called "challenges," exactly?

Establishing a pan-RCAF battle rhythm has been slow going, and it has proven difficult to source trained LLSOs for deployment on exercises and operations. A&LL personnel have filled many of these positions, but the expectation is that eventually the requirement will be met by tasking from the pool of more than 150 individuals already trained by CFAWC. A major constraint of the LLP is the fact that all resources (personnel, funding, and equipment) must come from existing capacities. Budgetary restrictions and the reality of a great organization that is simply not blessed with an abundance of extra bodies, let alone the personnel who may possess the necessary operational and staff experience to truly enable the LLP, are facts that speak for themselves. Consider this: the majority of qualified lessons learned staff selected by their applicable commanders, commanding officers, and senior staff have primary duties that exist outside of the LL domain.

Discussions surrounding existing challenges with the RCAF LLP would not be complete without considering the five-step process (see Figure 1).

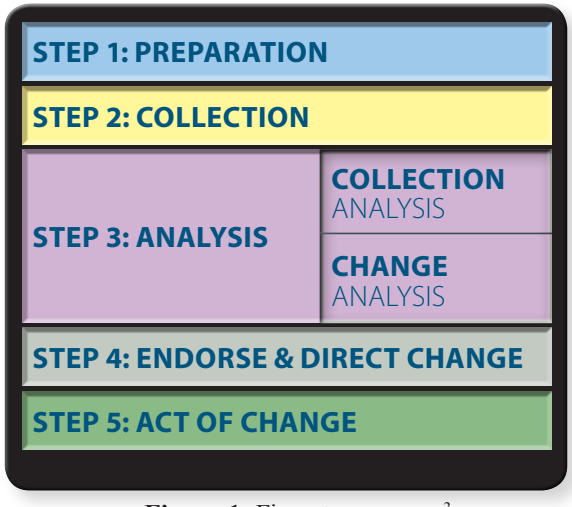

Figure 1: Five-step process[3]

Though positive results have emerged from efforts in the first three steps of the process, we continue to struggle with gaining the necessary traction within the realms of Endorse and Direct Change and Act of Change. Few results stemming from these steps and Change Analysis as a function of Step 3 have considerably slowed our momentum towards achieving lessons learned. Often misused in terminology, a lesson learned is declared once a change is put into effect as a result of analysis and the intended results of this change are then validated. Read further to discover what course of action will determine why our programme has not yielded lessons learned and what strategy will assist in getting us on track.

CAF Photo: Cpl K McMillan

Phase 3 and beyond

As listed in the Commander RCAF's implementation directive and further described in the lessons learned campaign plan, the LLP is being executed in four phases:

1. establish core elements;
2. implement the battle rhythm;
3. validate the programme; and
4. steady state.

The RCAF LLP must be validated before steady state can initially be recognized. The intended course of action to determine any deficiencies and/or best practices with programme implementation is for CFAWC to lead in the development of a validation plan. Once this plan is implemented, any necessary policy changes will be managed in the spirit of Steps 4 and 5 of the lessons learned process; in effect, we shall apply this process to the LLP.

While strategizing the transition of the RCAF LLP into phase 3, the A&LL Branch has begun the important process of reviewing and updating the BGA005780/AG001, *Air Force Lessons Learned Programme Manual*. The result will be a capstone publication more polished than the original, which still maintains the necessary depth and detail of information.

Conclusion

The CFAWC A&LL Branch looks forward to continuing collaboration with lessons learned stakeholders from outside of and within the RCAF. There are currently two projects with which CFAWC is assisting. The first is through support to 1 Canadian Air Division (Cdn Air Div) Lessons Learned Staff with information management and analysis of a variety of historical post-activity reports (PARs) dating back as far as March 2010.[4] The objective of this project is to identify trends in problem areas and/or best practices so as to facilitate change-management steps, as necessary. Work completed thus far has identified planning for joint and combined operations as well as training as the most common trends requiring improvement. The second project is in support of a 2 Cdn Air Div–led pilot-training system analysis. Its objective is to provide a report of findings and recommendations which could influence the future of all flying training in the RCAF.

Lessons learned is a burgeoning mechanism within the CAF and one which extends to our allies. A successful programme will not succeed with the efforts of only a few. Perhaps you, too, will embrace the notion that this great programme will one day be established as an institution of continuous learning and improvement, as it was originally envisioned. All hands on deck, as it will take the efforts of us all to see this through.

Major (Maj) Dax Chambers has been a member of the Analysis and Lessons Learned Branch at CFAWC since 2010. He was employed as the lessons learned officer for the air component coordination element during Exercise MAPLE GUARDIAN in the fall of 2011 and returned to Wainwright the following year in a similar capacity. Maj Chambers spent a combined six months in the former country of Yugoslavia as a line pilot with the CH146 Griffon Helicopter Detachment from November 2002 until July 2003. In addition to his first tour at 427 Squadron, Petawawa, Maj Chambers' other postings while a member of the Air Force have included RMC Kingston and 400 Squadron, Borden. Maj Chambers resides in Kingston, Ontario.

Abbreviations

A&LL	analysis and lessons learned
CAF	Canadian Armed Forces
Cdn Air Div	Canadian Air Division
CFAWC	Canadian Forces Aerospace Warfare Centre
LLP	Lessons Learned Programme
LLSO	lessons learned staff officer
Op	Operation
PAR	post-activity report
RCAF	Royal Canadian Air Force

Notes

1. Mario Fortin, "The Air Force on Its Way to Continuous Improvement," *The Canadian Air Force Journal* 4, no. 2 (Spring 2011), 55.

2. For the full report, titled "AF-AP-2010-01 Airlift Command and Control - OPERATION HESTIA - Final Report," see the Knowledge Management System (KMS), accessed June 25, 2014, http://kms.mil.ca/kms/CentralInstance.aspx?Type=Operation&Id=565. Note: this site can only be accessed via a Defence Wide Area Network (DWAN) computer.

3. This figure originally appeared in *The Canadian Air Force Journal* 4, no. 2 (Spring 2011), 57.

4. A PAR is defined as a "report generated after any military activity to record what happened, why it happened, and how it can be improved or maintained. Note: Post activity reports include after-action reports (AARs), post-deployment reports (PDRs), post-exercise reports (PXRs), post-operation reports (PORs), etc." (*Defence Terminology Bank*, record 43732).

CAF Photo: Cpl Vicky Lefrançois

THE JFACC AND THE CAOC-CENTRIC RCAF:

CONSIDERATIONS FOR THE EMPLOYMENT OF AIR POWER IN JOINT OPERATIONS

By Major Pux Barnes, CD, MA

Article #2 in a series on command and control and the Royal Canadian Air Force[1]

Introduction

During the century since the first flight, air power has experienced a startling evolution. Compared with the aircraft, systems and personnel of even 50 years ago, today's technology and training have developed an impressive array of skills and capabilities, resulting in an air force well-suited to serve citizens at home and abroad. When one considers the potential advantages and impact of air power's characteristics (such as elevation, precision, reach and speed), the Royal Canadian Air Force (RCAF) offers current policy makers a wide range of options to respond to domestic situations and participate in the international arena in a meaningful way. Every week of the year, the RCAF employs its many capabilities to support domestic operations including search and rescue, humanitarian assistance, evacuation, support to forest-fire fighting and security assistance, to name but a few.

Recent RCAF participation in the crises of Haiti, Libya and Mali illustrate the value of air power in the exercise of Canadian foreign policy. Each of these international operations was fundamentally different: disaster response and humanitarian assistance in Haiti, enforcement of a no-fly zone and subsequent destruction of ground forces in Libya, and provision of airlift to support land forces combating an insurgency in Mali.

Like all military endeavours, air-power operations can be complex and fast moving. Add to this the fact that air power is inherently joint, providing support to both the land and maritime environments (often simultaneously), and operations become increasingly complex. Air power has become not only ubiquitous but also indispensible in modern military operations. While it's nice to be wanted, the RCAF must ensure it can deliver air-power effects whenever and wherever they are needed. As all air personnel know, air operations "have a lot of moving parts."

With so many different possibilities for employing air power, how does the RCAF manage to provide forces in an effective and timely way, anywhere on the globe? Clearly, part of the answer lies in the highly trained and capable tactical air force, embodied in our wing and squadron/unit organizations. This part of the RCAF works well, continuing the proud tradition of successfully accomplishing the mission time and again. The other part of the answer lies in effective command and control (C2) at the operational level, a process driven by the joint force air component commander (JFACC) and the combined air operations centre (CAOC), located in Winnipeg.

Critically important to air-power operations today, the JFACC and CAOC represent the best model for the effective centralization of control for the myriad operations in which the RCAF participates. Building on the success of our allies, who developed the air component commander (ACC) and air operations centre (AOC) concept, the RCAF has evolved over the past five years into an air force whose operations are effectively coordinated and centrally controlled. Given the utility of air power and the demands being made on it by the government for employment in both domestic and international venues, the continued success of the JFACC, CAOC and the operational-level C2 structure is an imperative.

The ACC and AOC: A short history

The practice by military forces to centralize their key personnel within a formed headquarters (HQ) unit doubtless has its origins in ancient times. Military commanders at all levels have always needed a small core group of senior advisors to assist with decision making and then to take care of the details of planning and executing military operations. Most of the major conflicts in the 20th century involved the militaries of several countries, formed together under an overall "supreme" commander at the strategic level. Generally though, each country retained "national" command over their forces, with each service having a separate command structure. Towards the end of the Second World War, the United States military began to experiment with a joint HQ concept that permitted a single commander to exercise authority over all maritime, army and marine air forces assigned to a given operation. This organization became known as the joint task force (JTF).

Enter the JTF

The island-hopping campaign in the South Pacific was tailor-made for the JTF architecture, allowing one naval officer to command a complex operation that included United States Navy ships as well as landing craft, carrier-based aircraft and long-range bombers of the United States Army Air Force, all supporting amphibious landings of the United States Marine Corps. It was the JTF commander (JTF comd) who set the goals and priorities for the individual component commanders. Each component of the JTF was led by a different officer—a sailor, airman or marine—who understood how to exploit their service to the maximum extent in order to accomplish the overall aims of the JTF comd. Without the ability to perform centralized planning and coordination, operations of this complexity would likely have been difficult to accomplish.

DESERT STORM, the JFACC and the CAOC

The 1990–1991 Gulf War represented the first post–Cold War use of the component structure of the JTF. The JTF comd delegated control authority of the maritime, land, air and support "components" to the senior officer of each respective service.[2] The air component was commanded by United States Air Force Lieutenant General Charles "Chuck" Horner, who was responsible for planning and coordinating the activity of the air forces from all contributing countries of the coalition. Horner operated under the working title of JFACC, advertising the fact that he was the single officer responsible for the air campaign. Horner formed a robust CAOC to handle the details of planning and executing the air operation. The role of the JFACC and, indeed, much of the air operations cycle and battle rhythm of the CAOC that we employ today were developed during Operations DESERT SHIELD and DESERT STORM.[3]

The first JFACC: LtGen "Chuck" Horner briefing the media during Operation DESERT STORM in 1991

NATO and the combined joint task force

The successful JTF concept came to the North Atlantic Treaty Organization (NATO) in 1994 as part of redesigning the alliance's integrated command structure. The United States proposed the idea of establishing several combined joint task force (CJTF) HQs to provide "flexible command arrangements within which allied forces could be organized on a task-specific basis to take on a wide variety of missions beyond the borders of alliance countries."[4] In this case, the idea of a single JTF comd, exercising command over a multinational HQ, would be fused with individual component commanders, such as a combined joint force air component commander (CJFACC), exercising command over their respective HQs.[5] The CJFACC exercises operational control (OPCON) over the assigned multinational forces of each alliance member in order to task air-power missions. At all times, a Canadian Armed Forces (CAF) officer exercises operational command (OPCOM) of the RCAF elements assigned to NATO operations. This arrangement of *national command* and *alliance control* is a hallmark of NATO operations.[6] It is also the model for coalition operations.

The JTF concept and the CAF

The CAF adopted a version of the JTF model during the late 1990s in an attempt to organize forces for domestic operations. The resulting regional joint task force (RJTF) model provided a single commander with an HQ but no specifically named maritime, land or air component commanders. It was assumed that Air Command would provide forces as required to support each RJTF comd and would also ensure C2 was coordinated at the operational and tactical levels. In practice, there was no "air force" C2 process; rather, it was the commander of each group that provided support and the necessary C2 to accomplish the mission.[7] Each group had its own operations centre and planners to accomplish the required coordination. In the end, the RJTF/JTF (see Figure 1) has become a flexible structure that permits commanders to coordinate domestic military operations.

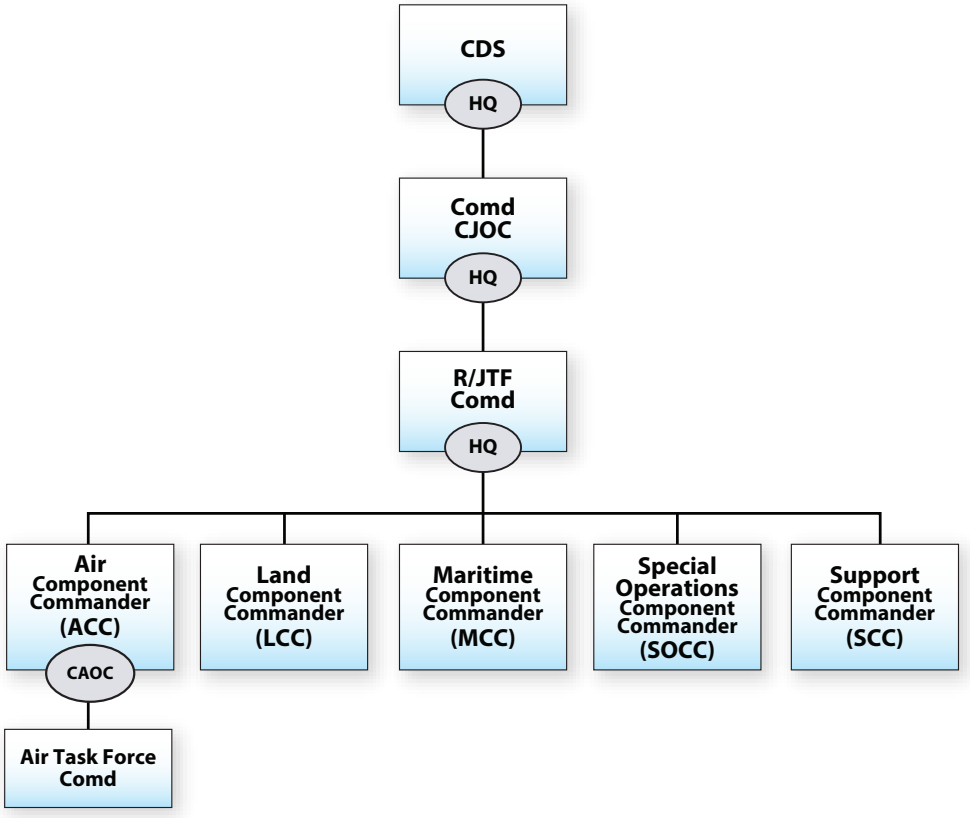

Figure 1. The Canadian Armed Forces RJTF/JTF

1 Canadian Air Division and the CAOC

It was not until the establishment of 1 Canadian Air Division (1 Cdn Air Div) in 1997 that one operational-level HQ began to develop within Air Command. Initially meant to serve as the Canadian North American Aerospace Defence Command Region (CANR) HQ, the 1 Cdn Air Div AOC functioned only during North American Aerospace Defence Command (NORAD) exercises and operations. After 9/11, the AOC began to take on the role of AOC for all Air Force operations, expanding slowly from being a situational-awareness tool of the 1 Cdn Air Div / CANR Commander, to the more fully functioning CAOC. The CAOC was formally stood up in June 2008, and the title of JFACC was officially adopted following Operation PODIUM, which provided support to the 2010 Olympic Winter Games.

In order to better understand the RCAF's operational-level C2 process, it is important to see the 1 Cdn Air Div staff and CAOC personnel as part of a team, led by the Canadian Joint Operations Command (CJOC) staff, that provides a continuous plan-to-task effort, translating a concept of operations into specifically defined and articulated orders for wings and squadrons/ units to execute. The staff formulates plans and assesses what courses of action (COA) could be taken to meet the intent of the JFACC, while the CAOC translates the chosen COA into directives, such as an air tasking order (ATO), used by the tactical level of the Air Force.[8]

The JFACC—the CAF's "standing ACC"

The JFACC is the CAF's only air component commander and, as such, can be considered the "standing ACC" for the CAF. The JFACC integrates air effects into joint, combined operations and fulfills three important roles (shown in Figure 2), including:

a. **Role 1: JFACC to the Comd CJOC**. The Comd RCAF has designated the JFACC, on a day-to-day basis, as the commander responsible for making recommendations to the Comd CJOC on the proper employment and C2 of all assigned, attached and made-available air forces. The JFACC advises on domestic, global and expeditionary operations. To accomplish these responsibilities, the JFACC employs the CAOC and a JFACC liaison officer (LO), located permanently at CJOC HQ, to facilitate operational-level coordination and planning. Depending on the existing span of control, the JFACC will recommend to the Comd CJOC that either the JFACC or an independent ACC be assigned to an operation. The Comd CJOC normally delegates OPCOM of assigned air power to the JFACC in operations that support CJOC's domestic and global operations.

b. **Role 2: JFACC to an RJTF/JTF Comd**. When assigned to a domestic or continental[9] operation, the JFACC assumes all responsibilities to provide air-power *support* to an RJTF/JTF comd. The JFACC is responsible for all aspects of conducting the air campaign, including (for both joint and component) planning, tasking, executing and overseeing operations as well as assessing the effectiveness of air effects. The JFACC normally exercises OPCOM of assigned air power.[10] To accomplish these responsibilities, the JFACC employs the CAOC and an ACCE at each RJTF/JTF HQ.

c. **Role 3: CANR Comd**. The JFACC is also the CANR Comd and is accountable to the Commander North American Aerospace Defence Command for exercising C2 of all air forces assigned, attached and made-available to the NORAD mission in CANR. To accomplish these responsibilities, the JFACC employs the CAOC, the Canadian Air Defence Sector (CADS) and assigned forces at various operating locations.

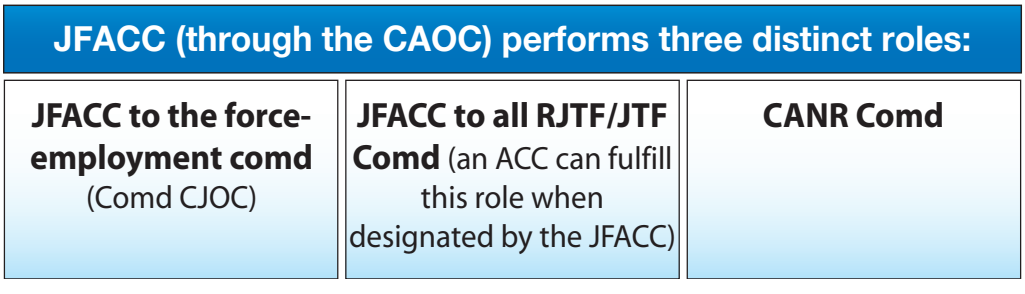

Figure 2. The JFACC's three roles

Looking to the future

The JFACC's continuing roles. The CAF will likely continue to perform operations that vary considerably in terms of scope, complexity and geographic location. Given that air power is a vital part of virtually all military endeavours, the RCAF can expect to participate regularly, supporting either the Comd CJOC or Comd Canadian Special Operations Forces Command for

domestic or expeditionary operations. Given the history of success with the ACC concept, the continuing need to have one airman/airwoman as the focal point for planning and executing air-power operations in a joint/combined operation cannot be understated. The JFACC will, therefore, continue to be the key leader performing the three critical roles. JTF comds will continue to rely upon the "air expertise" that the JFACC brings to the table, in the same way that they rely upon senior Navy, Army, special operations and sustainment officers to perform the key roles of maritime component commander (MCC), land component commander (LCC), special operations component commander (SOCC) and support component commander (SCC). The role of JFACC will endure.

The CAOC as critical C2 nexus. If there is no "going back" from the established roles of the JFACC, there must be a similarly understood tenet that the CAOC will remain the nexus for air-power operations in the future. The JFACC relies upon the CAOC to perform the principal role of being the centre from which air operations are directed, monitored, controlled and coordinated with the other components. The CAOC is, by design, structured to operate as a fully integrated facility and includes the personnel and equipment necessary to accomplish the planning, directing, controlling and coordinating of theatre-wide air operations. The CAOC provides the JFACC with the critically important situational awareness required to execute successful air-power operations. The role the CAOC plays in the effective exploitation of limited air-power resources for employment across Canada and around the world is the key to its growing success. The RCAF today is arguably better organized and better coordinated because of the CAOC-centric operations that have developed over the past decade.

Challenges and solutions. The current CAOC is hampered somewhat, however, by its size. With approximately 100 personnel assigned to it,[11] the CAOC will find it increasingly difficult to meet the growing demands upon air power by JTF commanders. Often the difficulty in supporting an operation lies not in the available people, aircraft or radars, it lies in the ability of the CAOC to effectively plan, execute and monitor multiple, protracted operations across the country and around the globe, all in different time zones. In order to meet this growing demand, the CAOC will require more personnel who are experienced in both tactical- and operational-level air-power activities. These personnel are hard to come by and must be given training in the air operations plan-to-task cycle in order for the RCAF to capitalize on their experience. In order to do this effectively, the RCAF must fast-track the growth of its operational-level professional-development programme to provide both leadership and battle-staff training. Already, gains are being made with the Air Force Officer Development (AFOD) Program, Block 5 course and the ACCE Seminar, but more has to be done to ensure a CAOC-centric culture is fully understood by the RCAF's current and future generations of the RCAF.

Summary

It is important to keep in perspective the fact that while the JFACC and CAOC concepts are relatively new to the RCAF, they have been evolving among our allies for over half a century. The JTF model, placing the responsibility to deliver air power in the hands of an air force officer in the role of ACC, has been successful in major operations since the end of the Cold War and is the norm for NATO and the United States. It is the responsibility of RCAF leadership at all levels to ensure the message of effective C2 of air power in joint/combined operations is best served by the ACC/AOC concept. In short, the JFACC and CAOC-centric air force are here to stay.

Abbreviations

1 Cdn Air Div	1 Canadian Air Division
ACC	air component commander
ACCE	air component coordination element
AOC	air operations centre
C2	command and control
CANR	Canadian North American Aerospace Defence Command Region
CAOC	combined air operations centre
CDS	Chief of Defence Staff
CAF	Canadian Armed Forces
CJFACC	combined joint force air component commander
CJOC	Canadian Joint Operations Command
CJTF	combined joint task force
COA	course of action
comd	commander
HQ	headquarters
JFACC	joint force air component commander
JTF	joint task force
NATO	North Atlantic Treaty Organization
NORAD	North American Aerospace Defence Command
OPCOM	operational command
RCAF	Royal Canadian Air Force
RJTF	regional joint task force

Notes

1. This is the second in a series of short articles on the subject of command and control in the RCAF. For more detailed information, consult B-GA-401-000/FP-001, *Canadian Forces Aerospace Command Doctrine*, found on the Internet at http://www.rcaf-arc.forces.gc.ca/en/cf-aerospace-warfare-centre/aerospace-doctrine.page and the Defence Wide Area Network at http://trenton.mil.ca/lodger/CFAWC/CDD/Doctrine_e.asp (both sites accessed October 30, 2013).

2. These positions were: joint force air component commander (JFACC); joint force maritime component commander (JFMCC); joint force land component commander (JFLCC); joint force special operations component commander (JFSOCC); and joint force support component commander (JFSCC).

3. Tom Clancy and Chuck Horner, *Every Man a Tiger: The Gulf War Air Campaign* (New York: Putnam Books, 1999).

4. Stanley Sloan, *Permanent Alliance? NATO and the Transatlantic Bargain from Truman to Obama* (New York: Continuum Publishing, 2010) 150–51.

5. Normally, an ACC (or JFACC or CJFACC) only *commands* the air component, comprised of the necessary staff and AOC personnel, assigned to the air component HQ of a given operation.

6. During allied/coalition operations, a Canadian JTF provides forces to be employed in concert with those of other participant countries within the CJTF. All CF personnel and equipment remain under the command of a single officer called the Canadian national commander (CNC). The CNC also performs the role of Canadian JTF comd for all assigned Canadian forces in the event of a national tasking which is separate from the allied/coalition operation.

7. From the Second World War until the mid 1990s, the operational-level HQ, known as the group, ensured that staffs worked theatre-level issues for different flying communities across the country. For decades, group commanders supported by senior staff officers ensured that institutional continuity endured for the squadrons and units that comprised Air Transport Group, Fighter Group, Maritime Air Group, 10 Tactical Air Group and 14 Training Group.

8. A detailed description of the CAOC and its various processes will be discussed in the next article in this series.

9. "Continental" operations include those relatively close to Canada such as Haiti (Operation HESTIA), Iceland (Operation IGNITION) and Jamaica (Operation JAGUAR).

10. As established by the CDS Directive on Canadian Armed Forces Command and Control and the Delegation of Authority for Force Employment, 28 April 2013.

11. The CAOC establishment is approximately 100 personnel located at 1 Cdn Air Div / CANR HQ in Winnipeg. In addition, approximately 30 personnel are located at CJOC HQ and RJTF HQs in various ACCE detachments.

THE RCAF THEATRE AIR CONTROL SYSTEM:

CONSIDERATIONS FOR THE EMPLOYMENT OF AIR POWER IN JOINT OPERATIONS

By Major Pux Barnes, CD, MA

Article #3 in a series on command and control and the Royal Canadian Air Force[1]

The story begins[2]

Into the clear blue. As the landing gear retracts after take-off, the two Royal Canadian Air Force (RCAF) CF188 Hornets commence a climb into a clear blue sky from a deployed operating base to fly their assigned missions. Canada has deployed a Canadian Armed Forces (CAF) joint task force (JTF) to be part of a North Atlantic Treaty Organization (NATO) operation somewhere in the world, and a major part of the CAF JTF is an RCAF air task force (ATF) comprised of a number of personnel, equipment and capabilities. Throughout the coming five-hour mission, the fighter pilots will come into contact with a complex and interconnected series of command and control (C2) organizations that will perform a number of functions, all dedicated to helping them accomplish one thing—the mission. This network of people, organizations and sensors is known as the theatre air control system (TACS).[3]

Since they arrived for mission planning that morning, the pilots began working with elements of the TACS, a continuous coordination that would not end until post-mission reporting was completed later that day. After the details of the mission were wrapped up at the squadron operations centre (SQOC), the pilots coordinated with the CC150(T) Polaris crew who would be launching before the Hornets, in order to provide the air-to-air refuelling (AAR) necessary to get the ordnance-laden fighters to their assigned combat air patrol (CAP) locations for the three-hour on-station time and then home again. The coordination continued with military air traffic control (ATC) as the aircraft started their engines, taxied and took-off.

Once airborne, they are handed off to the en route ATC who takes them to the area of operations (AO). The air tasking order (ATO) published by the NATO combined air operations centre (CAOC) directs them to then contact their tactical controller, a NATO E-3A airborne warning and control system (AWACS) aircraft orbiting off the coast at 30,000 feet [9,144 metres] on a relatively "short" 14-hour mission. The AWACS crew coordinates the AAR between the RCAF aircraft, and after topping up with 7,000 pounds [3,175 kilograms] more fuel each, the fighters go "feet dry" as they cross the coast to take up their CAP positions, flying a racetrack orbit as they wait to be called. The Hornets are carrying an array of weapons and sensors to assist troops on the ground who come into contact with the enemy, specified by the acronym "TIC," meaning "troops in contact." The goal is to respond within seconds when they get that call.

Pushing south. Receiving periodic updates from their tactical controller (the AWACS), the Hornet pilots settle in for a potentially long three hours. As the mission progresses, the pilots are given a change to their planned mission. It seems that the combat operations desk at the CAOC has received credible intelligence that a threat might be emerging in another part of the AO where friendly ground troops are operating. The combined joint force air component commander (CJFACC) has decided to push the CAP another 30 kilometres inland to ensure the Hornets are better positioned to help, if need be. Since this airspace belongs to another tactical controller, the Hornets switch frequencies and contact the tactical control radar (TCR) controllers on the ground. The AWACS crew keeps radar contact and monitors the radio transmissions of the Hornets as they move further south, for the E-3A is responsible for maintaining the AO's recognized air picture (RAP) that feeds the CJFACC's common operating picture, which, in turn, provides critical situational awareness (SA) of the constantly changing battlespace.[4]

The TCR controllers advise the Hornet pilots of the unfolding situation on the ground. A Canadian Army brigade is preparing to operate in a valley where the enemy has recently been seen. The brigade is supported by an RCAF aviation brigade comprised of CH146 Griffon and CH147 Chinook helicopters, who will be flying below 300 metres above ground level (AGL). The controller reminds the fighter pilots of the presence of the helicopters working the low-level airspace and that each one can be positively identified by their ATO information, including call sign and transponder codes. Since the enemy also has helicopters, it's vital to be able to distinguish friend from foe. Besides these RCAF helicopters, there is a CP140 Aurora flying a surveillance mission somewhere in the area, and two CC130J Hercules are expected to resupply the brigade within the next hour. Since these aircraft will be under tactical control (TACON)[5] of someone within the TACS, things will go well.

In the descent. Before long, the TIC call comes, and the Hornets are directed to leave their CAP and descend towards the troops making the call. The Hornets' mission has just changed from CAP to close air support (CAS).[6] The TCR controllers "push" the pilots to another radio frequency to contact their new tactical controller, the tactical air control party (TACP), a joint

Air Force–Army organization that coordinates all air activity in the airspace around the ground forces. The TACP controller updates the pilots on the location of the TIC and advises of other target-area details. As the pilots rapidly descend below 3,000 metres, they are advised of the location of other aircraft in the vicinity, both manned and unmanned. The TACP controller pushes the fighter pilots to their next tactical controller, the forward air controller (FAC) who is with the ground unit taking fire from the enemy.

The FAC's relief is apparent over the radio. The need for CAS is immediate as each time the FAC transmits, the pilots hear the distinct "plink-plink" sound of enemy fire bouncing off the hull of the armoured vehicle the FAC is kneeling behind. The FAC provides exacting directions to the pilots about what is required—a high-speed pass down the valley at low altitude with afterburners on as a show of force to scare the enemy off the ridge above the valley floor. But this "show of force" requires CJFACC approval before the lead fighter pilot can descend that low, due to the potential risks from the enemy and airspace conflicts with friendly forces. Remember … the helicopters are still down there somewhere. How does a FAC who is 1,000 miles [1,609 kilometres] away from the CJFACC get approval for this show of force? More importantly, *how can that approval happen within seconds, not minutes?*

Enter the TACS. Critical to the success of any military operation is the understanding of both the chain of command and the function of commanders and organizations at various levels. It is through this structure that commanders exercise the command and control of complex air-power activities, effectively integrating air effects into joint operations. The modern TACS has its origins in the Second World War during the Battle of Britain, where the Royal Air Force (RAF) Fighter Command utilized a complex system of radars, radios and control centres (see Figure 1) to direct Spitfires and Hurricanes against raids by the German Luftwaffe. Once scrambled, fighter squadrons could be directed towards the incoming enemy. Once a dogfight was over, the fighters could be immediately reassigned to intercept new targets using the same imagery as viewed on the ground-based controllers' radar screens. Agility on the part of the fighters was critical as flight time was limited by fuel. In the face of overwhelming odds, this coordination between radar and fighter pilot served to effectively multiply the effect of the RAF's defences and gain ultimate victory. The raison d'être of the TACS has remained essentially the same since then—making air power as agile, versatile and flexible as possible.

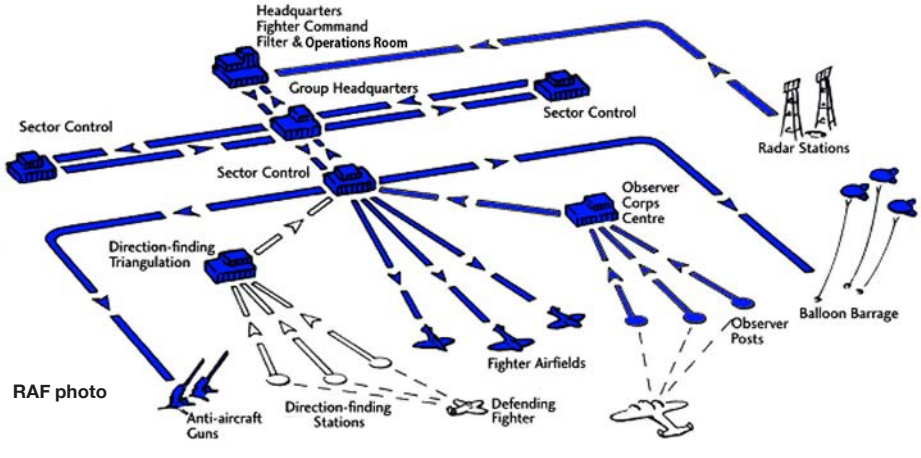

Figure 1. The RAF's Fighter Command air defence system in 1940

Sector Operations Centre Middle Wallop with (L to R) command staff, communications staff, map board staff and fighter squadron status boards

RCAF theatre air control system

Good news—the RCAF has a TACS. RCAF operations are also controlled through an overarching TACS. The TACS is centred on the CAOC and includes the organizations, units, personnel, equipment and procedures necessary to plan, direct and control air operations as well as to coordinate air operations with other components in the joint environment. The RCAF TACS includes the following elements of the air C2 chain that provides operational and tactical C2 of forces executing air power missions:[7]

a. **Combined air operations centre.** Located in Winnipeg, it is the principal centre from which air operations are planned, directed, monitored, controlled and coordinated with the other components. It is structured to operate as a fully integrated facility and includes the personnel and equipment necessary to accomplish theatre-wide air operations. The CAOC provides the RCAF's joint force air component commander (JFACC) with the SA required to execute domestic and global air operations.

b. **Air component headquarters (ACHQ)** is a scalable, operational-level headquarters (HQ) that supports an air component commander (ACC) who is not physically located at the CAOC. An ACHQ consists of a combination of A-staff and operations personnel who provide the deployed ACC with SA and perform the planning and coordination between the ACHQ, the JTF HQ and the CAOC, employing reachback. The ACHQ is a critical requirement that permits the ACC to integrate air effects into joint operations not controlled by the RCAF CAOC.

c. **Air component coordination element (ACCE)**[8] is a scalable, planning and coordination team assigned by the JFACC to support various operational-level commanders. An ACCE is responsible for conducting operational-level planning and coordination to facilitate the integration of air effects into joint operations. Whenever possible, an

ACCE will leverage the capabilities of the CAOC by employing reachback. Deploying an ACCE is an option when the Canadian JFACC is physically separated from the JTF HQ or a Canadian JTF is part of an allied/coalition operation possessing its own CJFACC. The RCAF possesses a deployable ACCE at 2 Wing. An ACCE is normally deployed to the following locations:

(1) **Canadian Joint Operations Command (CJOC) HQ.** Normally, a standing ACCE is permanently located at CJOC HQ;

(2) **Regional Joint Task Force (RJTF) HQ**. Normally, standing ACCEs are permanently located at each CAF RJTF HQ;

(3) **JTF HQ.** When a JTF commander—other than an RJTF commander—is designated to command an operation, an ACCE is employed at the JTF HQ;

(4) **ACHQ**. An ACCE is employed at an ACHQ to support a deployed ACC; and

(5) **Allied/coalition CAOC and national command element (NCE)**. During allied/coalition operations, the Canadian national commander (CNC) employs an ACCE at both the allied/coalition CAOC and the Canadian NCE HQ.

d. **Control and reporting centre (CRC)** is a ground-based, integrated C2 unit that may be static, mobile or deployable. Subordinate to the CAOC, the CRC is responsible for the decentralized execution of all defensive air, offensive air and airspace management activities within an assigned area. This is accomplished through surveillance, identification, weapons control, positive and procedural airspace control as well as datalink management. The CRC produces a recognized air picture that contributes to the overall common operating picture. The RCAF employs 22 Wing as a CRC on a daily basis and can deploy TCR squadrons from 3 and 4 Wings as CRCs.

e. **Wing operations centre (WOC)** performs continuous coordination between the CAOC, wing and subordinate squadrons. The feasibility of CAOC-assigned missions and tasks are verified by the WOC. The WOC monitors mission progress, ensures mission result reporting and provides continuous near real-time status of information to the CAOC. WOCs can be found at most RCAF wings, including the deployable air expeditionary wing (AEW), 2 Wing.

f. **Squadron operations centre** coordinates with the WOC and is responsible for preparing assigned missions and tasks, their timely execution and reporting mission results via the WOC to the CAOC.

g. **Combat operations centre (COC)** performs the role of C2 link between the CRC and Alert Force Commander for North American Aerospace Defence Command (NORAD) operations. The COC provides the CRC with continuous reporting and the status of NORAD-assigned resources while providing the Alert Force Commander with SA updates. The COC represents a vital link in the C2 chain between the JFACC and NORAD-assigned aircraft captains. 3 and 4 Wings each employ COCs.

h. **Tactical air control party** is the principal liaison and control element aligned with land force manoeuvre units from battalion to corps. The primary mission of a TACP is to advise the respective ground commanders on the capabilities and limitations of air power and to assist the ground commander in planning, requesting, coordinating and controlling air effects. RCAF personnel are assigned the TACP role.

i. **Forward air controller** is "[a] qualified individual who, from a forward position on the ground or in the air, directs the action of combat aircraft engaged in close air support of land forces."[9] A FAC operating from an airborne platform is known as a FAC(A). RCAF personnel are assigned the FAC role.

FACs call in a "show of force" from an A-10 Thunderbolt

A typical CAOC

Closing the TACON loop

Once the components and overall purpose of the TACS are understood, one can appreciate how it actually goes about collectively enhancing air power's agility. This process is particularly important when seen through the lens of asymmetric warfare, where the need exists to respond to mission changes in order to take advantage of fleeting, dynamic targeting opportunities. Commanders at all levels rely upon the TACS to action the rapid changes required of air power. Aircraft have returned to base many times after having flown a mission that, as a result of significant changes while en route, looked nothing like the mission originally assigned in the ATO. The fast-moving nature of joint warfare demands that aircraft be flexible, sometimes to the extreme. A well-coordinated TACS manages these changes, even ensuring that a FAC can

get a mission change approved on "the fly." It is by ensuring there are no breaks in the tactical control of aircraft during the entire length of the mission that the TACS can best serve the dynamic needs of the battlespace.

Closing the "TACON loop"[10] is the responsibility of the ACC, the operational-level commander who controls the TACS.[11] When a well-established TACS is able to respond quickly to change requests from the field, the request/approve/coordinate/execute (RACE) cycle speeds up, and air power increases its agility, flexibility and relevance to the joint force commander. When seen in terms of C2 relationships, the key is ensuring that elements of the TACS are able to provide sufficient TACON of aircraft during all phases of flight. As illustrated in Figure 2, an aircraft flies an "ATO mission path" that interconnects with elements of the TACS that exercise TACON over the mission. These TACON elements are interconnected with each other and with the ACC at the CAOC. When any one element of the TACS passes a request to change an ongoing mission, simultaneous activity occurs which provides expanding SA to all players, while the request is considered at the CAOC. Once approval is given, the TACS ensures the message is transmitted through all elements to the affected aircraft. In many cases, decision authority can be delegated to a TACON element to speed up the process.

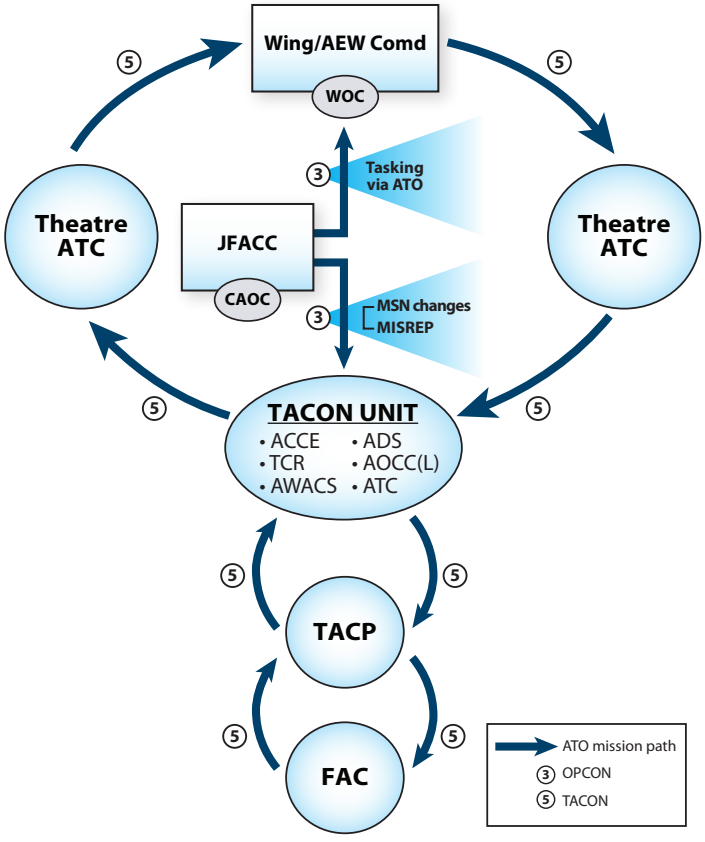

Figure 2. Employing the TACS: Closing the TACON loop

The RCAF "TACON loop." For the RCAF, the "ATO mission path" for any aircraft tasked in an ATO starts with the CAOC, the organization that issues the ATO (on behalf of the JFACC) to a wing's or AEW's WOC. The WOC ensures that squadrons are properly supported so that they can fly the ATO mission as "fragged."[12] Because ATO production occurs in the days preceding the actual day of flying, mission changes can be transmitted from the CAOC to the WOC before the mission starts. Anytime the aircraft is in motion, even during taxi and departure, ATC or the WOC can pass mission changes.[13]

Once with a TACON unit, mission changes can be dealt with fairly quickly, as previously described. Aircraft on the outbound and return legs of their "ATO mission path" can also be reached for mission changes. If, for example, the aircraft replacing you becomes unserviceable or is otherwise dynamically retasked, your return to base (RTB) could be delayed. The TACS can redirect you to a tanker for more fuel and put you back into the fight. The TACON loop completes its cycle once the aircraft lands and mission reporting is complete.

RCAF CC150(T) Polaris refuels a pair of CF188 Hornet

Summary

It is a fact of modern conflict that the battlespace is becoming increasingly complex and fast paced. If air power is to remain sufficiently flexible to meet the evolving challenges of a busy airspace, employed at all altitudes by both manned and unmanned systems, it will need to rely upon a well-equipped and trained TACS. The RCAF has developed a TACS that can meet the needs of any domestic or deployed operation, all the while preparing our aircrews and C2 personnel to operate effectively within the air control systems of NORAD, NATO or potential coalition partners. It is imperative that exercise planners begin to incorporate elements of the TACS as they prepare the RCAF to meet its future deployment goals.

Epilogue

And just how did that FAC eventually receive last-minute approval for the "show of force" needed to solve the TIC situation in that valley? A well-organized TACS provided the conduit. In this particular scenario, the FAC coordinated the CAS with the fighter pilots, and that conversation was monitored by both the TACP and the AWACS. The AWACS requested the mission change from the CJFACC at the CAOC. Once approved, the message was sent via reverse route to the FAC, while that TACP coordinated a temporary clearance of the valley of helicopter traffic and all supporting artillery fire. The mission was successfully concluded, and the air effect worked. This "show of force" example is based on real occurrences during Operation ENDURING FREEDOM, representing a realistic illustration of the TACS in action. The length of time required for a round trip of requests of this nature during the operation was routinely under 30 seconds. While any TACS can be justifiably proud of actioning such a quick response, 30 seconds can be an eternity for the FAC in that valley.

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Abbreviations

AAR	air-to-air refuelling
ACC	air component commander
ACCE	air component coordination element
ACHQ	air component headquarters
ADS	air defence system
AEW	air expeditionary wing
AOCC(L)	air operations coordination centre (land)
AO	area of operations
ATC	air traffic control
ATO	air tasking order
AWACS	airborne warning and control system
B-GA-401	B-GA-401-000/FP-001, *Canadian Forces Aerospace Command Doctrine*
C2	command and control
CAOC	combined air operations centre
CAP	combat air patrol
CAS	close air support
CAF	Canadian Armed Forces
CJFACC	combined joint force air component commander

CJOC	Canadian Joint Operations Command
COC	combat operations centre
CRC	control and reporting centre
FAC	forward air controller
HQ	headquarters
JFACC	joint force air component commander
JTF	joint task force
MISREP	mission report
MSN	mission
NATO	North Atlantic Treaty Organization
NCE	national command element
NORAD	North American Aerospace Defence Command
RAF	Royal Air Force
RCAF	Royal Canadian Air Force
RJTF	regional joint task force
SA	situational awareness
TACOM	tactical command
TACON	tactical control
TACP	tactical air control party
TACS	theatre air control system
TCR	tactical control radar
TIC	troops in contact
WOC	wing operations centre

Notes

1. This is the third in a series of short articles on the subject of command and control in the RCAF. For more detailed information, consult B-GA-401-000/FP-001, *Canadian Forces Aerospace Command Doctrine*, found on the Internet at http://www.rcaf-arc.forces.gc.ca/en/cf-aerospace-warfare-centre/aerospace-doctrine.page and the Defence Wide Area Network at http://trenton.mil.ca/lodger/CFAWC/CDD/Doctrine_e.asp (both sites accessed October 30, 2013).

2. Although fictional, this scenario is based on the author's experiences after more than 20 years working in C2 organizations within NORAD, NATO and RCAF at both the tactical and operational levels, including over 300 missions on NATO and United States Air Force E-3 AWACS in operations including NATO Stabilization Force, Operation ALLIED FORCE, Operation NOBLE EAGLE, Operation ENDURING FREEDOM and Operation IRAQI FREEDOM.

3. In NATO doctrine, this system is known as the air command and control system (ACCS).

4. The AWACS crew also monitors the pilots' progress for another reason. Should the fighters have to operate at a lower altitude, supporting the ground troops for an extended period of time, they will burn fuel at a much higher rate, greatly shortening their availability, known as their "on-station" time. The AWACS mission crew commander (MCC) would direct

the onboard controllers to quickly develop a plan with the CAOC and TCR to prioritize AAR assets should the Hornets call for gas in the middle of an engagement. In this case, the TACS as a whole coordinates to have a tanker aircraft close by and ready.

5. TACON permits effective local direction and control of movements of manoeuvres necessary to accomplish missions or tasks assigned. In general, TACON is delegated when two or more units not under the same operational control (OPCON) are combined to form a cohesive tactical unit for a specified period of time. Department of National Defence, B-GA-401-000/FP-001, *Canadian Forces Aerospace Command Doctrine* (Trenton, ON: Canadian Forces Aerospace Warfare Centre, 2012), 7. Will be abbreviated as B-GA-401.

6. The CAS mission is "air action against hostile targets that are in close proximity to friendly forces and which require detailed integration of each air mission with the fire and movement of those forces." *Defence Terminology Bank*, record 23335.

7. B-GA-401, 22–25.

8. For a detailed description of the duties/responsibilities of an ACCE and ACCE director, see B-GA-401, 27–29.

9. *Defence Terminology Bank*, record 552.

10. "Closing the TACON loop" is a concept developed by the Canadian Forces Aerospace Warfare Centre during 2012–2013.

11. See article #1 in this series for more information on the employment of C2 in air-power operations. Pux Barnes, "Command or Control? Considerations for the Employment of Air Power in Joint Operations," *Royal Canadian Air Force Journal* 3, no. 2 (Spring 2014) , http://www.rcaf-arc.forces.gc.ca/en/cf-aerospace-warfare-centre/command-and-control.page (Internet) and http://trenton.mil.ca/lodger/cfawc/CDD/C2_e.asp (Defence Wide Area Network).

12. "Fragged" is a term that dates back to the Vietnam War where complex flying orders were promulgated from a centralized location, being distributed to subordinate headquarters and flying units, expanding downward and outward in a fragmenting method.

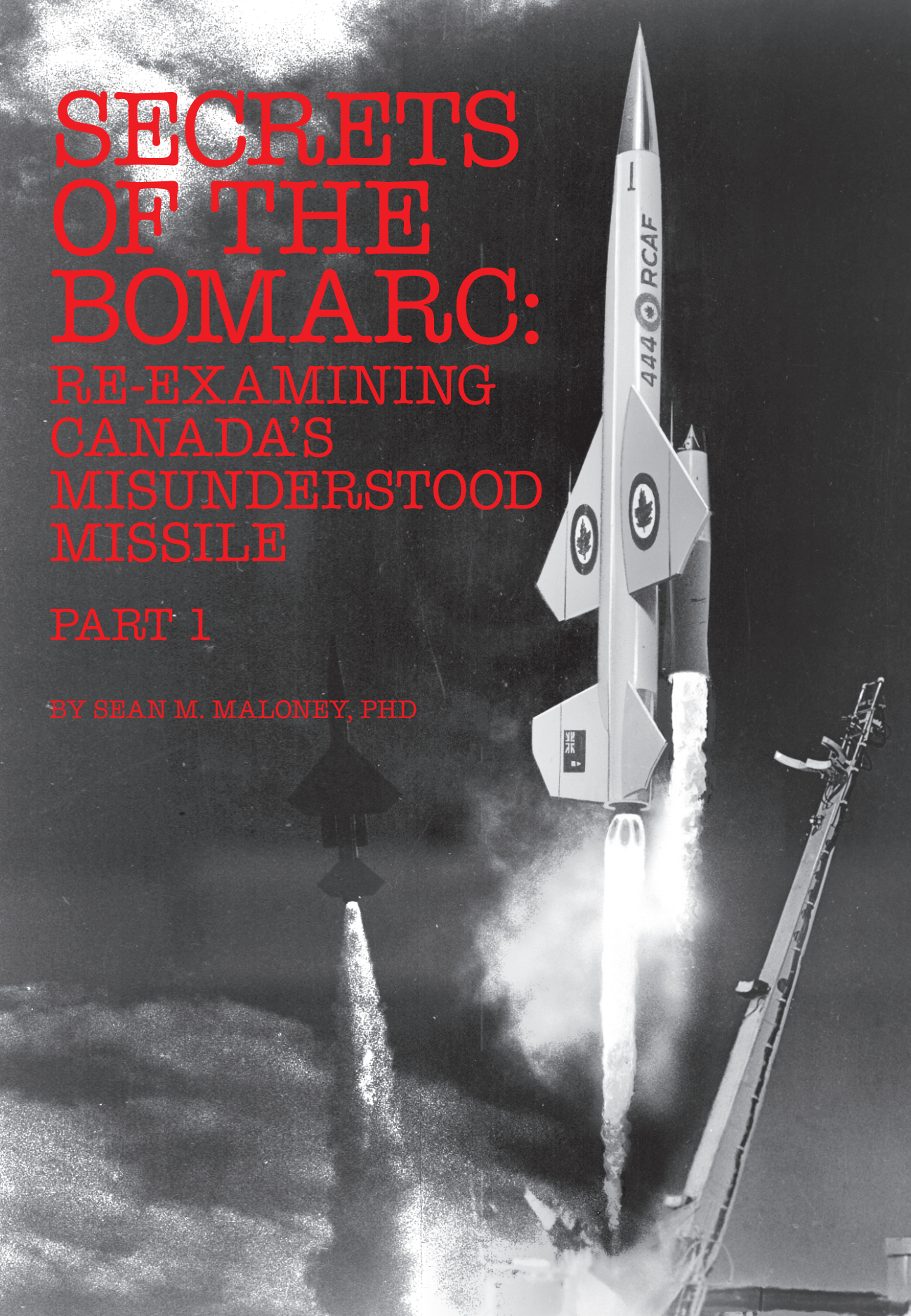
13. In the age of the paper ATO, the author spent up to 30 minutes on the ramp (on numerous occasions), with engines running, awaiting last-minute ATO changes to be delivered to the aircraft prior to taxi. Happily, ATO changes are now normally delivered via electronic means once aircraft are airborne.

SECRETS OF THE BOMARC:

RE-EXAMINING CANADA'S MISUNDERSTOOD MISSILE

PART 1

BY SEAN M. MALONEY, PHD



Publicly derided and quietly phased out in 1972, the "Coffin"[1] Interceptor Missile 99B/W40 Weapons System Mod 0, better known as the BOMARC,[2] has faded into near obscurity in Canadian history. Of the 56 BOMARC airframes deployed to Canada in the early 1960s, three remain on public display in Canada. The bronze plaque on one of them stationed outside the airport states: "In 1971 the BOMARC missile was abandoned. Although the BOMARC was nuclear warhead capable, it was a great disappointment for Canadian Forces to fulfill Canada's role in the North American Air Defence Command (NORAD)." Similarly, the data supplied at the Canadian Aviation and Space Museum in Ottawa states: "While on paper the missile looked impressive, the BOMARC was not able to intercept long range nuclear-armed missiles that began to be deployed at the beginning of the 1960s."

Any perusal of political cartoons from the period readily uncovers numerous caustic sketches usually depicting an unflattering caricature of Prime Minister John Diefenbaker juxtaposed with the missile in some fashion. Then there were the professional critics, comprising members of the nascent antinuclear movement in Canada, who wanted Canadian neutrality in the Cold War. There were opposition politicians looking for any angle from which to attack the government. There were armed forces personnel engaged in interservice politics. Less publicly, there was a serious personnel failure at 447 Squadron—the BOMARC unit at La Macaza, Quebec—which almost resulted in the removal of the warheads in 1964.[3]

"While on paper the missile looked impressive, the BOMARC was not able to intercept long range nuclear-armed missiles that began to be deployed at the beginning of the 1960s."

Historiographically, the BOMARC becomes the easily targeted scapegoat for the closeout of the now mythic CF105 Arrow programme. No book dealing with the Arrow programme gives the BOMARC system any positive ink in any way, shape, or form. Arrow is Canadian, BOMARC is American. Arrow good, BOMARC bad. There is no quarter. The BOMARC had to be bad so that the Arrow can be so good.[4]

Yet, despite the odds, Canada's two BOMARC squadrons quietly remained on guard for a decade, ready to engage Soviet bomber aircraft in the event of an attack on North America. This begs the question: If the system was so flawed, why did it stay in service so long? Was it simply a matter of bureaucratic or political inertia? Was it really as technologically flawed or as strategically obsolete as asserted at the time in the public domain?

There were aspects of the BOMARC system itself, and in particular the warhead that it carried, that suggest there may have been other factors in play. Given the levels of secrecy that existed at the time, and possibly remain even today, those aspects have not emerged in any coherent form. This article will examine the hypothesis that the BOMARC missile system could have had applications as an interim or expedient antiballistic missile (ABM) system. The evidence is not definitive, but circumstantial, and makes for an intriguing hypothesis. Indeed, this potential capability remained in the American domain because of the closehold aspects of nuclear-weapon design and employment. In the current policy climate regarding Canada and

ballistic-missile defence, lack of knowledge on Canada's part attenuates our ability to participate in and influence decisions made by our closest ally, the United States (US), very similar to the situation in the 1960s.

The origins of nuclear air defence systems

The nature of the air defence problem that emerged in 1949 and 1950 during the Berlin Crisis and the advent of the Korean War led to development of nuclear air defence weapons. The United States Air Force's (USAF's) Strategic Air Command (SAC) constituted the primary deterrent to global war and was seen to be increasingly vulnerable to Soviet bombers and their nuclear bombs as the opposing force grew in capability. The need for an air defence system was paramount and an unprecedented technological effort was implemented in the US.[5] The Canadian government, after careful consideration and consultations, accepted this view, and both partners embarked on the road that led to the NORAD agreement in 1958. The Canada-US Emergency Defence Plan Military Cooperation Committee (MCC) 300/9 was based on this concept: "To protect as much of the warmaking capability of Canada and the United States against air attack as is possible with the forces available … . The object … is the protection of Strategic Air Command bases."[6]

The pressing need for improved air defences because of the perceived vulnerabilities of SAC in 1950[7] led to a variety of American projects. One of these was the 1951 concept of adding a nuclear warhead to Boeing's planned BOMARC missile. That was dependent on reducing the size of the existing nuclear weapons to the point they could be inserted into a smaller-diameter airframe, and that technology did not yet exist. The other project was codenamed HEAVENBOUND and looked at the requirements for a lightweight warhead with low yield. In 1953, the feasibility of both projects was established, and by 1954, the Joint Chiefs of Staff gave approval to proceed on these and other tracks.[8]

The HEAVENBOUND project spawned the W25 warhead that was mated by the Douglas Aircraft Company with their aircraft-launched rocket and called the MB1 Genie. The construction of the MB1/W-25 weapon system was authorized in 1955–56, and on 19 July 1957, with Canadian observers present, Operation PLUMBBOB's Shot JOHN detonated over the Nevada desert after the rocket was fired from an F89J interceptor. Accounts noted that the "explosion pulverized anything caught within a one mile [1.6 kilometre (km)] radius" of the detonation.[9] Of note here was that the observer group comprised almost all senior officers involved in the future nuclearization of the RCAF: Air Marshal Roy Slemon, Air Vice Marshal Larry Dunlap, Air Commodore Clare Annis, Air Vice Marshal Larry Wray, Air Commodore Douglas Bradshaw, and others.[10] Air Vice Marshal John Easton observed Shot JOHN:

> The first MB-1 bursts I saw, and I was about 60 miles [96.5 km] away from it across the desert, and I thought I would manage with an ordinary pair of sun glasses …. I spent the next 24 hours with two black spots, one in the middle of each eye and it was impossible to read anything.[11]

The MB1 Genie entered USAF squadron service and stood alert for the first time in 1958.

The development of the BOMARC and its warhead was much slower, given the advanced but immature technologies that Boeing was dealing with and the need to incorporate the missile

into a complete air defence system that included radars, computers, and direction centres (later called the semiautomated ground environment [SAGE], the predecessor of today's internet).[12] USAF's Air Defense Command accepted the concept of a nuclear warhead for BOMARC in 1952, and HEAVENBOUND confirmed its feasibility. In 1953, the Atomic Energy Commission and USAF looked at a number of possibilities, with the specifications that the warhead be 18 inches [45.7 centimetres (cm)] in diameter, 30 inches [76.2 cm] long, and weigh 250 pounds [113.4 kilograms (kg)]. At some point, thought was given to using the Genie's existing W25 warhead in the BOMARC but increasing its yield.[13]

However, there was some breakthrough during the 1954–1955 testing series that "revealed the advisability of 'pocketing' greater nuclear yields" and "technological changes that led to smaller and lighter containers." These both led to the initial design of the W40 warhead in 1956.[14] Whatever developments took place at this time had some bearing on the future parameters of the W40: its final dimensions were 17.9 inches [45.4 cm] in diameter, 31.64 inches [80.36 cm] long, but it weighed 350 pounds [158.7 kg]. It was 100 pounds [45.3 kg] heavier than specified.[15] There were a variety of delays but the first W40s were available for the BOMARC missiles in September 1959, though a debate over safety rules delayed "mating" until May 1960.[16] Unlike the W25, the W40 remained untested when fired with its BOMARC airframe because of President Eisenhower's decision to implement a nuclear-test moratorium in October 1958. That said, the BOMARCs were still deployed to their sites throughout the US in 1959–60. The Canadian sites remained under consideration during the turbulent debate over the CF105 Avro Arrow and where it fit into the air defence system.

Canadian interest in nuclear air defence weapons

An extensive web of personal relationships developed between the scientists of Canada's Defence Research Board (DRB) and their American and British colleagues; they were coupled with strong military linkages through the planning groups in the Canada–US Permanent Joint Board on Defence and the MCC. These connections enabled Canada to be well aware of American developments in the continental defence field in spite of the strictures of the American Atomic Energy Act that prohibited the transfer of nuclear weapons' design information.[17]

The DRB, when queried by the Joint Special Weapons Policy Committee in 1954, anticipated a possible Canadian requirement for a high-altitude anti-aircraft missile and an "antimissile missile system to defeat tactical ballistic missiles with speeds from Mach 3 to Mach 20 and ranges of 50 to 600 nautical miles [92.6 to 1111.2 km]." Similarly, "It is considered that a nuclear warhead should be provided only for the weapon system designed to defeat enemy aircraft and missiles at high altitudes … ."[18]

Another entity keeping track of nuclear air defence developments was the Canadian Army's Anti-Aircraft Command (AAC). In 1955, Canadian personnel, likely through the DRB, were aware that the US Army was going to add a nuclear weapon to the Nike missile and that "Aweapons" were also in progress for BOMARC. Furthermore, the AAC was made aware by the RCAF that there was a growing belief in the US Continental Air Defense Command that "it is now too late to develop an interceptor to defeat the Type 37 and B 58 bomber (B 58 = M[ach] 1.8 and height 60,000 [feet] (18,288 metres [m]). Next development must be to defeat NAVAHOtype missile (M[ach] 4.0 and height 100,000 feet [30,480 m])."[19]

In August 1956, after Shot JOHN and other PLUMBBOB tests, the DRB noted internally that:

> an atomic weapon can be rendered inoperative as an atomic weapon by one of the effects from another atomic weapon. A defensive atomic weapon intended to render inoperative an atomic weapon carried by a conventional aircraft might be quite large yield, possibly in the order of hundreds of kilotons. Canada has no firm information on the effect mentioned, but from basic physical principles the defensive weapon would have to be very accurate if the yield were not very large.[20] [emphasis in original]

Of note:

> The real problem, however, will be the intercontinental ballistic missile carrying an atomic warhead. As a missile it will be difficult to destroy; the hope will lie in "neutralizing" the atomic warhead … . The interception would be planned at great heights, possibly in the order of 20 miles [32.2 km].[21]

The DRB even started looking at the "A/ICBM [anti-intercontinental ballistic missile] problem" in 1957, as it concerned "the protection of Strategic Air Command."[22]

Canadian industry was also engaged, and DeHavilland Canada, in a joint project with the US Convair company, approached the RCAF "on an antiICBM missile or detection system." DeHavilland representatives believed that "there were many things which were in Canada's capability to do, both to discover and to fabricate."[23] Some believed that BOMARC launchers "are perfectly capable of Canadian manufacture," as were the airframes which were "a simpler aircraft than the F86."[24]

> "In Canada, the RCAF had stolen the march on the Army and pushed ahead with BOMARC while the Army was still thinking in terms of anti-aircraft artillery."

Canadian defence personnel were, between 1954 and 1957, already looking towards not only nuclear defence against manned bombers but also at future use of nuclear weapons against intercontinental ballistic missiles (ICBMs) with something that "neutralized" the incoming warhead, not just the carrier system. That was speculative theory. The realities of politics now intruded.

From 1954 to 1959, an extremely complex web of technology-driven issues dominated Canadian defence policy. These included the Distant Early Warning Line, the MidCanada Line, interceptor aircraft including the CF105 Arrow, and the possible acquisition of BOMARC and Nike missile systems. The complexity revolved around the perceived need to integrate Canadian and American defence and how this played out in the political realm. That story is beyond the scope of this study. Where it becomes important in the runup to the acceptance by the Canadian government of the BOMARC system is in the debate over what constituted "point defence" and what system was best suited to it (and what service would command it).

In June 1956, Cabinet recognized that some form of long-range missile might replace some RCAF Air Defence Command (ADC) squadrons in the future. The target type that the missile was supposed to engage was unspecified but was implied to be bombers. In 1957, after the Sputnik launch, the MCC looked more and more at the growing ballistic-missile defence problem. These were not contradictory issues. Ballistic missiles did not replace bombers, they supplemented them and, over time, bombers would supplement the missiles.[25]

The RCAF was already looking at a combination of fighter and missile systems but by mid1956 was concerned that information on ICBM systems and how to counter them was being held back by the DRB.[26] However, at this time, the RCAF was already debating the merits of "the unguided atomic weapon" (MB1 Genie), and a nuclear-capable guided missile based on the Sparrow III, for its future manned interceptor, the CF105.[27]

The Canadian Army, however, was struggling to find its role in air defence. Their American counterparts had been granted responsibility for the missile defence of the US after a bout of interservice wrangling, but BOMARC remained a USAF weapon. In Canada, the RCAF had stolen the march on the Army and pushed ahead with BOMARC while the Army was still thinking in terms of anti-aircraft artillery. The Army was desperately trying to catch up, and the American developments with nuclearizing some form of a Nike missile held promise.

In the debate over BOMARC, the Army noted that in the Canadian context, "The objective of the BOMARC program is to develop an interceptor missile defence system 'to give an effective area defence against high-performance aircraft and missiles.'"[28] The Army argued that ICBM defence would "be of a local nature" not area, that "perimeter" defence weapons would be overwhelmed, and "thus by 1960 or shortly after Canada must have in existence an antimissile capability." The Canadian Army already had, it claimed, 225 personnel trained in the use of the Nike Ajax missile (non-nuclear) and, they were in a position to train 7 personnel for Nike Hercules.[29] Taking their cues from the US Army, the Canadian Army developed arguments against area defence and focused on point defence. The Army changed its approach and attacked BOMARC because it "had no capability against ballistic missiles."[30]

By this time, the Cabinet Defence Committee agreed that the SAGE and BOMARC system should be seriously examined and that the Chief of the Air Staff brief them on "the introduction of nuclear weapons into the system."[31] The Army fought back: "the introduction of BOMARC should be strenuously resisted until its cost effectiveness has been weighted against other weapons systems … and until the policy on an A/ICBM has been decided."[32]

Furthermore:

> It is fundamentally wrong to plan only to defeat the manned bomber. By 1963, our air defence arsenal in Canada would presumably be the CF 105 and BOMARC, neither of which has any capability against the "sharply increasing" threat of the ICBM. Thus just about the time that the peak costs for BOMARC are being reached we may have to consider the equally costly installation of the ZEUS A/ICBM.[33]

In June 1958, Chairman of the Canadian Chiefs of Staff Committee General Charles Foulkes shut down the Army on this issue. The scale of the blast of thermonuclear weapons delivered by supersonic missile or bomber meant that point defence was useless. Nike Ajax

and Nike Hercules sites would be consumed by megaton-yield weapons directed at the targets they were protecting.[34]

What is significant is that Foulkes did not introduce the need for an ABM system into the debate when dealing with the Army or the RCAF. He had good reasons. First, he was likely aware from his former Second World War command that there were political problems with US Army antiballistic missile systems. President Eisenhower decided against the system's deployment in early 1959.[35]

More importantly, Foulkes was invited to attend the HARDTACK nuclear test series in 1958, where he was given preferential treatment in observing particular tests and in collecting information on them.[36] The purpose of the HARDTACK test shots at the Pacific islands proving grounds was to focus on the following:[37]

a. small, low yield highly mobile weapons for tactical and antisubmarine warfare uses;

b. modern, lightweight and instantly ready weapons of sophisticated design for use against hostile aircraft;

c. warheads for antimissile use;

d. deterrent and retaliatory weapons, including warheads for second-generation intermediate-range ballistic missiles, ICBMs, and fleet ballistic missiles; and

e. a family of "clean" weapons.

The HARDTACK test series (there were 35 of them) was comprehensive. One of these was Shot TOBACCO, which involved a test shot of a Nike Zeus with a W50 nuclear warhead in May 1958, one month before Foulkes shut down the Army on Nike systems. The second stage of the warhead failed to ignite and the test was a failure.[38] The next shot of interest was YUCCA. This is believed to have involved a W25 warhead, the same as the MB1 Genie's warhead, elevated by balloon to 26 km and then successfully detonated with a 1.7 kiloton yield. This test simulated the use of the W25 against an incoming ballistic missile. Then, finally, there were Shots TEAK and ORANGE. These spectacular events involved Redstone ballistic missiles with W39 thermonuclear warheads yielding 1.9 megatons detonated at altitudes of 77 and 43 km respectively. The shots generated a variety of interesting electromagnetic disturbances in the stratosphere and mesosphere that had serious implications for antiballistic missile systems.[39]

Foulkes would have been unable to pass on the specifics of Shot HARDTACK to Canadian policy makers and military personnel because of the extremely high level of secrecy associated with the tests. By late 1958, nuclear weapons, their design and employment had gone far, far beyond the relatively crude gravity bomb weapons of the 1940s that Canadian military leaders were familiar with. Fortunately, Foulkes's access permitted him to gently influence Canadian policy.

Finally, on 24 September 1958, a USAF BOMARC missile successfully intercepted a Navaho missile flying at Mach 1.5 at 50,000 feet [15,240 m] off Cape Canaveral.[40] The unarmed BOMARC A, tracked by radar, "came close enough … to destroy the [Navaho]."[41] This distance was unspecified in "secret-level" reportage. With Nike Zeus in suspended animation for the

Observers view atmospheric testing during operation Hardtack.
Source: National Nuclear Security Administration Nevada

time being and the British having no comparable system available yet, BOMARC was the only game in town for Canada.

From the policy standpoint, Minister of National Defence George Pearkes stated in retrospect that:

> The theory which the Americans were working upon, and so were we, was that if there was an attack by missiles or rocket-carrying aircraft, it would probably be followed up by a bomber attack on the cities and while they hadn't got an adequate defence against the missiles at the time, they felt they had to obtain the confidence of the people in the large cities in that area, they had to make a show at some defence and the BOMARC was something new or quite impressive to look at … . It was partly for show, but I think it was an effective weapon if there had been bombers … . Oh, there was opposition to the use of nuclear warheads … . I always maintained that we should have the best possible weapons which we could put into the hands of our service people. Nuclear warheads were the best.[42]

Editor's note: Part 2 of this article will appear in the fall issue of the *Royal Canadian Air Force Journal*.

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Abbreviations

AAC	Anti-Aircraft Command
ABM	antiballistic missile
A/ICBM	anti-intercontinental ballistic missile
ADC	Air Defence Command
ATI	Access to Information
cm	centimetres
DHH	Directorate of History and Heritage
DRB	Defence Research Board
ICBM	intercontinental ballistic missile
JCS	Joint Chief of Staff
JSWPC	Joint Special Weapons Policy Committee
kg	kilogram
km	kilometre
m	metre
MCC	Military Cooperation Committee
NORAD	North American Air Defence Command
RG	Record Group
SAC	Strategic Air Command
SAGE	semiautomated ground environment
US	United States
USAF	United States Air Force
USNARA	United States Naval Advanced Research Agency

Notes

1. The launch containers for the BOMARC missiles resembled coffins, hence the nickname.

2. BOMARC is derived from Boeing Michigan Aeronautical Research Center.

3. CANAIRDEF [Canadian Air Defence Command] to CANAIRHEAD [Canadian Air Headquarters], dated 11 March 1964, Access to Information [ATI] message. I quote, "Results of [Capability Inspection / Operational Readiness Inspection] at La Macaza were almost disastrous and if at USAF unit would have caused removal of the warheads."

4. Palmiro Campagna, on page 40 in the third edition of his *Storms of Controversy: The Secret Avro Arrow Files Revealed* (Toronto: Stoddart, 1992), explains that in a 1991 interview

with former Air Vice Marshal John Easton the CF105 was projected to have some form of antiballistic-missile capability. The details receive no elaboration in this or any other work.

5. USNARA [United States Naval Advanced Research Agency] documentation, "Commander's Conference April 24, 25, & 27, 1950 Ramey Air Force Base, Puerto Rico," National Security Archive holdings.

6. Director Military Operations and Plans (DMO&P) "Air Defence of North America," Directorate of History and Heritage [DHH], 19 December 1957, file 112.3M2.009 (D208).

7. The Soviets would not develop a potent intercontinental bomber force between 1952 and 1954. See Steven J. Zaloga, *The Kremlin's Nuclear Sword: The Rise and Fall of Russia's Strategic Nuclear Forces 1945–2000* (Washington, DC: Smithsonian Press, 2002).

8. United States Freedom of Information Act (FOIA), Air Defence Command (ADC) Historical Study No. 21, "BOMARC and Nuclear Armament 1951–1963"; and ADC Historical Study No. 20, "Nuclear Armament: Its Acquisition, Control and Application to Manned Interceptors 1951–1963."

9. ADC Historical Study No. 20.

10. "JOHN Shot-Operation PLUMBBOB: Information for RCAF Observers," 20 June 1957, Records Group (RG) 24, vol. 21444 file 1894-2.

11. Shorthand Transcript of 1961 Air Officers Command Conference, 21 March 1961, DHH, Raymont Collection, File 2008.

12. BOMARC-SAGE integration is discussed in some detail in Kent C. Redmond and Thomas M. Smith's *From Whirlwind to MITRE: The R&D Story of the SAGE Air Defense Computer* (Cambridge: MIT Press, 2000).

13. Chuck Hansen, *US Nuclear Weapons: The Secret History* (New York: Orion Books, 1987), 187.

14. ADC Historical Study No. 20.

15. Hansen, *US Nuclear Weapons*, 187.

16. ADC Historical Study No. 20.

17. As described in some detail in Chapter 4 of the author's *Learning to Love The Bomb: Canadian Nuclear Weapons and the Cold War 1951–1970* (Dulles: Potomac Press, 2007).

18. DRB to Joint Special Weapons Policy Committee (JSWPC), "Possible Canadian Requirements for Nuclear Warheads," 2 November 1954, ATI.

19. See DHH, file 423.009 (D14), letter Stearne to Rothschild and attachment, 1 Februrary 1955; and "File Memo on PROJECT COMBINE," 12 April 1955.

20. "Control of Tests of Atomic Weapons," ATI DRB memo, 31 August 1955.

21. Ibid.

22. "Some Factor Affecting Defence Research Policy: A Short Report to Board Member, October 1957," Library and Archives Canada (LAC), RG 24 acc 83-84/167 vol. 7407 file 173-1 pt. 1.

23. Hendrick Diary, 5 March 1958, DHH.

24. Ibid., 17 February 1958.

25. "Air Defence of North America," 19 December 1957, DHH.

26. Hendrick Diary, 24 May 1956, DHH.

27. Ibid., 6 April 1957.

28. "BOMARC IM99 Interceptor Weapons System: Its Capabilities and Limitations," 17 February 1958, DHH, file 112.3m2.009 (D208) DMO&P.

29. "Air Defence of Canada," 24 February 1958, DHH.

30. "Army Comments on the Proposed BOMARC," 23 April 1958, DHH file 112.3m2.009 (D208).

31. Extract from the Minutes of the 620th Meeting of the Chiefs of Staff Committee, 18 April 1958, DHH, file 112.3m2.009 (D208).

32. D Arty [Director of Artillery] to DMO&P, "Review of Air Defence Against the Manned Bomber," 5 June 1958.

33. Ibid.

34. Chiefs of Staff Committee Meeting, "Review of Air Defence Against the Manned Bomber," 10 June 1958, DHH, file 112.3M2.009 (D260).

35. The details are in the US Army's Center for Military History's *History of Strategic Air and Ballistic Missile Defense, Volume II (1956-1972)*, accessed June 18, 2014, http://www.history.army.mil/catalog/pubs/40/40-5.html.

36. USNARA, RG 218, box 79, Chairman, Chiefs of Staff 471.6 4-25-50 sec 20, "Invitation to Observe Atomic Weapon Test," 5 April 1958; and JSPC [Joint Strategic Plans Committee] to the JCS [Joint Chiefs of Staff], "HARDTACK Observers" 7 January 1958; RG 59 box 2878, memo to SECSTATE [Secretary of State], 10 February 1958.

37. Memo from JCS for Secretary of Defense, "Nuclear Testing," 30 April 1958, Declassified Document Reference System 1979, frame 37C.

38. "Operation HARDTACK I," www.nuclearweaponsarchive.org (site discontinued).

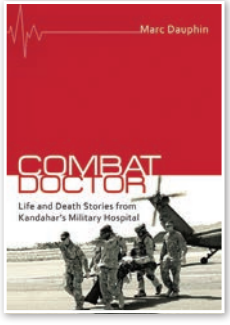
39. Ibid; William Robert Johnson, "High Altitude Nuclear Explosions," accessed June 18, 2014, http://www.johnstonsarchive.net/nuclear/hane.html; Defense Technical Information Center (DTIC) Defense Nuclear Agency, "Nuclear Weapons Tests Nuclear Test Personnel Review, Operation HARDTACK I 1958"; and Hansen, *US Nuclear Weapons*, 88–90. See also http://glasstone.blogspot.ca/2006/03/emp-radiation-from-nuclear-space.html (accessed June 18, 2014), which suggests that Shot YUCCA was the first time electro-magnetic pulse was measured.

40. Dwight D. Eisenhower Library Anne Whitman Files, "First Intercept of a Supersonic Target with an IM-99A (BOMARC)," Declassified Document Reference System, box 77 98B, frame 454.

41. James N. Gibson, *The Navaho Missile Project* (Atglen: Shiffer Publishing, 1996), 78. The Navaho was a hybrid rocket-guided missile combination.

42. University of Victoria Archive, The George Pearkes Papers, interview with George Pearkes, 7 March 1969.

BOOK REVIEWS



COMBAT DOCTOR: LIFE AND DEATH STORIES FROM KANDAHAR'S MILITARY HOSPITAL

By Marc Dauphin

Toronto: Dundurn, 2013
301 pages
ISBN 978-1-4597-1926-2

Review by **Major Mark Nasmith, CD**

Military non-fiction covers most aspects of conflict throughout history. There are tales and accounts of army, navy and air force personnel across the rank spectrum. The majority of these are oriented toward experiences and events on the battlefield itself. When a soldier is wounded, they are carted off to a hospital tent or whisked away in a Huey. What is usually left unwritten is what comes next; the struggle for survival and healing as well as the medical support and infrastructure, and the realization that the cost of war is not only paid on the front lines. It is this "what comes next" element that was Captain Marc Dauphin's (Retired) experience.

Early in reading Dauphin's book, it felt less like a memoir or historical account and more like a conversational recounting of his experiences on deployment. His is the tale of a Canadian Forces' reservist and civilian trauma surgeon running a North Atlantic Treaty Organization hospital in a combat zone, including many peripheral experiences a reader may not expect. One would anticipate accounts of wounded soldiers, but reading about the high number of civilian casualties, a record number of allied wounded, logistical difficulties and the seamless interconnectivity of multinational personnel brings the reader behind the scenes.

The anecdotes and events paint a vivid picture of the author's life in Kandahar, 2009. The narrative captures Dauphin's self-awareness; that what he and his team were doing and seeing would come at a cost. As the black humour, broken bodies and burned children became commonplace, so too did the awareness that they were fundamentally changing as people. Once the unimaginable became routine, could Dauphin and his team simply return to Canada and rejoin a polite society? This will strike a chord with anyone who has witnessed changes in themselves or friends after one, two or more operational tours. Nothing comes for free, and the author is commendably honest about the price he and his team paid in serving their nations.

Dauphin provides insight into the lives of Afghan civilians in this time of violence and poverty. I had anticipated the stoic and practical nature of the Afghan people; nevertheless, the situations and outcomes related were often tragic, and emotional reaction was unavoidable. There are vignettes of particularly enlightening events, both rewarding and disturbing, and the author consistently avoids the disservice of sanitizing his reality for the unquestionable benefit of the reader.

A positive aspect I will take from Dauphin's story regards genders and military roles. When I speak to family or the public about military life, there are often questions about gender equality and employment opportunities. Through his words and pictures, Dauphin turns the issue of gender equality into one of gender irrelevance. From the female United States Army flight medic (a trade that is well-armed and committed to defending their patients at any cost), to the "Five-Foot-Two Crew" (a highly proficient all-female Canadian Forces surgical team), to the male United States Navy nurse who lovingly held a dying child in her last hours, the concept of gender has no place in Dauphin's operational experience. The only metric was performance, and the performance of the staff of the role 3 hospital[1] and their peers speaks for itself.

The photographs in the book are a welcome embellishment to the text. Seeing the faces of many role 3 staff allows the reader to better empathize with the staff as peers and professionals. While there are few explicit pictures of wounds and medical procedures, they are tastefully chosen, and perhaps more should have been considered: many in uniform are aware of the havoc a bullet or shrapnel can make of a soldier's body, but civilian readers are likely unaware of this simple yet brutal reality.

Lacking in the book was the opportunity to learn more about the care and treatment of our Canadian wounded. What medical lessons may be inferred from the increasing use of improvised explosive devices (IEDs)? How does a young, healthy Canadian soldier react to a fearful wound? Does training truly sustain the soldier through the worst of it, or is there an inevitable moment when training is forgotten and we all regress to become frightened humans? Dauphin acknowledges some of these questions, but states his opinion that those moments in life are intensely personal and it is for each of our wounded to tell their own story when they are ready. While I cannot disagree with his opinion, it may leave 158 stories of our lost Canadians largely untold.

If I was to offer advice as a reader, I would caution against the overuse of running jokes and satire. Most were amusing, and even informative in a single instance, but became disruptive with repetition. Regardless, I found at least one that was particularly effective: the author highlights how all Canadian Forces trades get pulled into the grim aspects of war despite job titles and assignments. He suggests that some trades are perceived as notable or

headline-worthy (such as pilot, surgeon and soldier) but that the story is incomplete without all members of the team (other medical professionals, logisticians, administrators, etc.), though there will be little recognition for them.

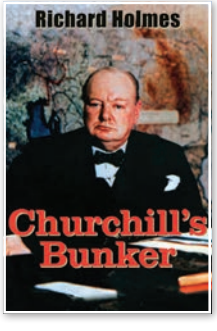
Canadian veterans should be encouraged by Dauphin's candid and frank accounts (most notably when he openly discusses his own post-traumatic stress disorder [PTSD] experience). In finishing their own narratives, they may enable others to understand that, for so many of our brothers and sisters, the battle did not end when they were AIREVAC'd (air evacuated) to the role 3. For many, the wounded and their saviours alike, it had just begun.

If you are looking for an academic account of Major (acting) Dauphin's tour as the Officer Commanding Role 3 Multi-national Medical Unit (MMU), Kandahar, complete with unit annotations, chronological accounts and operational analysis, this book is merely a curiosity. If you are interested in what happens to fellow Canadians as they become immersed in the bloody realities of life and death in a desperate country, this book is worthy of your time.

Major Mark Nasmith, a Sea King airborne combat systems officer, is currently Officer in Charge of Electronic Warfare Operational Support with the Canadian Forces Aerospace Warfare Centre Detachment Ottawa.

Note

1. In general terms, a role 3 hospital is normally found at a larger unit, base or on-board a hospital ship. It has virtually all of the medical capabilities you would associate with a civilian facility and could include specialist diagnostic resources, specialist surgical and medical capabilities, operational stress management teams, etc.



CHURCHILL'S BUNKER: THE SECRET HEADQUARTERS AT THE HEART OF BRITAIN'S VICTORY

By Richard Holmes

London, United Kingdom: Profile Books Ltd, 2009
246 pages
ISBN 978 1 84668 225 4

Review by **Lieutenant-Colonel Doug Moulton, MBA, CD**

As the Canadian Forces Liaison Officer to the United Kingdom Air Warfare Centre at Royal Air Force Waddington, I had on many occasions the opportunity to tour the various locations of the Imperial War Museum. One in particular piqued my curiosity and resulted in my reading of this book. Written by Brigadier Richard Holmes, CBE, TD, JP (Retired),[1] Professor of Military and Security Studies at Cranfield University, *Churchill's Bunker: The Secret Headquarters at the Heart of Britain's Victory* tells the story of life and struggle during World War II in the British headquarters. His book is an excellent read which I recommend to anyone with an interest in Churchill and the command and control of British forces during the Second World War.

Written 70 years after the complex became operational and 25 years after it was opened to the public, Holmes has endeavoured to share with the reader the experiences of those who called the headquarters home for the majority of the war. Having had the opportunity to explore the museum at length, the book provides a realistic insight into the nuances of living underground in the dark, cramped quarters, while at the same time trying to carry on normal, everyday activities.

The book—divided into six chapters, each of which is organized chronologically—looks first at the secret of the hidden headquarters and the reasons behind its selection. The book then moves on to discuss the conditions associated with the Battle of Britain, the German bombing campaign and the effect that they had on the headquarters' functioning. Chapter Three focuses on the actual operations of the headquarters and its management of the worldwide effort of British forces. Chapter Four then returns to the everyday experience of living underground and the people who made it all happen, from security to the feeding of the troops. As the war moved forward and allied successes accumulated, it soon became apparent that the headquarters had to go on the road. This monumental task is described in Chapter Five and touches on a number of issues, including that of civilian secretaries travelling on military transport and the challenges that caused. Finally, Chapter Six looks at the headquarters' transition from nerve centre to museum. Important from the perspective that few, if any, outside the headquarters' circle really understood what occurred in these cramped quarters during the war. The foresight of those who recognized this facility's uniqueness has resulted in millions having had the opportunity to see a large portion of the actual headquarters as it was.

A well-researched book, Holmes has corralled a wide variety of sources to bring the story alive. Combined with appropriate maps, figures and photographs, Holmes has succeeded in rendering an understandable and enjoyable read, providing an insight into one of the most important headquarters of the Second World War. *Churchill's Bunker: The Secret Headquarters at the Heart of Britain's Victory* is a well-written book that will prove an enjoyable read for the Churchill enthusiast.

Lieutenant-Colonel Doug Moulton, a Sea King pilot, is currently the Deputy Chair, Department of Exercise and Simulation, Canadian Forces College, Toronto.

Note

1. Commander of the Order of the British Empire, Territorial Decoration, Justice of the Peace.

By Major Roy Thomas, MSC, CD, MA (Retired)

It was great to see Professor Trudgen's article on the Sarajevo air bridge [Operation Air Bridge: Canada's Contribution to the Sarajevo Airlift," *Royal Canadian Air Force Journal*, Vol. 2, no. 2, Spring 2013] around the 20th anniversary of the start of the "air flow." His work prompted me to submit the following anecdotal evidence on some 9-liner[1] medical evacuations (MEDEVACs) that I noted during my nine months as the senior United Nations military observer (UNMO) in Sector Sarajevo.

A major concern came with assumption of the duties of a United Nations (UN) senior military observer (SMO), Sector Sarajevo, in October 1993. The commander responsible for not only the UNMOs in the observation posts around Sarajevo but also a team in the demilitarized safe haven of Zepa as well as another in the militarized safe haven of Gorazde. "Safe" is a misnomer, as the documents establishing these safe havens were UN Security Council Resolutions, yet the only UN military personnel in Gorazde were the UNMOs. In Zepa, in addition to an UNMO team, there was also a mechanized company from the Ukrainian United Nations Protection Force (UNPROFOR) contingent.

The Bosnian Serb campaign in Eastern Bosnia had driven the Bosnian government forces and Muslim refugees into three pockets of resistance with their backs to the Drina River. The Srebrenica safe haven was part of another UNPROFOR sector. All overland communications had to pass through Bosnian Serb territory and many checkpoints.

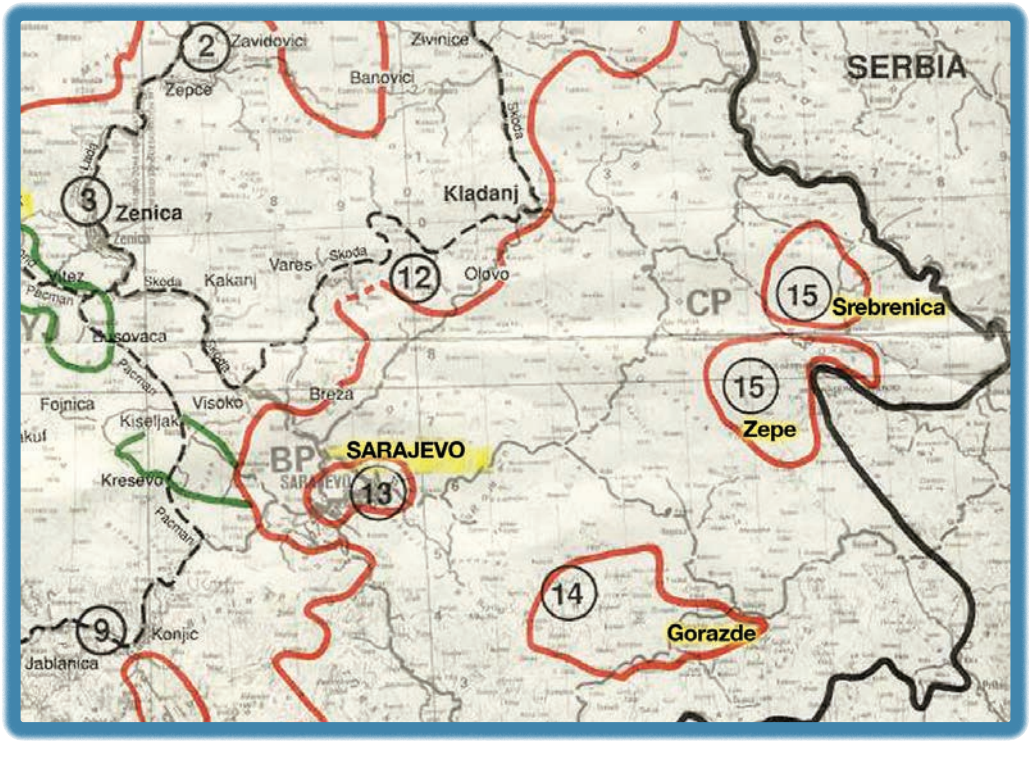
Before the author became SMO, an UNMO severely wounded in Gorazde had required treatment under field conditions in the local Bosnian hospital until safe passage of a MEDEVAC

helicopter could be negotiated with the Bosnian Serb hierarchy. Although the North Atlantic Treaty Organization (NATO) maintained a no-fly zone above Bosnia, the Bosnian Serbs had significant mechanized ground-based air defence assets. Indeed, during NATO's air strikes on Gorazde targets in April 1994, one such air defence system shot down a Royal Air Force Harrier. There was a threat! Negotiations were frustrating and took time. In the case of Gorazde, for example, clearance could not be obtained in a timely manner for helicopter evacuation of a seriously ill child, so the Gorazde UNMO team, itself, had to transport the child and mother overland using mountainous roads and checkpoints that often did not have the authorization to let them pass.

In the case of Zepa, a helicopter MEDEVAC involving several French Pumas was successful thanks to the personal courage of the commander of Sector Sarajevo, French General André Soubirou.

When the Bosnian Serb clearance was not forthcoming, he told his headquarters to advise the Bosnian Serb commander that he would be on the first helicopter. The flights to and from Zepa were without incident.

The process on the ground was not as smooth, due to the lack of any UN High Commissioner for Refugees' representative except local temporary employees, as well as because of the devotion of the Zepa pocket's only doctor (a Bosnian) to his spouse. As the triage decision maker who decided who would be medically evacuated, the doctor put his wife (the safe haven's only dentist) on the list to be airlifted out with these flights, even though she had no reason to go to the local clinic. A riotous crowd protested her inclusion as an evacuee and the UNMO team intervened with interpreters to ensure a valid medical case was substituted for the Zepa pocket's only dentist.



In Sarajevo itself, two MEDEVAC flights stand out as illustrations of the courage of the French Puma aircrews. After dark, one flight transported casualties from a French post on Mount Igman, of 1984 Olympic fame. On the return to the French hospital in Sarajevo, the pilot's bulletproof seat took multiple small arms hits (it was next to impossible at night to determine who actually fired and from where). This particular crew turned around and undertook another MEDEVAC to the same location after the first casualties had been unloaded. The approach for the hospital helipad provided a continuous demonstration of pilot skill, as the Puma had to settle down from a hover in a square of sandbags so as to minimize the potential for damage from the daily shelling. A February 1994 agreement stopped the artillery shelling, but the sandbags remained in place as sniper activity increased.

These few anecdotes illustrate that there was danger for the helicopters that flew 9-liners for the UNPROFOR and UNMOs in Sector Sarajevo. Personal courage was required from not only the aircrew and medics flying the mission, but also, in the case of Zepa, from the Sector Commander himself. Also evident was that what happens on the ground can be completely out of the hands of the aircrew or helicopter medics involved. Finally, a 9-liner didn't necessarily mean a helicopter would appear. There is a Canadian dimension to the MEDEVAC that finally took place in the case of the UNMO casualty in Gorazde before the author arrived in Sector Sarajevo. The Canadian Field Hospital in Visoko is credited with saving this UNMO's life when he finally got there. Fortunately, during the author's nine months as SMO ending mid-July 1994, there was no need for a 9-liner for any Sector Sarajevo UNMO.

Roy Thomas is a retired armoured reconnaissance officer with UN service in Cyprus, the Golan Heights, Jerusalem, Afghanistan, Macedonia, Sarajevo and Haiti. Roy is a recipient of the Meritorious Service Cross; an UNPROFOR Force Commander's Commendation: a United Nations Mission in Haiti Force Commander's Commendation and a US Army Commendation Medal. He is a graduate of the Pakistan Army Command and Staff College, Quetta, Baluchistan, and the United Kingdom Tank Technology course in Bovington, Dorset, as well as our Army Staff College. Since leaving the Canadian Forces, Roy has shared his UN experiences through training and lectures in Zimbabwe, Thailand, Ecuador, Switzerland, Sweden, the United States and Canada, including two Air Symposiums (1998 and 2011). He has published numerous magazine articles and book chapters, the majority on military topics.

Abbreviations

MEDEVAC	medical evacuation
NATO	North Atlantic Treaty Organization
SMO	senior military observer
UN	United Nations
UNMO	United Nations military observer
UNPROFOR	United Nations Protection Force

Note

1. A "9-liner" refers to the specific number of lines in a MEDEVAC request. In general, the NATO format is: Line 1 – location of the pick-up site; Line 2 – radio frequency, call-sign and suffix; Line 3 – number of patients by precedence; Line 4 – special equipment required; Line 5 – number of patients; Line 6 – security at pick-up site; Line 7 – method of marking pick-up site; Line 8 – patient nationality and status; and Line 9 – nuclear, biological and chemical contamination.

Generations in the Workplace

by Major François Dufault, CD

Lately, I have been witness to senior military personnel stating that the new, younger generation is not as "keen" as older generations. Some readers are probably nodding their heads in agreement, either for having heard the comment before or for agreeing with it. Perhaps it's the culture and attitude of a specific generation, or other factors, that are creating this impression.

According to a 2009 poll conducted in the United States, when asked whether today's younger generation has less respect than past generations (see Table 1), 75 per cent of respondents think that, yes, manners are worse than 20 or 30 years ago.[1] I am of the opinion that this perception has always existed between generations. For example, a 1942 article in the *Saturday Evening Post*[2] by G. B. Walton mentions that in the 1910s, when he was young, he often heard people say that "the younger generation was going to the dogs" and that he still heard such statements in 1942. I would argue that this impression is caused by intergenerational value clashes. Surveys like the 2009 United States poll focus on the impressions in behavioural divergences, but there are few studies that actually measure these differences. Furthermore, other studies have shown that gender, age, organizational tenure, position or educational level had no effect on an individual's behaviour.[3]

Generation name	Time frame
Millennial	1977–1998
X	1965–1976
Baby Boomer	1946–1964
Silent	1933–1945

Table 1. Who's who (when they were born)?[4]

Similarly, studies conducted among samples of college student populations have shown that the Millennial Generation is the most narcissistic generation ever, with their narcissism increasing 59 per cent between 1982 and 2009. I prefer to put this statistic into perspective, much like Stein and Sanburn quote in their *Time* article: "Just imagine how narcissist[ic] the Boomers would have been if they would have had YouTube or Twitter at Woodstock?"[5]

On a more positive note, Millennials are recognized for being more accepting of differences. A United States Army 15-year veteran recruiter mentioned that "the generation that we enlisted when I first started recruiting was sort of do, do, do. This generation is think, think about it before you do it. This generation is three to four steps ahead. They're coming in saying, 'I want to do this, then when I'm done with this, I want to do this.'"[6] Furthermore, Generation X and the Millennial Generation, being the first ones to grow up with computers, are recognized as being the most productive and high-performing generations.[7] Interestingly, a study published by Verschoor in 2013 showed, among other things, that Millennials are the most likely to report workplace misconduct.[8]

Now, let us push the analysis a bit further. Older-generation managers today who complain about the attitude of the younger generation can—to some level—be to blame for it. Some of the biggest complaints from businesses are the lack of interpersonal skills and that employers have to train young employees in simple manners because those were not taught at home.[9] The Boomers are generally described as workaholics[10] who place greater emphasis on their careers than their families. This differs from the following generations, as Generation X is not interested in copying the workaholic behaviour of their parents and is less willing to make personal sacrifices than their parents. There is certainly a generational clash between Millennials, Generation X and the Baby Boomers. Let us also not forget that the Boomers include the great innovators Bill Gates and Steve Jobs and that their vision of how technology can be used greatly influenced the generations that followed.

One of the biggest generation gaps today, in my opinion, is the technological one. The example I like to use to demonstrate this is the flight simulator. You take a brand new, full-motion flight simulator and bring in high-ranking officers, likely part of the Baby Boomer Generation, for a demonstration. Surely their reaction will be one of excitement in all the manoeuvres and training that can be accomplished in this simulator that they themselves had to do in a real aircraft! Then you take a younger officer, likely part of the Millennial Generation, and their reaction is likely to be one of disappointment, stating that their gaming console has more connectivity and ease of use than this multi-million-dollar flight simulator. Generation X and Millennials are the most tech-savvy persons ever to enter the marketplace; to them, technology is a tool necessary to function properly. Soon to enter the Royal Canadian Air Force (RCAF) will be Generation Z, who not only grew up with computers but also with the Internet; they were born after the fall of the Berlin Wall.

What can leaders do to take into account generational divergence in their organization? The first step is to recognize what motivates members of this organization. A study by Stephanie Kodatt in 2009 among Boomers, Generation X and Millennials showed that they all preferred charismatic and humane-oriented leadership. Charismatic leadership reflects the ability to inspire and motivate, whereas humane-oriented leadership reflects supportive and considerate leadership, while also including compassion and generosity. Up to now, we have determined that generations differ, so why would they all prefer the same styles of leadership? Kodatt suggests that Boomers, Generation X and Millennials interpret charismatic and humane differently. To demonstrate this, she looked into the different attributes of charismatic and humane-oriented leadership. Let us use the "inspirational motivator" attribute as an example for each generation. Boomers seek promotions and management recognition. Generation X seeks learning opportunities (especially if they come with formal qualifications), and they also seek career security over job security. Meanwhile, Millennials seek a sense of belonging; meaningful assignments are more important than job security.[11]

Today's managers, leaders, officers and senior non-commissioned officers need to acknowledge the generational differences between them and their younger colleagues and subordinates. In order to do so, expectations of behaviour and how to properly motivate subordinates should be understood by the organization's leadership. The basis for these expectations should be the belief that the next generation has the potential to take over and outperform its predecessors, thereby moving the Royal Canadian Air Force ahead. From what I see in junior officers, we are in good hands. Will the organization change? Certainly, and that will be a good thing.

Major François Dufault joined the Canadian Forces in 1994 and is a CH146 Griffon pilot currently assigned to 430 Tactical Helicopter Squadron in Valcartier as Officer Commanding A Flight. He holds a bachelor's degree in Civil Engineering from the Royal Military College of Canada and a Master of Engineering Management from the University of Ottawa. Major Dufault was born in 1977 and identifies with the Millennial Generation.

Notes

1. "Civility," Connect with Kids website, accessed November 25, 2009, www.connectwithkids.com (content updated).

2. G. B. Walton, "The Younger Generation," *Saturday Evening Post*, July 25, 1942.

3. W. Hepworth and A. Towler, "The Effects of Individual Differences and Charismatic Leadership on Workplace Aggression," *Journal of Occupational Health Psychology* 9, no. 2 (2004): 176–85.

4. Dates and names of these generations vary from one reference to another and should be taken as approximation. The Millennial Generation is also known as Generation Y, and the Silent Generation as the Elders or Traditionalists.

5. J. Stein and J. Sanburn, "The New Greatest Generation," *Time*, May 20, 2013, 26.

6. Ibid.

7. S. L. Lai, J. Chang, and L. Y. Hsu, "Does Effect of Workload on Quality of Work Life Vary With Generations?" *Asia Pacific Management Review* (2012): 437–51.

8. C. Verschoor, "Ethical Behavior Differs Among Generations," *Strategic Finance* 95, no. 8 (2013): 11–14.

9. R. Corelli, "Dishing out Rudeness," *MacLean's*, January 11, 1999, 44.

10. Nancy Langton, Stephen P. Robbins, and Timothy A. Judge, *Organizational Behaviour: Concepts, Controversies, Applications, 5th Canadian Edition*, (n.p.: Pearson/Prentice-Hall, 2010), 93.

11. S. Kodatt, "I Understand 'You': Leadership Preferences Within the Different Generations," in *Proceedings of the European Conference on Management, Leadership and Governance*, ed. John Politis (Reading, UK: Academic Publishing Limited, 2009).

POINT/COUNTERPOINT

INTRODUCTION
BY COLONEL KELVIN TRUSS

In my introductory comments to this edition of *The Royal Canadian Air Force Journal* I challenged readers to reinvigorate the air-power debate. If we are to have a meaningful dialogue then, as professional aviators, I firmly believe we need to explore points of view and opinions that seem counter to what we might intuitively believe. If we do not challenge ourselves and our thinking we are doing a disservice to Canadian taxpayers that rely on us to provide good, professional judgement and sound military advice. Furthermore, we are doing a disservice to ourselves if a tendency to drift into "group-think" leads us to a point where, in capability terms, "the emperor is found to be wearing no clothes." The purpose of this "Counterpoint" section, which will be included periodically in the *Journal*, is to give voice to some views that differ from the official Royal Canadian Air Force (RCAF) line, that disagree with accepted doctrine, or that challenge a commonly held premise, so as to stimulate subsequent debate.

POINT

F35s AND THE CANADIAN "MILITARY-TECHNICAL CONDITION"

BY MAJOR J. D. MCKILLIP, MSM*, CD, PHD,
WITH CONTRIBUTIONS BY R. W. H. MCKILLIP, CD, MA

The elemental task of the Canadian Armed Forces is, as it is for the armed forces of all nations, to provide the government with a force of last resort. Such a resort to force against a direct attack cannot be allowed to fail; this means that the military must be able to overmatch any threat to the nation's existence. This is a straightforward and unambiguous requirement and allows for the structuring of the military forces of many countries on the basis of perceived or anticipated threats. By contrast, the situation with respect to the use—actual or anticipated—of military force internationally is much more complicated and uncertain.

For many in the Canadian defence community as well as for numerous observers and commentators, the contrasting nature of domestic versus international defence requirements represents a conundrum. Generally speaking, it has been more or less accepted that Canadian military forces should be organized, trained and equipped on the basis of the perceived requirements of the collective defence needs of the day. This has been the case for the entirety of Canada's history and will almost certainly remain so for the foreseeable future. Although Canada went through a transition by which its status changed from organic element of the British Empire to sovereign nation, a process that took some time, the essential fact is that Canada was originally a junior partner in British defence arrangements, those which protected and secured Canada. More recently, and primarily as a result of the reordering of power that resulted from the Second World War, Canada has become an important but still junior partner in United States defence arrangements that, as with previous British arrangements, also protect and secure Canada.

Often the design of military forces available for use as a "force of last resort" domestically has been based logically, some would argue, on the assumption that pretty much any military structure good enough for collective defence would be more than enough for any domestic challenges. The problem with this approach is that it is well-nigh impossible to determine a force structure based on any specific threat criteria. The question of how much military force Canada should have available for commitment to collective defence arrangements is rather like asking the question: How long is a piece of string?

Since Canada can never hope to field a force that can act single-handedly against a major adversary, the question always becomes one of determining how much is enough. Although there have been efforts to tie defence structures to cost benchmarks such as percentage of gross domestic product or percentage of federal government spending, these measures have never proven very useful. As a consequence, the Canadian military has inevitably been limited in scope and scale by the amount of money that successive governments have been willing to allocate to defence generally, and the amount allocated has always been determined by political and financial considerations rather than by military ones. With the widespread acceptance of the argument that any collective defence structures will be more than capable of handling domestic defence needs, Canadian defence procurement, unless diverted by political imperatives such as regional economic development initiatives and industrial offsets, has generally consisted of a struggle between the Navy, Army and Air Force for the most high-end, high-tech and high-priced equipment that any given budget permits.

This approach is both understandable and wrong-headed. First of all, the notion that Canada needs to organize and equip its military forces on the basis of being able to effectively participate in collective defence missions was long ago debunked. In 1972, Colin Gray, in what is probably the only truly objective strategic analysis of Canadian military requirements ever conducted for the post–Second World War era, properly observed that it was more or less irrelevant what forces Canada had available for collective defence tasks. Since Canadian military forces would inevitably form a significant but still modest part of any real collective defence effort, the importance of those forces would be more political than practical. Since their political importance outweighed their practical value, Canadian military contributions would always be welcomed, regardless of the specific nature of those forces. Rather than trying to build a force structure on the shifting sands of vaguely conceived international defence challenges, Canada should build its forces on the basis of its domestic requirements, understanding that whatever resulted from that process could and would be of value for collective defence. Gray further offered that "the Canadian Armed Forces should only be charged with the performance of tasks that are in themselves believed by Canadians to be necessary. The performance of these tasks should not be defensible solely in terms of the friendliness that they are deemed likely to evoke in allied capitals."[1]

The other problem with the high-end, high-tech approach is that it is undermined by what I will call here the essential "military-technical condition" that confronts Canada. The great powers may well, and frequently do, challenge each other in efforts to gain and maintain a fighting edge through something akin to a low-level arms race, but this is not something that Canada can do. Major equipment acquisitions by Canada are rare, and the huge expense of the latest weapons systems guarantees that, once Canada purchases something, it will be in use for a long, long time. If a premium is paid for the most up-to-date technology available at any given time, there is great risk, in fact a near inevitability, that money thus spent will have been wasted when the moment of battle approaches. Simply put, Canada will always be in the position of

having out-of-date systems simply because the leading nations will always be developing new weapons, new techniques, new tactics and even new technologies that quickly render obsolescent anything that comes before.

USAF photo

If these criticisms and observations are valid, what then is Canada to do with respect to an approach for equipping its military forces? Fortunately, an alternative suggests itself as a result of the near total collapse of anything approaching a consensus on the best way to deal with the not-quite-imminent end of the service life of Canada's only in-service fighter aircraft, the CF18. In fact, the current impasse presents a rare opportunity to rethink the problem, not only of the CF18, but of equipment acquisitions generally. Unfortunately, most public discussion on the topic revolves around this or that airplane and which one is the best fighter for Canada. The lack of a coherent discussion is also clouded by the apparent willingness of the public to accept the idea that nothing less than the current "state-of-the-art" will do—thus the continued invocation of the near-meaningless concept of fourth, fifth and now even sixth "generation" fighter planes. It is astonishing—at least to this writer—that it was only when the price of a potential F35 fleet approached the $40-billion mark that the public started to have sticker shock. Even at the original, wildly optimistic estimate of $9 billion, the expenditure of such a colossal amount of money should have given pause.

If we really want to "reset" this discussion, or any of the equipment-acquisition discussions, the first thing to do is to determine the actual requirements of any weapon or "system" on the basis of filling clearly articulated strategic/tactical considerations. The next thing to do is to design to or purchase to these requirements with an understanding and acceptance that: (1) the

thing purchased will be in the inventory for a long time; (2) the technology of the thing will certainly change, probably rapidly and often; (3) thus, the thing will need to be of a design that will permit frequent and rapid updating; and (4) perhaps most importantly, whatever the thing is, it will almost certainly be acceptable as a Canadian contribution to a collective defence initiative more as a result of its representational significance than its operational value.

For virtually every major military platform—from tanks to airplanes to ships—this means that certain characteristics will of necessity be obtained. Generally speaking, the platforms should be big. This will allow them the sheer space to accommodate new weapons, new technologies and new conceptions of employment. The platform should be of solid, sturdy construction. Although this may seem trite, consider the limitations of ships made of aluminum or airplanes made of brittle radar-absorbing panels. And finally, the platform should have plenty of power. Once again, this is to ensure that the demands of any improvement or adaptation can be met.

If we accept that everything we build or buy should be big, sturdy and powerful, we can easily imagine filling requirements based on strategic demands. We can see how this might work by returning to the question of purchasing a new fighter for the Royal Canadian Air Force. There have been many reasons proffered why Canada requires fighter aircraft. Some of these have merit; the ability to contribute meaningfully to coalition operations being perhaps the easiest to defend. Others are less convincing. Though the requirement for air-to-air weapons seems clear enough, the need to engage in single-aircraft combat with a sophisticated enemy—dogfighting—is not well articulated and has a weak foundation in the history of the Canadian use of air power since the Second World War. Some are downright ridiculous; the idea that we need to spend billions of dollars to attract pilot candidates being perhaps the most egregious example.

It has also been suggested that the future in the skies belongs to remotely piloted aircraft, the so-called drones, and that there is really no requirement for crewed aircraft at all. Others have argued that Canada should dispense with fighters completely and that we would be better off building a niche capability that could serve various domestic needs and then be available as Canada's contribution to any expeditionary operations that we elected to join. An example of this is the idea of purchasing a large fleet of heavylift aircraft which could then be "chartered-out."

But if we accept that the single most important task of the Canadian Armed Forces is maintaining our sovereign territory (as has been routinely asserted in numerous defence papers, public policy statements and government declarations), a compelling need remains. Canada needs to have the ability to respond more or less immediately and independently to any intrusion into our territory with an unambiguous demonstration of resolve, a resolve backed up by real force. Given the vastness of the land and the expanses of our waters, the only practical way to do that now, and in the foreseeable future, is through the possession of a fleet of long-range, high-speed manned aircraft that are capable of engaging air, ground and marine targets.

If we accept the arguments regarding technology, money should not be wasted on premium aircraft capabilities and exotic technologies such as stealth that will soon be rendered irrelevant and are not of much use in the Canadian context at the best of times. With money saved by avoiding the premium of buying state-of-the-art aircraft, new weapons can be purchased as they become available. State-of-the-art weapons and sensors can be fitted to existing aircraft, at a fraction of the cost of acquiring new aircraft, as long as the aircraft have sufficient space and power. It is no accident that ancient aircraft such as B52s are still flying. Armed with modern weapons such as satellite and laser-guided bombs and missiles, they are still highly effective platforms.

Closer to home, our own venerable CF18s, armed with modern precision weapons, contributed to the recent coalition operations in Libya, garnering nothing but praise—both domestically and internationally.

So, what does this long-range, high-speed, manned and armed aircraft look like? Who knows? While consideration might be given to buying less-costly derivative aircraft that are already in service, aircraft shopping is not the only option. Why not pose the question to the Canadian aircraft industry and find out what they can offer? But whatever the acquisition method we choose, it should not be founded on a vain and costly attempt to be at the leading edge of high-end, high-tech aircraft or be based on impossible to define coalition requirements. The requirements we set for our aircraft and other military equipment should, instead, be based primarily on our fundamental self-defence needs and our middle-power status. Our needs will be better met and our allies will certainly eagerly accept any contribution Canada draws from the forces we create.

Major James McKillip is an armour officer with considerable overseas experience who is currently employed at the Directorate of History and Heritage in Ottawa. He holds a PhD with specializations in comparative colonial, Aboriginal and military history. Uniquely, he has been awarded two Canadian Meritorious Service Medals (Military Division).[2]

Bill McKillip is a former naval officer who works in private industry supporting the testing of naval weapons and sensors. He has military and civilian experience in equipment acquisition and holds an MA in War Studies from the Royal Military College of Canada.

NOTES

1. Colin S. Gray, *Canadian Defence Priorities: A Question of Relevance* (Toronto: Clarke, Irwin and Company, 1972), 70.

2. The asterisk in this article's byline denotes this double awarding of the MSM.

COUNTERPOINT

BY COLONEL KELVIN TRUSS

My thanks to the McKillips for their contribution, in which they raise some interesting points worthy of further consideration. In part, their article deals with the specific question of the F35 as a CF188 replacement. The fighter-replacement debate has been raging for some time now, attracting commentary from a number of contributors—some informed and some less so. The RCAF position has been clear and consistent throughout, and there is little to be gained from using this journal as a forum to compare the merits of one fighter type against another at this stage in the process. The McKillips' paper, though, goes beyond the question of "which fighter," and, instead, questions if due consideration has been given to whether a fighter is needed at all, concluding that it has not. Much as I may disagree with some of what has been presented here (and that is the purpose of this section, after all),

it would not normally be my position, as Editor-in-Chief, to critique the authors' logic; however, as this is the first of these "Counterpoint" articles, I will take the liberty of fuelling the fire a little on this occasion.

The authors ask the reader to accept much unsubstantiated rationale, for example, as stated on page 58: "Generally speaking, . . . (major military) platforms should be big." Aside from this type of leap-of-faith statement, three observations made by the McKillips definitely merit additional consideration, and hopefully, in due course, will spur you to comment.

Firstly, the assertion that Canadian military contributions would always be welcomed, regardless of the specific nature of those forces, does not resonate with my own experience of air operations in which influence, political and military, is achieved by a seat at the targeting table, and a seat at the targeting table is dependent on participation with the right forces, not any forces.

USAF photo

One could argue that the only thing worse than not being a member of a coalition established for a worthwhile cause is to be a burdensome member of that coalition, unable to integrate seamlessly with other coalition partners or to accept an appropriate proportion of the task. Given *Canada First* Defence Strategy aspirations to demonstrate Canadian leadership abroad, tokenism on operations does not seem to be an appropriate approach. I would be interested to hear what others think on this issue.

Secondly, the authors decry "the continued invocation of the near-meaningless concept of fourth, fifth and now even sixth 'generation' fighter planes," [see page 57] and in this they are perhaps right. We could, and some would argue should, stop using the misnomer "fighter" for small, fast, agile platforms that can generate aerospace-control, surface-attack and intelligence-surveillance-and-reconnaissance effects simultaneously, as doing so would make it easier to view any CF188 replacement in holistic capability terms, thus breaking unhelpful mental models of what fighters are for. Lieutenant General David Deptula (Retired), United States Air Force, makes this point in his recent article, "A New Era for Command and Control of Aerospace Operations," when he states that aircraft such as F22 and F35 are not fighters at all, and that "they are F-, A-, B, E, EA, RC, AWACS 22s and 35s."[1] Is our (Canadian) apparent fixation with the notion of fighters an unfortunate diversion that is undermining the quality of debate on capability requirements?

Finally, the authors ask the readers to accept that "money should not be wasted on premium aircraft capabilities and exotic technologies such as stealth that will soon be rendered irrelevant and are not of much use in the Canadian context at the best of times." [see page 58] Aside from noting that I would want such capabilities to be of use to us in the worst of times, not the best, I struggle with this logic if I extend it beyond the narrow context of CF188 replacement. If it is that we should not invest in stealth because counter-stealth technology will likely be developed, should we dispense with ship camouflage because surveillance capabilities will render current masking techniques ineffective, or cease to armour our tanks because armour-piercing weapons technology will improve to a point where to do so would be pointless? I think not. The point is, perhaps at some point we need to say, "enough technology is enough" and should avoid chasing unaffordable goals driven by an irrational desire to be at the cutting edge for the sake of it. Is that where we are? Are we, from an equipment-capability perspective, institutionally courageous enough to settle for "good enough" when "excellent" is dangled in front of us?

I again thank the McKillips for their valuable contribution and hope they can forgive me for using their article as a catalyst for debate, to which end I have offered what I believe to be some reasonable critique. Key here is that they care enough to have voiced their personal opinion, and I ask you to show equal commitment and take the time to respond to their views or mine.

Colonel Kelvin Truss was born in Maldon, England, in 1962. He joined the Royal Air Force (RAF) in 1982 as a gunner in the RAF Regiment but was commissioned shortly thereafter and, after flying training, was posted as a first-tour flying instructor. Thereafter, he flew the Tornado F3 as a front-line pilot and instructor until 1993, when he joined the Royal Air Force Aerobatic Team, the Red Arrows. While in the Red Arrows, Colonel Truss was promoted to squadron leader, and he completed his time with the team as the lead solo pilot. During his three years with the Red Arrows, Colonel Truss completed over 300 displays in the United Kingdom (UK) and overseas, including South Africa, Australia, and the Far and Middle East. Colonel Truss returned to the Tornado Force in 1997, first as a flight commander and Deputy Commanding Officer of 5 (Army Cooperation) Squadron and later, in 2004, as Commanding Officer of 111 (Fighter) Squadron.

Colonel Truss not only has flown operationally in the Falkland Islands and Iraq but also was a force commander for air defence of the UK. He has over 4000 flying hours on Jet Provosts, Hawks and Tornado F3s.

During his time in the RAF, Colonel Truss held staff appointments in the UK Directorate of Flight Safety as a squadron leader and, after completing Canadian Forces Staff College in 2002, in the Air Resources and Plans Directorate of the UK Ministry of Defence, initially as a wing commander and subsequently as a group captain.

After transferring to the RCAF in 2008, Colonel Truss was posted to the Directorate of Air Strategic Plans during which time he was seconded for one year to the Defence Force Structure Review Team. In 2011, he deployed to the North Atlantic Treaty Organization Combined Joint Force Air Component headquarters in support of Operation UNIFIED PROTECTOR, where he was responsible for strategy and targeting. Colonel Truss subsequently held the position of Detachment Commander, Canadian Forces Aerospace Warfare Centre (Ottawa). Following his promotion and appointment as the Director of Air Readiness and Plans in 2013, he is currently the Commanding Officer, Canadian Forces Aerospace Warfare Centre in Trenton.

ABBREVIATIONS

RCAF	Royal Canadian Air Force
RAF	Royal Air Force
UK	United Kingdom

NOTE

1. David A. Deptula, "A New Era for Command and Control of Aerospace Operations," *Air and Space Power Journal* 28, no. 4 (2014): 8, accessed September 10, 2014, http://www.airpower.maxwell.af.mil/digital/pdf/articles/2014-Jul-Aug/SLP-Deptula.pdf. The abbreviations listed in the quotation represent fighter, attack, bomber, electronic warfare, electronic attack, reconnaissance, and airborne warning and control system.